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STATE OF NEW YORK
OFFICE OF THE ATTORNEY GENERAL

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DIVISION OF PUBLIC ADVOCACY
ENVIRONMENTAL PROTECTION BUREAU

March 8, 2005

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

Re: Crossroads Ventures LLC: DEC Application No. 0-9999-0096/00005
Petition for Amicus Status Filed by Watershed Inspector General.

Dear Judge Wissler:

In light of the extensive record already before you, and the limited purpose of our *amicus* submission, this letter is to confirm that we will not be submitting any reply papers concerning the above-referenced Petition.

Thank you for your time and consideration.

Respectfully submitted,

James M. Tierney

James M. Tierney
Watershed Inspector General
Assistant Attorney General

cc: Jeffrey S. Baker, Esq.
Terresa Bakner, Esq.
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Kevin M. Young, Esq.

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

In the Matter of the Application of:

Application No.
0-9999-00096/00005

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

ALJ Wissler

Petition for *Amicus* Status and Request to File a Late Petition

I. Preliminary Statement.

By this petition James M. Tierney, in his capacity as the New York City Watershed Inspector General, respectfully requests permission to submit the enclosed *amicus* brief and exhibits concerning the scope of issues to be adjudicated in the above-captioned administrative proceeding. The position of New York City Watershed Inspector General is an Assistant Attorney General who serves as a joint appointment of the Governor and the Attorney General. This position was established pursuant to the 1997 New York City Watershed Memorandum of Agreement ("MOA") and by Gubernatorial Executive Order No. 86. (Attached as Exhibit A.)

The authority provided by Executive Order No. 86 relates to the "use operation and protection of the Watershed" and includes, *inter alia*: assuring compliance with the MOA; undertaking civil and criminal investigations and enforcement; recommending legislative, regulatory and management practice changes; taking actions consistent with the authority vested in the position of Assistant Attorney General; and "cooperat[ing] with any agency or department possessing regulatory authority relating to the use operation and protection of the Watershed." The enclosed *amicus* brief and associated exhibits provide factual information, as well as a

to be amicus not factual, but only policy/legal

discussion of legal and policy issues, that will materially assist this administrative court of the New York State Department of Environmental Conservation ("DEC") when determining what issues should be the subject of administrative adjudication.

II. The Requirements of 6 NYCRR § 624.5(b)(1) and (3) are Satisfied.

DEC's permit hearing procedures require that a person seeking *amicus* status in an administrative proceeding file a petition that meets the requirements of 6 NYCRR § 624.5(b)(1) and (3).

The proposed *amicus* party is James M. Tierney, an Assistant Attorney General and New York City Watershed Inspector General within the Office of Eliot Spitzer, Attorney General of the State of New York. The Watershed Inspector General is charged with the responsibility to take action to protect the unfiltered drinking water of some 9 million individuals. Mr. Tierney will act as the representative in this proceeding. See 6 NYCRR § 624.5(b)(1)(i) and (iv). Please note that there has been, and will be, no communication concerning this matter between staff of the Attorney General's Office who are working with Mr. Tierney on this matter and those staff members who may be representing DEC in any litigation that might arise from this proceeding.

As discussed in the attached *amicus* brief and exhibits, the proposed Belleayre Resort at the Catskill Park (the "Project") is a major development within the New York City Watershed ("Watershed") that has the potential to have significant adverse impacts on drinking water quality. In his capacity as Watershed Inspector General and Assistant Attorney General, Mr. Tierney has a strong interest in the statutes, regulations, permits and general permits administered by DEC related to water quality, and the natural resources that protect water quality, within the Watershed, including proceedings pursuant to the State Environmental Quality Review Act

Not so strong that he has standing to participate as a party

("SEQRA"), ECL Article 8. See 6 NYCRR § 624.5(b)(1)(ii).

Petitioner seeks to serve as a "friend" of the administrative court. Therefore, this petition and the attached *amicus* brief is not specifically in the nature of "grounds for opposition or support" identified in 6 NYCRR § 624.5(b)(1)(v). Rather, the petitioner seeks to submit technical information and policy argument concerning water quality impacts that might arise from the proposed Project in an effort to assist this administrative court concerning which issues are worthy of adjudication. The specific issues we request permission to discuss in our *amicus* brief are as follows:

(i) natural conditions at the project site related to water quality, such as soil characteristics, rainfall intensity and construction slopes;

(ii) the technical adequacy of the proposed program and permit to limit contaminants in runoff both during and after construction;

(iii) the sufficiency of the assessment of cumulative growth inducing impacts;

(iv) the adequacy of the integrated pest management program that will govern the use of pesticides and herbicides at the project site; and

(v) wetland delineation and destruction.

See 6 NYCRR § 624.5(b)(1)(v).

The enclosed *amicus* brief and exhibits discuss legal and policy issues concerning what we believe to be "substantive and significant" issues that merit full administrative adjudication. The factual background information concerning the importance of the New York City Watershed, as well as soil, slope, storm intensity, and other essential conditions at the Project site, speak directly to the exceedingly sensitive environmental conditions in which this large-scale development Project is being proposed. Within this context, we seek to make legal, factual

and policy arguments concerning storm water permits, the scope of cumulative growth assessments in the environmental impact statement, wetland protection, and pesticide usage. See 6 NYCRR § 624.5(b)(3)(i).

As discussed above, the work and responsibilities of the position of New York City Watershed Inspector General make the proposed *amicus* party one that is in a special position with respect to the above-referenced issues. See 6 NYCRR § 624.5(b)(3)(ii). Therefore, petitioner has also met the requirements of 6 NYCRR § 624.5(d)(2) so as to be granted *amicus* status.

III. The Requirements of 6 NYCRR § 624.5(c) Concerning Late Filed Petitions are Satisfied.

In general, a person seeking party status must file a petition by the date set in the notice of hearing. See 6 NYCRR § 624.5(b). However, late petitions may be granted, pursuant to the discretion of the Administrative Law Judge, if the following demonstration is made pursuant to 6 NYCRR § 624.5(c)(2):

(i) that there is good cause for the late filing;

(ii) that participation by the petitioner will not significantly delay the proceeding or unreasonably prejudice the other parties; and

(iii) that participation will materially assist in the determination of issues raised in the proceeding.

Id. All of these requirements are satisfied here.

This office prepared and submitted to DEC detailed technical comments concerning the adequacy of the draft environmental impact statement ("DEIS") that was submitted by the applicant. These comments, submitted pursuant to the State Environmental Quality Review Act

("SEQRA"), were referred to extensively in the course of the "issues conference." This office has conducted a further review of various responsive documents that were submitted to DEC by the applicant, after the end of the DEIS comment period and during the course of the issues conference, on matters that were the subject of our SEQRA comments. Good cause exists for accepting this late filing because it assesses this newly developed information (much of which was submitted by the applicant) as well as applies previously submitted information to the specific issues pending before this administrative court. See 6 NYCRR § 624.5(c)(2)(i).

Submission and consideration of the proposed *amicus* brief and exhibits will not significantly delay the proceeding as the *amicus* submission will not trigger any further proceedings and is being submitted on this topic at the same time as the briefs of other parties. No other parties are prejudiced because they have all received and likely reviewed the detailed technical comments that were previously submitted by this office and made part of the administrative record. Thus, there will not be any surprise by other parties at the concerns expressed in the *amicus* brief and associated exhibits. See 6 NYCRR § 624.5(c)(2)(ii).

The *amicus* brief will explain whether the detailed technical concerns raised in our SEQRA comments have been effectively addressed or satisfied by these new submissions. Such information would bear directly on the scope of issues that may be deemed appropriate for adjudication. Extensive technical and legal expertise with respect to the Watershed's water quality has been developed by the petitioner in the course of fulfilling his responsibilities as New York City Watershed Inspector General since 1998. Scientific staff of the Attorney General's Environmental Protection Bureau, who have provided assistance in the formulation of the proposed *amicus* submission, possess a great deal of expertise on the matters discussed.

Therefore, participation by the petitioner as an *amicus* party will provide highly relevant information and analysis concerning the scope of issues appropriate for full adjudication; this will be of material assistance to this administrative court. See 6 NYCRR § 624.5(c)(2)(iii).

IV. Conclusion.

Petitioner respectfully requests that this administrative court grant *amicus* party status for the limited purposes described above.

Dated: January 21, 2005

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EXHIBIT A

State of New York

Executive Chamber

No. 86

EXECUTIVE ORDER

ESTABLISHING THE NEW YORK CITY WATERSHED INSPECTOR GENERAL

WHEREAS, it is the policy of the State of New York to conserve, improve and protect its natural resources and environment, and control water pollution to enhance the health, safety and welfare of the people of the State;

WHEREAS, adequate and suitable water for water supply and domestic and municipal use is essential to the health, safety and welfare of the people and the economic growth and prosperity of the State;

WHEREAS, the drainage basins of the Croton, Catskill and Delaware systems of the New York City drinking water supply provide drinking water to approximately nine million individuals, constituting approximately fifty per cent of the State's population;

WHEREAS, to fulfill its responsibilities as trustee of the environment for the present and future generations, the State must use all available and reasonable means to ensure that the waters of the State are conserved and developed for all public beneficial uses, and to prevent contamination of the waters of the State;

WHEREAS, consistent with, and to effectuate the above policies, the State of New York entered into a Memorandum of Agreement ("MOA") with the City of New York, the Coalition of Watershed Towns, the United States Environmental Protection Agency, various environmental organizations, Westchester County, Putnam County and other municipalities on January 21, 1997, which provides for the development and implementation of a Watershed protection program that maintains and enhances the quality of the New York City drinking water supply system and the economic vitality and social character of the Watershed communities; and

WHEREAS, the parties to the MOA have agreed that a Watershed Inspector General should be appointed to enhance current efforts to protect the New York City drinking water supply from activities that have the potential to adversely affect the New York City Watershed reservoirs and tributaries;

NOW, THEREFORE, I, GEORGE E. PATAKI, Governor of the State of New York, by virtue of the authority vested in me by the Constitution and laws of the State of New York, do hereby establish the position of Watershed Inspector General as follows:

1. Appointment, Compensation, and Removal

The Governor and the Attorney General shall jointly appoint the Watershed Inspector General who shall be an Assistant Attorney General. The Attorney General shall employ, fix the compensation and, in consultation with the Governor, remove the Assistant Attorney General appointed as the Watershed Inspector General.

2. Definitions

(a) "Watershed" means the drainage basins of the Croton and Catskill and Delaware systems.

(b) "Croton system" means the Amawalk, Bog Brook, Cross River, Croton Falls, Diverting, East Branch, Middle Branch, Muscoot, New Croton and Titicus Reservoirs, Kirk Lake, Lake Gleneida, and Lake Gilead, and the tunnels, dams and aqueducts which are part of and connect the above listed reservoirs and controlled lakes.

(c) "Catskill and Delaware system" means the Ashokan, Cannonsville, Kensico, Neversink, Pepacton, Rondout, Schoharie and West Branch/Boyd's Corner reservoirs, and the tunnels, dams and aqueducts which are part of and connect the above listed reservoirs.

3. Powers, Duties, and Responsibilities

To the full extent permitted by law, the Watershed Inspector General shall have the following powers, duties and functions relating to the use, operation and protection of the Watershed:

(a) to conduct and supervise investigations of alleged violations of the MOA, any statute, rule or regulation of the State, and any permit or order issued by the State;

(b) to subpoena witnesses, administer oaths or affirmations, take testimony and compel the production of such books, papers, records and documents as the Watershed Inspector General may deem to be relevant to an investigation undertaken pursuant to this Order;

(c) to commence, prosecute and settle proceedings relating to civil and criminal violations;

(d) to coordinate with the New York City Watershed Program Coordinator within the Executive Chamber;

(e) to cooperate with any agency or department possessing regulatory authority relating to the use, operation and protection of the Watershed;

(f) to apply for search warrants pursuant to article six hundred ninety of the Criminal Procedure Law;

(g) to report, on an annual basis, to the Governor and the Attorney General, a listing of enforcement actions completed and activities undertaken;

(h) to recommend legislative, regulatory and management practice changes;

(i) to undertake any other investigations and enforcement actions, or enter into civil, administrative or criminal orders or settlement agreements, pursuant to the authority otherwise vested by law in the position of an Assistant Attorney General;

(j) to have full and unrestricted access to all records, reports, audits, reviews, documents, papers, recommendations or other material available to all agencies and departments over which the Governor has executive authority, and all public benefit corporations the heads of which are appointed by the Governor, for the purpose of carrying out this Order; and

(k) to request such information, assistance and cooperation from any federal, State or local government department, board, bureau, commission, authority or other agency or unit thereof for the purpose of carrying out this Order.

4. Cooperation of Agency Officials and Employees

Every agency and department over which the Governor has executive authority, and all public benefit corporations the heads of which are appointed by the Governor, shall provide all reasonable assistance requested by the Watershed Inspector General for the purpose of carrying out this Order.

5. Notice to the State Inspector General

Upon obtaining evidence of corruption, fraud, criminal activity, conflicts of interest or abuse by any agency or department over which the Governor has executive authority, or any public benefit corporation the heads of which are appointed by the Governor, or any employee thereof, the Watershed Inspector General must provide prompt notice of such evidence to the State Inspector General. Prior to commencing an enforcement proceeding against any such agency, department, or public benefit corporation, or any such employee thereof, the Watershed Inspector General must give notice to the State Inspector General of the violation and the proposed enforcement action.

G I V E N under my hand and the Privy Seal of the State in the City of Albany this nineteenth day of August in the year one thousand nine hundred ninety-eight.

BY THE GOVERNOR

/s/ George E. Pataki

/s/ Bradford J. Race, Jr.
Secretary to the Governor

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

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CROSSROADS VENTURES, LLC
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Amicus Brief of the New York City Watershed Inspector General Concerning the Scope of Issues that Warrant Full Administrative Adjudication

---

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January 21, 2005

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Amicus Brief of the New York City Watershed Inspector General Concerning the Scope of Issues that Warrant Full Administrative Adjudication

I. Preliminary Statement

This *amicus* brief and attached exhibits are submitted by the New York City Watershed Inspector General, a position within the Office of the Attorney General, to assist this administrative court in its determination of issues that warrant administrative adjudication in connection with draft permits and the environmental review for the proposed "Belleayre Resort at Catskill Park" (the "Project"). The Project is located within the New York City Watershed ("Watershed"), the source of unfiltered drinking water for some 9 million individuals. Moreover, the sheer size of the proposed Project, and the highly challenging attributes of the soils, construction slopes, and precipitation intensity at the Project site, are a cause for serious concern. The extraordinary sensitivity of the Project site should bear strongly on scope of issues that should be adjudicated.

Based on the potential impact on surface water quality, there are numerous "substantive and significant" issues within the meaning of 6 NYCRR § 624.4(c) associated with the applicant's proposed program to control and treat stormwater flows both during and after

construction of the proposed Project. Similar issues exist with respect to the assessment of wetlands to the extent that the applicant does not fully accept the revised determination of the United States Army Corps of Engineers concerning what areas constitute "jurisdictional" versus "isolated" wetlands or continues to seek to undertake avoidable wetland fills. Finally, the draft Environmental Impact Statement ("DEIS") on the Project is insufficient within the meaning of 6 NYCRR § 624.4(c)(6)(i)(b) with respect to stormwater, cumulative impact assessment and pesticide/herbicide usage. These issues should be the subject of administrative adjudication.

II. Sensitivity of the Proposed Project Site.

The proposed Project is located in a portion of the State that serves as the unfiltered drinking water supply for half the State's population. Attached as Exhibit A to this brief are the April 23, 2004 Comments of the New York State Attorney General on the DEIS for the proposed Project ("Attorney General's Comments"). Pages 1 to 4 of these comments detail the highly sensitive environmental context in which the Project is proposed, as well as the pollutants of particular concern in an unfiltered drinking water system. The entire "West of Hudson" Watershed is surprisingly small, as it constitutes only 3.4% of land mass of the State, an area roughly equal in size to Delaware County.

The two reservoirs that are directly affected by the Project, the Ashokan and Pepacton, are particularly important because the two other large West of Hudson reservoirs (the Cannonsville and the Schoharie) are often adversely affected by algae blooms or high turbidity, respectively. The eastern ("Big Indian") portion of the proposed Project raises the highest concerns as it drains toward the Ashokan Reservoir. The Ashokan and its main tributary, the Esopus Creek, are already formally listed as "impaired" due to silt and sediment by the New

York State Department of Environmental Conservation ("DEC") on its Clean Water Act § 303(d) list. Therefore, the waters of the Ashokan, a "terminal" reservoir that has been and can be drawn directly into the water distribution system, already violate State water quality standards specified at 6 NYCRR § 703.2 ("turbidity") on a regular basis.

The Attorney General's Comments at pages 5 to 10, and the tables contained in Exhibit 3 to those comments, contain a detailed assessment of soils at the Project site as they relate to erosion, percolation, slopes and other relevant factors. This critical information was not contained in the DEIS. Our analysis demonstrated that the Project site has characteristics (e.g., high erosivity, high clay/colloidal-type particle size, exceedingly low percolation rates) that present significant erosion and sedimentation concerns under the best of circumstances. Here, however, the proposed project would disturb over 230 acres on slopes at or in excess of 15%. Of this, 157 acres of the disturbance would be on exceedingly steep slopes over 35%. (For perspective on the sheer size of this steep slope construction cut, consider that 1 acre is roughly equivalent in size to a football field, including end zones).

Moreover, the only soils found on the entire site are low percolation Hydrologic Soils Group C and D soils – a circumstance that causes very little percolation in exposed soils and corresponding high volumes and high peak intensity of stormwater runoff. Using a generally accepted methodology developed by the United States Natural Resources Conservation Service, this office determined that almost all of the construction on the proposed Project site would be classified as "severely" restricted for its intended use. The risk associated with large-scale development in such an area is further exacerbated by the fact that the Project site is located within the most intense rainfall region of the State.

This highly sensitive environmental context bears strongly on the question of whether issues related to water quality arising from the propose Project are substantive and significant so as to warrant adjudication. Much of this information was not marshaled in the DEIS, and thus, has not been fully developed by further comment. These site attributes are also highly relevant to the scope, detail and methodology employed in the assessment of potentially adverse environmental impacts associated with the Project in the DEIS.

III. Numerous Issues for Adjudication Associated with Storm Water Controls.

Our technical comments on the DEIS identified numerous fundamental deficiencies in the applicant's proposed plan to address polluted runoff both during construction and after completion of the Project. See Attorney General's Comments at 10 to 22. DEC had previously determined that the applicant would be required to seek an individual storm water permit as opposed to the Project being merely "covered" under DEC's SPDES General Permit for Stormwater Discharges from Construction Activity (Permit No. GP-02-01) ("General Permit"). The substantive and significant nature of these concerns were heightened by the magnitude of the proposed development and the sensitive nature of the soils, slopes, precipitation intensity and watershed in which it was located.

Our comments were to the effect that there simply was nothing provided by the applicant in the DEIS, or elsewhere, that could be termed a "Stormwater Pollution Prevention Plan" ("SPPP") that was in any way consistent with the requirements of the General Permit or the technical manuals that the General Permit references as standards: New York State Standards and Specifications for Erosion and Sediment Control (Empire State Chapter of the Soil and Water Conservation Society) April 1997 and New York State Stormwater Management Design Manual

(prepared for DEC by the Center for Watershed Protection) October 2001. The General Permit at Part III.D.2 expressly requires that the SPPP contain the "fully designed and engineered stormwater management practices with all necessary maps, plans and construction drawings." The applicant's claims that the controls would operate effectively were unsubstantiated. Our review found that the opposite was true – that if this Project was approved with the applicant's proposed stormwater controls, the controls would fail and enormous amounts of polluted runoff would be discharged over many years into sensitive streams and drinking water reservoirs.

This office has now reviewed the transcript of the issues conference as it related to stormwater controls, as well as supplemental submissions by the applicant on this topic. We are disappointed to report that almost none of the concerns presented in the 29 detailed technical comments that this office previously submitted to DEC were addressed. This non-responsiveness by the applicant is contrary to our experience in numerous other SEQRA proceedings within the Watershed, where the project sponsor addresses our concerns and provides a complete and fully engineered SPPP, with all supporting engineering calculations and assumptions, as part of the environmental impact statement.

Therefore, we request that this administrative court find that substantive and significant issues exist with respect to all 29 technical comments presented in the Attorney General's Comments at 10 to 22. These issues go to both compliance with the requirements of DEC's General Permit and to the need for a supplemental DEIS that presents this information for public review and comment.

We emphasize that the fact that this is a large construction site does not justify the use of a "conceptual" SPPP. The General Permit does not allow for any such accommodation, nor

should one be made for the Project given its highly sensitive location. The applicant has insisted that the only build alternative to be assessed in the DEIS is one that encompasses the full build of both the Big Indian and Wild Acres resorts over a multi-year period. Prior to filing a "notice of intent" for coverage under the General Permit, a completely engineered SPPP, one that can be effectively implemented by the construction crews, must already be in place and available for review. Given the extraordinary risks to water quality associated with the proposed Project, a full SPPP should be prepared and made available for review prior to any determination on the individual permit and as part of the DEIS.

Finally, we are particularly concerned that the applicant is seeking to implement a construction phasing plan that allows for as much as 50 acres of raw earth to be exposed at any one time. The General Permit at Part III.D.2(a)(4) expressly states that "there shall not be more than five acres of disturbed soil at any one time without prior written approval of the [DEC]." The New York State Standards and Specifications for Erosion and Sediment Control ("E&SC Standards"), the DEC recognized SPDES standards (see General Permit at Part III.D.1), also state that "[n]o more than 5 acres of unprotected soils should be exposed at any one time" and goes on to state that "[s]ite factors including topography, soil erosion potential, proximity to wetlands and water courses may require limiting the amount of raw earth that can be exposed at any one time to less than 5 acres." See E&SC Standards at Appendix A, Section E.1 (emphasis added). We request that a full administrative adjudication be undertaken concerning whether any departure should be allowed from this 5 acre limitation – especially given our experience with significant erosion events at large sites. We further request adjudication on the question of whether raw earth construction phasing at levels significantly below the 5 acres level should be implemented

for sensitive areas, such as the 157 acres of slopes over 35% that the applicant has slated for excavation. See Attorney General's Comments at 16 to17.

IV. The Question of Whether the DEIS Should Contain a Cumulative Impact Analysis Should be Adjudicated

This office requested that Dr. Gerrit Knaap, Director of the National Center for Smart Growth Education and Research at the University of Maryland review the DEIS and independently assess the secondary and cumulative impacts of the propose Project with respect to growth (e.g., construction cuts and impervious surfaces) that could adversely affect drinking water quality. Dr. Knaap's full report is contained in the Attorney General's Comments as Exhibit 4. Dr. Knaap concluded that the "secondary growth" analysis contained in the DEIS was largely correct. However, Dr. Knaap's detailed and independent assessment of cumulative impacts found the potential for high levels (many square miles) of new development and construction disturbances over time within the West of Hudson Watershed. This was due to likely development pressure arising from the proposed Project, proximity to the New York City metropolitan area, proposed casinos, and other relevant circumstances.

The key finding of Dr. Knaap was that the DEIS was deficient because it failed to require a detailed cumulative impact analysis to better determine the full extent of growth impacts so as to better guide decision-making on the large-scale regional development Project under consideration here. In our opinion, the question of the scope and detail any cumulative impact analysis in the DEIS is both substantive and significant; it should be the subject of full administrative adjudication. DEC, as the SEQRA lead agency, has the clear discretion to require a full cumulative impact assessment. In our view, DEC should require that such an assessment

be undertaken in the manner described by Dr. Knaap.

V. Pesticide and Herbicide Use: Adequacy of the Integrated Pest Management Program

This office submitted detailed comments on the applicant's proposed Integrated Pest Management Program ("IPM"), as described in the DEIS, which is supposed to be designed to minimize the use and dispersal of chemical pesticides and herbicides. Our comments found numerous and serious deficiencies in the proposed IPM program. See Attorney General's Comments at 23 to 29. In response, the applicant has submitted to ALJ Wissler a letter dated October 13, 2004, from Kevin Franke of the LA Group (Applicant's Supplemental Exhibit 13). We have carefully reviewed Mr. Franke's letter. There are numerous serious factual inadequacies in Mr. Franke's response that reflect the inadequacy of the DEIS on this important topic, thereby raising numerous substantive and significant issues that merit full adjudication. An outline of some of the significant issues follows with more detail is provided in Exhibit B:

1. Inert Ingredients (See Franke letter, Items 8 & 9). Citing DEIS page 2-89, Mr. Franke claims that "The DEIS presented a full discussion of the analysis of inert ingredients." However, that is incorrect. First, DEIS Table 2-8 does not identify all products with their associated inert ingredients that would be used on the Project. Second, Franke's reliance on inert ingredients listed on the label is close to meaningless since EPA regulations require only the specific identification of the 8 inerts on their List 1 (Inerts of Toxicological Concern) and do not require the listing of most other inert ingredients on other lists (approximately 3,100 chemicals). Franke's conclusion that no assessment of toxicity was necessary for products other than those on EPA List 1 is unsupported by the facts as many chemicals on those lists have serious toxic

effects. Third, Franke argues that all of the products are properly registered for use on golf course turf in New York. However, that a pesticide product is registered for use is not an assurance of its safety, but rather a permit to sell the product for specific uses based on a risk/benefit analysis in which risks and benefits may be apportioned to different entities. To the extent that the inert ingredients in any product proposed for use at the Belleayre Resort is unknown, or has not been fully assessed for its risks to human health and the environment, that deficiency in the risk assessment should be prominently revealed in the DEIS. Unsupported, and unsupportable, assurances of safety, made in the absence of adequate information, should be removed from the DEIS.

2. Assessing Health Effects (See Franke letter, Item 10). Franke seeks to dismiss the potential for chronic effects attributable to either the pesticides applied or their degradation products, claiming that any discharge to surface water would be episodic, and therefore would not cause any chronic effects. However, Franke confuses chronic exposure with chronic effects. Chronic exposure is simply long-term exposure. Chronic effects, however, are those that are manifested long after the initial exposure. It is not true that chronic effects always arise as the result of chronic exposure, as Franke implies. Chronic effects may arise as the result of acute exposures, as a single exposure to a genotoxic agent may cause cancer, and as brief exposure to a neurotoxin during early development may cause permanent neurological disorders. Moreover, Franke concludes that episodic pesticide applications could only result in episodic acute exposures. That would only be the case if all of the pesticides applied and all of their degradation products had extraordinarily short half lives, so that they broke down in a very short time and if they were only transported by surface runoff, which would carry them rapidly to

receptors. Failing that, the pesticides and/or their degradation products may persist in the environment and serve as a continuing (chronic) source of exposure. Finally, experimentally derived LC_{50} values, which reflect only the potential of the a specific chemical to kill the specific target organism within a short period of time is unacceptable as the sole metric of environmental risks arising from the use of pesticides at the proposed Project.

3. Biological Controls (See Franke letter, Item 14). The DEIS relies on statements made in 1991 and 1994 to characterize the utility of biological controls. The science and technology of pest control has advanced significantly since then and those statements are outdated and inaccurate.

4. Notification (See Franke letter, Item 17). While Franke agrees to the value of notices of pesticide applications posted on the golf course, he does not say if such notices will be posted before or after applications. He also makes no provision for notice to golf course neighbors who do not use the course. Notice should serve both an informational and precautionary function. If neighbors are not notified prior to applications then they cannot take such precautionary actions as they may deem appropriate to prevent exposure to pesticides and to protect their health and welfare. Notice should not be limited only to those who use the course.

Therefore, the DEIS fails to present a meaningful assessment of the risks associated with the proposed use of pesticides at the proposed Project. Furthermore, it fails to provide accurate and adequate information for an independent assessment. In this respect, the DEIS is woefully inadequate and these issues should be the subject of adjudication.

VI. Wetland Protection

In our prior comments, this Office raised detailed concerns with respect to the proposed destruction or disturbance of 4.5 acres of wetlands. Attorney General's Comments at 29 to 34. The applicant had proposed this activity on the basis that these wetlands were non-jurisdictional or "isolated" wetlands which fell outside the permit program of the United States Army Corps of Engineers ("Army Corps"). After a detailed site inspection, the Army Corps substantially revised its prior position and determined that almost all of the wetlands on the Project site which the applicant sought to disturb were, in fact, jurisdictional. See Applicant's Supplemental Exhibit 12, October 28, 2004 Letter to ALJ Wissler from Kevin Franke of the LA Group. In response, the applicant immediately revised the Project design so as to limit the acreage of wetland destruction to a level that might classify for coverage under a national permit. The speed of this re-design indicates that all wetland disturbances, as well as a 100 foot buffer, can and should avoided. Until that is done, the protection of these vital wetland resources qualifies as an issue for adjudication.

VII. Conclusion

We respectfully request that this administrative court determine that the issue presented above should be the subject of full adjudication in this administrative proceeding.

Dated: January 21, 2005

Respectfully submitted,

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EXHIBIT A

STATE OF NEW YORK
OFFICE OF THE ATTORNEY GENERAL

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DIVISION OF PUBLIC ADVOCACY
ENVIRONMENTAL PROTECTION BUREAU

April 23, 2004

Via Overnight Delivery

Mr. Alexander F. Ciesluk, Jr.
Deputy Regional Permit Administrator
New York State Department of
Environmental Conservation, Region 3
21 South Putt Corners Road
New Paltz, New York 12561

Re: SEQRA Draft EIS: Belleayre Resort at the Catskills Park
DEC App. Nos: 3-9903-00059/00001 (DEIS Reference Number)
0-9999-00096/00005 (SPDES Big Indian)
0-9999-00096/00007 (Section 401 Water Quality Certification)
0-0000-00096/00009 (SPDES Wildacres)

Dear Mr. Ciesluk:

Thank you for providing us with an opportunity to submit comments with respect to the draft Environmental Impact Statement and the above referenced permit applications for the proposed Belleayre Resort at the Catskills Park. These comments address issues associated with the proposed project as they relate to water quality. Our comments address the above-referenced SPDES permits as they relate to the adequacy of controls on polluted runoff during and after construction. We also submit detailed comments concerning wetlands, a matter that is relevant to the project sponsor's application for a Section 401 water quality certification.

Again, thank you for the opportunity to submit these comments. If we can be of any assistance on this matter please do not hesitate to call.

Very truly yours,

Jim Tierney

James M. Tierney
Watershed Inspector General
Assistant Attorney General

Charlie Silver

Charles D. Silver, Ph.D.
Watershed I.G. Scientists

cc: Distribution

OFFICE OF THE NEW YORK STATE ATTORNEY GENERAL

COMMENTS OF THE NEW YORK CITY WATERSHED INSPECTOR GENERAL ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT AND ASSOCIATED ENVIRONMENTAL PERMITS WITH RESPECT TO THE PROPOSED

"BELLEAYRE RESORT AT CATSKILL PARK"

New York State DEC
Application No. 3-9903-00059/00001

April 23, 2004

OFFICE OF THE NEW YORK STATE ATTORNEY GENERAL

COMMENTS OF THE NEW YORK CITY WATERSHED INSPECTOR GENERAL ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT AND ASSOCIATED ENVIRONMENTAL PERMITS WITH RESPECT TO THE PROPOSED "BELLEAYRE RESORT AT CATSKILL PARK."

New York State DEC Application No. 3-9903-00059/00001

April 23, 2004

We appreciate this opportunity to submit comments to the New York State Department of Environmental Conservation ("DEC") concerning the draft environmental impact statement ("DEIS") with respect to the Belleayre Resort at the Catskill Park (the "Project"). The position of New York City Watershed Inspector General is a joint appointment of the Governor and the Attorney General within the Attorney General's Office that was established pursuant to the 1997 New York City Memorandum of Agreement.

These technical comments present our concerns with respect to the adequacy and scope of the DEIS as it relates to adverse impacts on water quality. These comments focus on: (i) natural conditions related to water quality such as soil characteristics, rainfall intensity and construction slopes; (ii) the technical adequacy of the program to limit contaminants in runoff both during and after Project construction; (iii) the sufficiency of the assessment of secondary and cumulative growth inducing impacts of the Project; (iv) wetland destruction; and (v) the adequacy of the integrated pest management program that will govern the use and monitoring of pesticides and herbicides.

As explained below, there are significant deficiencies with the DEIS and related documents. We request that there be another opportunity for public comment on the revised DEIS and other documents.

I.

THE PROPOSED PROJECT IN ITS ENVIRONMENTAL CONTEXT WITH RESPECT TO WATER QUALITY.

The proposed Project is located within both the Catskill and Delaware water supply "systems" of the New York City Watershed ("Watershed").[1] This portion of the Watershed serves as an unfiltered drinking water source for over 9 million people. The only treatment this water receives from reservoir to tap is disinfection through chlorination. The Project is also

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[1] While the New York City Watershed provides drinking water for half of State, it only comprises 4.2% of the State's land mass. The entire "West of Hudson" Watershed, the usual source of 90% of the drinking water, constitutes only 3.4% of the State – an area that is roughly the size of Delaware County.

situated within the Catskill Park. No portion of the proposed Project is planned to be located within an existing village or hamlet area.

The proposed Project consists of two complexes on mountain ridges and sides that straddle both shoulders of the State-owned Belleayre Ski Center. It would involve 400 hotel rooms, a conference center, 351 additional hotel/condo units and two 18-hole championship golf courses, on 573 disturbed acres. A total of 130 new buildings would be constructed. Full-time employment is estimated by the developer at 542 individuals; part-time employment is estimated at 330.[2] The Project is located in the Towns of Shandaken, Ulster County and Middletown, Delaware County.

The portion of the Project site in Ulster County is generally drained by tributaries of the Esopus Creek, the major source of water flowing into the Ashokan Reservoir. The Project area within Delaware County generally is drained by tributaries of the East Branch of the Delaware River, the major water supply for the Pepacton Reservoir. Both the Ashokan and the Pepacton are classified by DEC as "AA" surface waters. Thus, by virtue of DEC regulation, these water bodies are required to be maintained at a quality that allows each to serve as an unfiltered drinking water source.

The Ashokan and the Pepacton reservoirs are particularly important reservoirs within the Watershed, as the waters of the two other large reservoirs of the Catskill and Delaware systems, the Cannonsville and the Schoharie, are often subject to significant environmental impairments. The Cannonsville Reservoir is affected by algae blooms and eutrophic conditions due to excess phosphorus.[3] The Schoharie Reservoir is adversely affected by high levels of turbidity and

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[2] These numbers are provided in the DEIS, although without any supporting analysis. The consultants for the Project sponsor did not independently model employment and wage projections, but rather, accepted estimates provided by the Project sponsor.

[3] The Cannonsville Reservoir has seen levels of total phosphorus decrease slightly over the past decade to levels that are slightly below State DEC's guidance value of 20 micrograms per liter (or 20 parts per billion) – a guidance value developed to protect recreational uses. According to the New York City Department of Environmental Protection ("DEP"), however, there has been a slightly upward trend in levels of chlorophyll *a* over the time period of 1990 to 2002. With respect to algae blooms, therefore, the water quality of the Cannonsville Reservoir is not improving and is actually getting somewhat worse. The Cannonsville Reservoir continues to be classified as eutrophic under the Carlson Trophic State Index ("TSI"). DEP's most recent evaluation of chlorophyll *a* levels gave the Cannonsville a TSI of 52. Any measurement of 50 or over is considered eutrophic. Problematic blue-green algae blooms continue to occur in the summer growing season. Moreover, low dissolved oxygen conditions persist in the lower and mid-level waters of the Cannonsville Reservoir. Due to these algae blooms, City DEP will frequently turn off the Cannonsville's flow. Algae blooms in the Cannonsville can also "seed" algae blooms in down-stream reservoirs, such as the Roundout Reservoir.

suspended solids.[4] Therefore, two of the key water pollutants of concern when reviewing new projects in the Watershed are phosphorus[5] and suspended sediment (also referred to as turbidity).[6]

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[4] The Schoharie Reservoir is often brown in color due to high levels of suspended sediments. The upland soils and stream beds within the Schoharie's drainage basin contain many clay or colloidal-type soils, as do the reservoir bottom and shores. Wave action, stream erosion, storm flows, construction excavation, soil tilling, roadway drainage cuts, timber harvesting, mud boils and underwater scour near the entrance to the Shandaken Tunnel inlet are some of the sources of this turbidity. High levels of sediment and silt have resulted in DEC formally listing the Schoharie Reservoir as "impaired" on its 2002 list of impaired water bodies under § 303(d) of the Clean Water Act.

[5] The adverse impacts of algae blooms due to phosphorus pollution are well established. Excess phosphorus leads to algae blooms, including increased growth of toxin emitting blue-green algae. Algae blooms lead to high bacteria growth that, in turn, depletes the reservoir bottom waters of dissolved oxygen. Low dissolved oxygen suffocates or drives off fish. Low oxygen levels cause a change in the biology of reservoir waters that result in impaired water taste, odor, and color. Iron, manganese and hydrogen sulfide are brought into the water column under these de-oxygenated conditions. Moreover, the higher levels of dead algae, bacteria and other chemicals in the water constitute an increase in organic matter that interacts with chlorine during the drinking water disinfection process – likely causing elevations in disinfection by-products; many of these chlorinated organic compounds are suspected by the U.S. Environmental Protection Agency ("EPA") of being carcinogens and have been identified in a number of medical studies as a factor linked to early term miscarriages. Finally, the increased material suspended in the water, resulting from phosphorus-induced algae blooms, can interfere with the effectiveness of chlorination and help to transport waterborne pathogens to water consumers.

[6] Turbidity in water can help to transport pathogens, serve as food for pathogens, promote the regrowth of pathogens in the water distribution system, and shelter pathogens from exposure to attack by disinfectants such as chlorine. The organic particles that cause turbidity can also combine with chlorine to create problematic disinfection by-products that are possible carcinogens and suspected of increasing the risk of miscarriage. For these reasons, the EPA in its Surface Water Treatment Rule, prohibited raw water turbidity measurements in unfiltered drinking water at the intake to the distribution system in excess of 5 nephelometric turbidity units ("NTU"), see 40 CFR § 141.71(a)(2). More than one violation per year is grounds for EPA to require construction of the water filtration plant for the New York City supply, estimated to cost over $6 million with an additional $200 to $300 million a year to operate. For an overview of the public health concerns raised by turbidity in drinking water, *see* U.S. EPA, *Guidance Manual for Compliance with the Interim Enhanced Surface Water Treatment Rule: Turbidity Provisions*, Office of Water, EPA 815-R-99-010, April 1999, Chapter 7 (and numerous cited references); *see* also Kistemann, T., *et al.*, *Microbial Load of Drinking Water Reservoir Tributaries During Extreme Rainfall and Runoff*, Applied Environmental Microbiology, Vol. 68, No. 5, pp. 2188-2197 (May 2002); Naumova, E., *et al.*, *The Elderly and Waterborne Cryptosporidium Infection:*

In addition, the Ashokan Reservoir itself exhibits high turbidity at times. For example, during most of the week of March 15, 2004, the Catskill system of the Watershed (which is comprised of the Schoharie and Ashokan Reservoirs) was in a "turbidity alert," with increasingly turbid waters flowing from the Ashokan Reservoir into the Kensico Reservoir and then into the water distribution system. Turbidity levels in water leaving the Ashokan Reservoir had reached 4.07 NTU's as of March 17, 2004. A review of records shows that there were at least eight other Catskill system turbidity events since 1996 – some of which lasted many days and even months.[7] DEC has formally listed the Ashokan as "impaired" due to high silt and sediment levels on its 2004 list of impaired water bodies pursuant to § 303(d) of the Clean Water Act.

Developments such as the Project can affect water quality through construction-related impacts as well as through increased runoff caused by increased impervious surfaces. As discussed below, the Project, particularly given the relevant environmental characteristics of the site, appears to present significant water quality concerns that are not addressed in the DEIS.

The portion of the proposed Project that is located within the "Catskill" portion of the Watershed would appear to raise more significant concerns with respect to drinking water quality. The Schoharie Reservoir, one of two reservoirs within the Catskill system, is already severely impaired, even though the Schoharie basin is not highly developed. The Esopus Creek, which drains the eastern portion of the Project site, has also been formally recognized as impaired on the State's Clean Water Act § 303(d) list due to excess silt and sediment. The Ashokan Reservoir basin is only approximately 257 square miles in size. While the water quality of the Pepacton Reservoir may recover by flowing through a series of other reservoirs before entering the water distribution system, the Ashokan Reservoir is a terminal reservoir so that water can be and is drawn directly from that reservoir into the water distribution system. Even during normal operations, the settling time available to Ashokan waters in the Kensico Reservoir is generally far shorter (approximately 30 days) than those available for Pepacton waters. Moreover, due to its relative proximity to population centers in the southeastern portion of New York State, it is also likely that the Ashokan Reservoir basin will be subject to the highest development pressure over the long-term.

Gastroenteritis Hospitalizations Before and During the 1993 Milwaukee Outbreak, Emerging Infectious Diseases, Vol. 9 No. 4, pp. 418-425 (2003). These articles are attached as Exhibit 1.

[7] Records maintained by the State Department of Health indicate that the initial dates of these eight additional turbidity alerts were: January 19, 1996; January 13, 1997; September 15, 1999; December 16, 2000; March 22, 2001; March 30, 2001; September 17, 2003; and September 29, 2003. The turbidity flowing from the Ashokan Reservoir was so significant on three occasions that DEC allowed DEP to add chemical flocculants into reservoirs to reduce turbidity (the events starting January 19, 1996, January 13, 1997, and December 16, 2000).

II.

SUMMARY ASSESSMENT OF SOILS FOR EROSION, PERCOLATION, SLOPES AND OTHER RELEVANT FACTORS AT THE PROJECT SITE.

A. Overview of Soils Analysis

We have undertaken a detailed assessment of the soil and slope characteristics of the Project site, and reviewed the soil and slope conditions that are found generally in the Catskill portion of the New York City Watershed. This information was obtained from the Project sponsor, City DEP, and the various County Soil and Water Conservation Districts that operate within the Watershed. Geographical Information System ("GIS") mapping was employed to assess the actual acreage of various soil types and slope conditions as they relate to specific areas of construction disturbance. This analysis employed the soil use ratings of the United States Department of Agriculture's Natural Resource Conservation Service.

This information, which was not contained in the DEIS, is of critical importance to designing effective engineering controls on polluted runoff and developing appropriate conditions for the SPDES individual stormwater construction permit. It also supports the recommendation (see Part III of these comments) that upward departures from the 5-acre State-wide limit on "raw earth" construction excavations be allowed only after careful evaluation. Further evaluation may also demonstrate that certain areas slated for construction may require reductions below the 5-acre standard. The detailed tables summarizing this assessment are presented as Exhibit 3. The tables are explained below. The background on soils and slopes in the Catskill portion of the Watershed (Table 9 of Exhibit 3) is useful for assessing potential risks associated with secondary or cumulative growth from the Project (see Part IV of these comments).

Many of the soil types located on the Project site have characteristics (high erosivity, clay or colloidal-type particles, low percolation rates, etc.) that can present significant erosion and water quality concerns. Slopes are often steep (15% and above) to very steep (35% and above). The project is in the highest rainfall region in the state. Precipitation for the one-year storm event is 3.5 inches, the two-year storm event is 4 inches, the ten-year storm event is 6 inches, the hundred-year storm event is 8 inches and average annual rainfall is 47.1 inches according to the Natural Resources Conservation Service. The project site is characterized by a combination of intense rain fall/snow melt events, low soil percolation, high soil erosivity, and colloidal soil particles that can remain suspended for many months and steep slopes, all of which create significant challenges with respect to the protection of water quality.

This soils analysis demonstrates that some of the areas of the Project site that are proposed for construction disturbance pose a very significant risk. Over 230 acres of the project will involve construction on slopes at or in excess of 15% with soils that are classified by the Natural Resources Conservation Service as being severely restricted for such use. Moreover,

some 157 acres of the Project site will be constructed on slopes at or in excess of 35% with severely restricted soils. Hydrologic soils group C and D soils are the only soils groups found on the entire project site. These soils have very low percolation rates, a factor that tends to significantly increase volumes of stormwater runoff. Many of the soils found on slopes below 15% also present severe erosion potentials. In addition, over 52% of the entire Catskill portion of the Watershed is characterized by slopes at or in excess of 15% with soils that are classified as severely limited. (Table 9 of Exhibit 3).

B. Geology

The Project site is in an area that is strongly influenced by the activities of glaciers that covered the area during the most recent ice advance 16,000 years ago. Both depositional and erosional features resulting from the glaciers are found throughout the area. Although bedrock can be found close to the surface in the higher elevations, significant thicknesses of unconsolidated deposits are also found in the vicinity of the Project site, particularly in the lower elevations and on the valley floors. Depth to bedrock at the higher elevations ranges between 12 to 22 inches. In some areas of the valleys, bedrock can be found 80-100 feet below grade. The unconsolidated deposits are composed largely of glacial tills and glacial lacustrine deposits. Thick deposits of silts and clays, deposited by glacial lakes that once existed, are found throughout the region.

C. Soils

Soils on the Project site were characterized and delineated for the Project sponsor by Roger Case, a consultant and former Natural Resources Conservation Service ("NRCS") soil scientist. Mr. Case produced the "Soils Map Eastern Portion"and "Soils Map Western Portion" that are displayed in the DEIS (Figures 3-6 and 3-7 respectively) and which were employed in this analysis. To evaluate the level of impact to soils from construction we referred to two GIS files: (i) the soil maps and (ii) a map of proposed impervious surfaces (e.g., buildings and roads) and landscaped areas (e.g., golf fairways). This data was reviewed to evaluate whether the soils underlying the areas proposed for construction disturbance are suitable for their proposed use pursuant to federal guidelines. A number of tables were assembled to assist in evaluating potential adverse impacts associated with proposed construction.

D. Definitions, Evaluation Methods and Results of the Assessment

Tables 1 and 2 of Exhibit 3 present soil characteristics associated with slope, percolation rates, runoff, and erosivity for both the Big Indian (eastern) and Wildacres (western) portions of the Project site. The soils with specific characteristics are presented in gross acreage and in percentage of the Project site. Soils that comprised less that 1% of the Project site were not included in these tables (explaining why some columns do not add up to 100%). The terms used in these tables as well as the tables themselves are summarized below.

1. DEIS Soils Codes: This column lists the soil codes (e.g., "EkD") that represent the specific soils (e.g., Elka Silt Loam, 15 to 25 percent slopes) that were identified on a portion of the Project site. The soil codes (also called map units) presented in the first column were the ones used in the DEIS. One point of confusion was that different soils scientists and Soil Conservation Districts employ different soils codes for the same soils. We have conformed all of these definitions and identified the construction risk characteristics associated with these soils as defined by the federal Natural Resource Conservation Service.

2. Delaware County Soils Codes: The Eastern portion of the proposed development is in Ulster County and virtually all of the Western portion of the project site is in Delaware County. The Ulster County Soil Survey was published in 1979, whereas the Delaware County Soil Survey was released "on-line" in 2003. Soil scientists at the NRCS were contacted for their expertise and guidance concerning which soils codes to use to interpret site soils. The NRCS soil scientists selected the Delaware County soil codes.

3. % of Eastern / % of Western Project Site: Any soil that was referred to in the DEIS and was present on the Eastern or the Western portion of the site at greater than or equal to 1% is listed and quantified in this column.

4. Slope (%): This represents the slope of the land. Percent is employed as the standard term even though the term "degree" (as in a "30 degree angle") is thought to be more appropriate by some. Slopes exceeding 15% are designated as "steep slopes" by the New York State erosion control guidance manual. Slopes in excess of 15% are considered too steep and deemed unsuitable for siting septic systems in New York by the New York State Department of Health. See 10 NYCRR Part 75, Appendix 75-A p. 4503). Slope influences the retention and movement of water, the potential for soil slippage, accelerated erosion, the ease with which machinery can be used and the engineering uses of the soil. Slopes on this site are often quite steep. For example, about two thirds of the Project site is characterized by steep slopes (15% or more) and more than a third of this site (39%) is characterized by very steep slopes (35% to 70% slopes).

5. Hydrologic Soils Group: The NRCS has grouped soils into four distinct classes based on how they respond to water. The four classes are hydrologic soils group:

A: High Infiltration Rate (water "seeps" into the ground quickly)
B: Moderate Infiltration Rate
C: Slow Infiltration Rate
D: Very Slow Infiltration Rate (if the site is "flat" water is prone to form puddles, if the site is "hilly" the water will likely flow downhill)

(NRCS 2003 Part 618.35). Group A soils are often sandy, whereas Group D soils often

have a high clay content or a restrictive layer (e.g., bedrock). Soils at the project site are classified as C and/or D. As a result, runoff is high and infiltration is low.

6. Erosion Factor (Kf): Erosion is an important process that affects soil formation and may remove all or parts of the soils formed in natural landscapes. Evaluating the degree of erosion that takes place is important in assessing the health of the soil and in assessing the soil's potential for different uses. Removing increasing amounts of soil alters various properties and capabilities of the soil. Soil erosion factors (Kf) were developed to quantify how susceptible very small soil particles (e.g., clay, fines, <2.0 millimeters) are to being detached from soil and rock by water. These factors are particularly important in the Watershed because (as discussed in Part I) detached clay particles suspended in water cause turbidity and adversely impact drinking water quality. The Kf soil erosion factor also accounts for freeze thaw cycles and predicts long term average soil loss. Kf erosion factors range from none (0.02) or slight to severe or very severe (0.49 in the northeastern US). The higher the Kf erosion factor the greater the probability that small particle erosion will occur. Soils at the project site have Kf erosion factors of .28 - .32 indicating that erosion of small soil particles at the project site is a significant concern. (NRCS 2003 Part 618.55).

7. Runoff Class: The index surface "runoff class" refers to the loss of water from an area by flow over the land surface. Runoff classes can be estimated using soil slope and permeability. There are six runoff classes: negligible (N), very low (LV), low (L), medium (M), high (H), and very high (HV). (NRCS 2003 Part 618.49). Applying the runoff class values to the soils on the Big Indian portion of the site, 35% of the soil (428 acres) is classified as having very high runoff potential, 37% (436 acres) as having high to very high runoff potential, and 28% (345 acres) has medium runoff potential. Applying the runoff class values to the soils on the Wildacres portion of the site, 30% of the soil (213 acres) is classified as having very high runoff potential, 51% (364 acres) as having high to very high runoff potential, and 18% (130 acres) has medium runoff potential.

8. Soil Interpretation Rating Guides: Soil Interpretation Rating Guides prepared by the NRCS were employed to assess a soil's limitations for different uses. Based on the proposed land use at the Project site, the following soil interpretation rating classes were assessed:

(1) dwellings with or without basements;
(2) local roads and streets; and
(3) golf fairways, lawns, and landscaping.

These soil ratings are defined in terms of severity such as "slight," "moderate," or "severe."

(i) Slight (Not limited): This rating is given to soils that have properties favorable

for the use. The degree of limitation is minor and can be overcome easily. Good performance and low maintenance can be expected (NRCS 2003 Part 620.03).

(ii) Moderate (Somewhat limited): This rating is given to soils that have properties moderately favorable for the use. This degree of limitation can be overcome or modified by special planning, design, or maintenance. The expected performance of the structure or other planned use is somewhat less desirable than for soils rated slight. The needed measures usually increase the cost of establishing or maintaining the use, but the cost is generally not prohibitive.

(iii) Severe (Very limited): This rating is given to soils that have one or more properties unfavorable for the rated use. This degree of limitation generally requires major soil reclamation, special design, or intensive maintenance. Some of the soils, however, can be improved by reducing or removing the soil feature that limits use; but in most situations, it is difficult and costly to alter the soil or to design a structure so as to compensate for a severe degree of limitation. This rating does not imply that the soil cannot be adapted to a particular use, but rather that the cost of overcoming the limitation would be high.

Individual tables for each of these three rating classes and their limiting features -- the soil characteristics that create the risk -- were prepared for the eastern and western portions of the Project site (Exhibit 3, tables 3-8.) Use of the soil interpretation rating guides in the planning and evaluation process allow the user to identify and recommend site selection and plan measures that minimize impacts on the soil resource (NCRS 2003 Part 620.05).

Table 3 of Exhibit 3 evaluates the 14 acres of soil at the Big Indian portion of the property that has been set aside for buildings. The data demonstrate that more than two thirds (10.6 acres) of this area is proposed to be built on steep slopes that exceed 15%. The rating class for the proposed development with basements is severe for all 14 acres. Dwellings without basements have a moderate rating as long as the slope of the land does not exceed 15%.

Table 4 of Exhibit 3 evaluates the 10.5 acres of soil at the Wildacres portion of the property that has been set aside for buildings. The data demonstrate that just under half (4.8 acres) of this area is proposed to be built on steep slopes that exceed 15%. The rating class for the proposed development with basements is severe for 10.2 of the acres.

Local roads and streets are those roads and streets that have all-weather surfacing (commonly of asphalt and concrete) and that are expected to carry automobile traffic year-round. For the purpose of interpreting how these proposed impervious surfaces at the Project site might impact soils, parking lots were included in our local roads and streets evaluation.

Table 5 of Exhibit 3 evaluates the 36.7 acres of soil at the Big Indian portion of the property that has been set aside for roads, streets, and parking. The data demonstrate that

approximately two thirds (24.0 acres) of this area is proposed to be built on steep slopes that exceed 15%. The rating class for 22.9 acres of the 24 acres is severe.

Table 6 of Exhibit 3 evaluates the 24.6 acres of soil at the Wildacres portion of the property that has been set aside for roads, streets, and parking. The data demonstrate that more than a third (8.8 acres) of this area is proposed to be built on steep slopes that exceed 15%. The rating class for more than 10.2 acres is severe.

Lawns, landscaping, and golf fairway soils are rated for their use in establishing and maintaining turf. The ratings are based on the use of soil material at the location that may have some land smoothing. Irrigation may or may not be needed and is not a criterion in the rating. Golf greens are not included in this rating.

Table 7 of Exhibit 3 evaluates the 235.2 acres of soil at the Big Indian portion of the property that has been set aside for lawns, landscaping, and fairways. The data demonstrate that over 60% (148.6 acres) of this area is proposed to be cleared on steep slopes that exceed 15%. The rating class for all 148.6 acres is severe. In addition, 100 acres of land that has a slope of greater than 35% is proposed to be disturbed.

Table 8 of Exhibit 3 evaluates the 161.2 acres of soil at the Wildacres portion of the property that has been set aside for lawns, landscaping, and fairways. The data demonstrate that almost half (73.7 acres) of this area is proposed to be cleared on steep slopes that exceed 15%. The rating class for the 73.7 acres proposed on steep slopes have been rated as severe. In addition, 30.5 acres of land that has a slope of greater than 35% is proposed to be disturbed.

This soil information was not included in the DEIS and reflects highly relevant data for the water quality impact analysis. The DEIS should be revised to address the challenges presented by the soil and slope characteristics of the site, recognizing the risks established by the NRCS.

III.

ASSESSMENT OF THE PROPOSED EROSION AND SEDIMENT CONTROL AND POST-CONSTRUCTION STORMWATER POLLUTION PREVENTION PLAN .

A. Overview

Polluted runoff flowing from the project site both during and after construction was correctly determined by DEC to be an attribute of the proposed development project that could have significant adverse impacts on the environment, thereby requiring review within an environmental impact statement. DEC has also determined that the proposed project will require an individual stormwater permit, as opposed to the project being "covered" under DEC's SPDES General Permit for Stormwater Discharges from Construction Activity (Permit No. GP-02-01)

("General Permit"). DEC is reviewing both the DEIS as it relates to stormwater pollution and the application for an individual SPDES stormwater permit at the same time. These comments also address both documents.

The potential for adverse impacts to water quality from construction of this Project is significant. According to EPA, sediment runoff rates from one acre of a construction site are typically 1,000 to 2,000 times that of one forested acre.[8] Therefore, the stormwater sedimentation and associated contaminants flowing from one uncontained acre subject to construction are generally equivalent to the sedimentation from two to three square miles of forest (1 square mile = 640 acres). Once eroded, clay particles (a type of particle that is represented at a high level in soils on and around the project site) often remain suspended for 6 to 9 months and even longer.[9] This period of suspension could allow these particles to remain in the water as it flows from the project site to the Ashokan Reservoir and on into the New York City water distribution system where it is then consumed. Similarly, the increased volume of stormwater from new impervious surfaces (e.g., parking lots, roadways, roof tops, etc.) is high. One acre of impervious surface creates the same amount of runoff as 16 acres of naturally vegetated meadow.[10] Numerous studies indicate that impervious surfaces areas at levels below 8 to 10% in a standard watershed can result in significant adverse impacts on water quality.[11]

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[8] EPA Storm Water Phase II Final Rule: Small Construction Program Overview EPA 833-F-00-013 (Fact Sheet 3.0) January 2000 (available at www.epa.gov/owm/sw/phase2); see generally, 64 F.R. 68722, 68728 to 68731 (December 8, 1999) (EPA Phase II Stormwater Pollution Control Program, Final Rule and Report to Congress summarizing adverse impacts of runoff from construction sites); National Research Council Watershed Management for Potable Water Supply: Assessing the New York City Strategy at 416-426 (2000) (discussing attributes and effectiveness of SPPPs in the context of the New York City Watershed).

[9] See, e.g., R.J. Davies-Colley, W.N. Vant, D.G. Smith, Colour and Clarity of Natural Waters, at 25 (1993).

[10] T. Schuler, The Importance of Imperviousness at p. 100, Watershed Protection Techniques, Vol. 1, Issue 3 (1994).

[11] See, e.g., Schueler, T., The Importance of Imperviousness, Watershed Protection Techniques, 1(3) pp. 100-11 (1994); Arnold, C. and Gibbons, J., Impervious Surface Coverage: The Emergence of a Key Environmental Indicator, Journal of the American Planning Association, 62(2) pp. 243-258 (1996); Booth, D. and Jackson, C., Urbanization of Aquatic Systems: Degradation Thresholds, Stormwater Detection, and the Limits of Mitigation, Journal of the American Water Resources Association, 33(5) pgs. 1077 to 1090 (1997); Wang, L., Lyons, J. Kanehl, P., Impacts of Urbanization on Stream Habitat and Fish Across Multiple Spacial Scales, Environmental Management, 28(2) pgs. 255-266 (2001). The EPA has also provided a detailed summary of the adverse water quality impacts of development when it promulgated its "Phase II" stormwater regulations. See 64 Fed. Reg. 68722, 68724 to 68727 (December 8,

Therefore, new impervious surfaces (as well as the substantially less-pervious surfaces created by the removal of vegetation and compaction of soils associated with construction excavations) can transmit very high volumes of stormwater relative to natural conditions that then operate to destabilize streams and cause additional erosion. As discussed in the introduction to these comments, elevated turbidity or suspended sediment levels present particular public health concerns in an unfiltered drinking water supply; a problem that already significantly affects the Catskill portion of the New York City Watershed, including the Schoharie and Ashokan Reservoirs and the Esopus Creek. Thus, the stormwater from the project must be carefully analyzed and fully addressed.

B. General Comments

1. The DEIS should include a detailed Stormwater Pollution Prevention Plan ("SPPP") for the entire project. The DEIS now contains only a limited proposed SPPP for an 85-acre portion of the Big Indian resort complex. This SPPP is to serve as an example of the type of program the project sponsor would follow for other portions of the site. A complete SPPP is necessary to analyze impacts as required by SEQRA. Moreover, engineering designs and calculations must be attuned to the highly varying conditions found throughout the project site, so one sample set of designs cannot address other portions of the site. A full SPPP is also required to allow DEC to adopt mitigation measures, as mandated by SEQRA, that will mitigate adverse environmental impacts to the maximum extent practicable taking into account social and economic considerations.

2. The limited SPPP contains numerous deficiencies with the proposed program to address both erosion and sediment controls (the controls on polluted runoff during project construction) and stormwater controls (the controls on polluted runoff after completion of the project). According to DEC guidelines, the SPPP should comply with the standards and requirements contained in the DEC General Permit for Construction Activity, as well as the technical manuals its references: New York State Standards and Specifications for Erosion and Sediment Control (Empire State Chapter of the Soil and Water Conservation Society) April 1997 and New York State Stormwater Management Design Manual (prepared for DEC by the Center for Watershed Protection) October 2001. Other guidance has been provided by U.S. EPA, see National Management Measures to Control Nonpoint Source Pollution from Urban Areas (published at www.epa.gov/owow/nps/urbanmm/index.html) (July 2002), as well as by numerous reports issued by technical organizations such as the Center for Watershed Protection (see generally, www.cwp.org). However, due to its incomplete and general nature, it is not possible to demonstrate compliance. Given the highly sensitive nature of this project site, the SPPP should be re-done in more detail, showing how it complies with these standards.

3. Overall, the SPPP must include much greater detail. The SPPP as it relates to the erosion and sediment control plan for the 85-acre Phase 2 area does not contain the "fully

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1999). These articles are attached as Exhibit 2

designed and engineered stormwater management practices with all necessary maps, plans and construction drawings" required by the General Permit at Part III.D.2. The specific requirements of the erosion and sediment control plan are outlined in the General Permit at Part III.D.2(a)(1 to 16); these requirements have not been met. The fact that this is a large site does not justify the use of a conceptual SPPP that would be unacceptable at smaller sites. Rather, the size indicates a need for greater, not lesser, detail. At a minimum, for each area of the site, the SPPP should contain specific design details concerning: (i) the phasing of construction; (ii) the clearing of vegetation; (iii) the movement and stockpiling of earth; (iv) the channeling and volume of stormwater; (v) the deployment and sizing of erosion control measures such as check dams, stone channels, geo-textile materials, hydro-seed, silt fencing, sod, and mulch; and (vi) detention basin sizing, location, peak flow attenuation, decantation and maintenance. This information should be presented on engineered construction plans in a manner that allows for actual implementation by construction contractors.

The SPPP must be designed based on the attributes of the construction site (e.g., average peak storm intensity, soil erosivity, soil percolation rates, levels of impervious surfaces after construction, slopes, etc.) and the use of standard engineering models and formulas to calculate the size and spacing of various stormwater control measures (e.g., the appropriate capacity of a detention pond based on likely stormwater volume within a particular catchment area). The conceptual SPPP presented in the DEIS does not allow for effective review and critique; nor does it provide sufficient information for DEC to make fact-based determinations on appropriate individual stormwater permit conditions.

C. Specific Comments

4. The DEIS has incorrectly identified design discharge points at the bottom of the mountain near the property boundary for stormwater calculation comparisons. The removal of vegetation, the manipulation of earth and the construction of the proposed project will significantly alter the hydrology of the project site. This change in hydrology will be most significant at the point where the construction disturbance ends and stormwater is discharged. The DEIS and its predicate calculations, however, do not assess the effects of the stormwater discharges (from basins or ditches or other methods) at the various locations on the side of the mountain where the discharges actually occur, but rather, assume the boundary is the discharge point. This failure has taken place in the development of both the erosion and sediment control plan and the post-construction stormwater plan. Therefore, these stormwater calculations were not determined in accordance with DEC's Stormwater Management Design Manual.

As a result, the calculations and assessments with respect to: (i) appropriate rates of discharge from basins; (ii) detention basin volume and outfall design; and (iii) the erosive impacts of the stormwater discharges at the point of discharge on the mountain side, are not valid and must be re-done. The redesign of stormwater controls based on correct inputs should be required.

The selection of design discharge points at the bottom of the mountain should not be accepted by DEC as it would tend to significantly reduce the projected impact of stormwater discharges by ignoring the impact on the undeveloped land within the Project's boundary. Moreover, contrary to what is suggested in the DEIS, natural "sheet flow" conditions will not be replicated along the middle of the mountainside in a manner that existed prior to construction because the hydrology of the project site will have been dramatically altered by construction activity. Finally, design discharge points at the base of the mountain are not appropriate because stormwater effects will not be mitigated as the water travels down mountain slopes because: (i) the project site consists of hydrologic soil group "C" and "D" soils that have very low percolation rates – especially under storm flow conditions and (ii) the site has steep slopes so there will be little retention time for infiltration.

5. The DEIS does not provide sufficient detail to demonstrate compliance with water quality standards and to further improvement of the impaired Esopus Creek. The DEIS must demonstrate compliance with all New York State Water Quality Standards. See 6 NYCRR Part 703. Of particular applicability to construction activity are the water quality standards for turbidity ("[n]o increase that will cause a substantial visible contrast to natural conditions") and for suspended, colloidal and settleable solids ("[n]one from . . . wastes that will cause deposition or impair the waters for their best usages"). 6 NYCRR § 703.2. The DEIS must also address the additional silt and sediment pollution that will be discharged from the eastern portion of the project site in light of the fact that the Ashokan Reservoir and the Esopus Creek, which drain this area, are listed as "impaired" for silt/sediment by State DEC on its 2004 Clean Water Act § 303(d) list, as the DEIS forms the basis for SEQRA mitigation measures and SPDES permit conditions. Currently, in both scope and specificity, the DEIS and SPPP lack such detail.

6. As detailed in Part II of these comments, all soils on the site are hydrologic soil group C and D soils with little to exceedingly low percolation rates. It appears that the DEIS indicates lower levels of stormwater volumes as a result of water infiltration in a number of situations (e.g., in detention basins and on steep mountain slopes after discharge from basins). For example DEIS Appendix 10 at pp. 2-3 describes a 29% volume loss in stormwater in the lined detention ponds that the are situated in low to no percolation soils. This would appear to be a very significant overestimate. Given the exceedingly large number of calculations associated with the design of the SPPP presented in the DEIS, we were not able to review all of the predicate calculations and modeling assumptions to determine the full extent of this inappropriate methodology. An underestimate of stormwater volumes due to assumed infiltration that is in fact unlikely to occur, would result in the inadequate design of numerous stormwater and erosion control measures. The DEIS should re-do calculations and model assumptions to determine where infiltration was improperly assumed, correct any mis-calculations, and re-design/re-size stormwater measures as appropriate.

7. The stormwater model used was not correctly calibrated. The DEIS employs a stormwater model known as "WinSLAMM" to support much of the stormwater plans contained

in Appendix 10 of the DEIS. This office consulted with Professor Robert Pitt, Ph.D., who is the Cudworth Professor of Urban Water Systems in the University of Alabama's Department of Civil and Environmental Engineering. Professor Pitt is the principal author of the WinSLAMM model, as well as other stormwater modeling systems. After a detailed review of the DEIS, Appendix 10 and other data, Professor Pitt reports that it was inappropriate for the project sponsor to employ the WinSLAMM model to estimate pre-development conditions (e.g., stormwater volumes and pollutant levels). The existing project site is presently heavily wooded with some prior logging and minor clearance. According to Professor Pitt, the WinSLAMM model was never intended (or likely ever tested) for use as a mechanism to determine pre-development stormwater attributes of such an area. The "undeveloped" or "open space" conditions modeled in WinSLAMM are, according to Professor Pitt, for small undeveloped areas in otherwise developed urban areas. Furthermore, the model results for such areas are not likely to accurately represent wooded lands or lands that have been subject to logging. Professor Pitt further determined that the WinSLAMM model used in the DEIS was not calibrated with actual local water quality and flow measurement data; rather, the parameter files employed in the model to determine stormwater attributes prior to construction were simply the general "default" files that are supplied with the WinSLAMM program. As a result, the pre-development stormwater information in the DEIS lacks model support and should not form the basis of the stormwater plans. A re-calculation and re-assessment of the stormwater management program should be undertaken employing accurate modeling information concerning pre-development conditions as a predicate. Claimed pollutant removal efficiencies of stormwater and erosion controls that are presented in the DEIS relative to projected pre-development conditions should be revised to reflect valid calculations from a valid model. See General Permit at Part III.D.2(b)(5).

A fundamental element in the environmental analysis of stormwater and erosion impacts is an accurate understanding of pre-development conditions. Projected pollution and flow levels in stormwater both during and after construction are compared to pre-development conditions to understand potential adverse environmental effects relative to the "no-build" condition. Moreover, pre-development conditions often serve as a bench-mark for the pollutant removal efficiencies and flow attenuation levels to which an SPPP is required to be engineered. For example, City DEP generally requires pollutant loadings to be returned to pre-construction conditions as part of its individual permitting program. Similarly, an accurate assessment of pre-development sediment loadings is important when evaluating the additional burden this project may place on the Ashokan Reservoir and the Esopus Creek, water bodies that drain all of the eastern or "Big Indian" portions of the proposed project site and which are already classified as "impaired" due to high silt/sediment levels. An accurate depiction of pre-development sediment levels flowing from the project site is an essential element of such an analysis.

8. Construction phase discharges should be no greater than the current discharges to avoid further impairment. As discussed above, the Ashokan Reservoir and the Esopus Creek are already impaired due to silt/sediment levels and are in violation of state water quality standards. Given this status, the SPPP for the eastern portion of the proposed project that drains into the Esopus Creek should be designed to a standard that maintains stormwater sediment

discharge levels at accurately determined pre-development levels during and after the eight-year construction period. This condition should be contained in the individual SPDES permit for the project and the project sponsor should be required to demonstrate compliance in the SPPP and supporting calculations. There is precedent within the Watershed for such a requirement, as City DEP generally requires all SPPPs, within the Watershed to be designed to achieve discharge levels that are no higher than pre-development conditions.

9. Construction phasing should follow DEC guidelines and ensure proactive monitoring. The General Permit at Part III.D.2(a)(4) requires the project sponsor to "provide a construction phasing plan describing the intended sequence of construction activities, including clearing and grubbing, excavation and grading, utility and infrastructure installation and any other activity at the site that results in soil disturbance." This provision further identifies the state-wide requirement that "there shall not be more than five acres of disturbed soil at any one time without prior written approval of the [DEC]." The New York State Standards and Specifications for Erosion and Sediment Control ("E&SC Standards"), that are the DEC recognized SPDES standards (see General Permit at Part III.D.1), also state that "[n]o more than 5 acres of unprotected soils should be exposed at any one time" and goes on to state that "[s]ite factors including topography, soil erosion potential, proximity to wetlands and water courses may require limiting the amount of raw earth that can be exposed at any one time to less than 5 acres." See E&SC Standards at Appendix A, Section E.1.

Despite these standards, the DEIS proposes a construction phasing plan that seeks to exceed the 5 acre standard, with construction phases exposing as much as 50 acres of raw earth at one time on the project site. The project sponsor has also requested that it be allowed to depart from the state-wide standard as part of its individual SPDES stormwater construction permit application.

As detailed in Part II of these comments, the soils, slopes and intensity of rain/snow melt events[12] present significant technical challenges for the design and implementation of effective controls on polluted runoff. The significant percentage of "small particle" or clay-type soils makes this site particularly sensitive because of its location within a major unfiltered drinking water system. Indeed, the sensitivity of this site would justify a downward departure from the normal 5 acre "raw earth" standard due to the risks associated with a significant failure. Moreover, the major deficiencies in the SPPP and the DEIS that these comments identify support the conclusion that there is no technical justification for a departure from the 5 acre state-wide standard.

Experience with construction in the Watershed suggests that the 5-acre standard is sound

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[12] As discussed, northwest Ulster County generally has the highest rainfall intensity in the state. Precipitation for a hundred year storm event is 8 inches, for the two year storm event 4 inches and for the one year storm event is 3.5 inches. The average annual rainfall is 47.1 inches. (Source: Natural Resources Conservation Service, 2003).

and appropriate. For example, the New York State Department of Transportation's approximately 50 acre construction site along the Taconic Parkway in Westchester County sent high volumes of highly turbid water on at least eight occasions into an adjacent stream that flows into the New Croton Reservoir. Expansive plumes of brown, sediment-laden, water were observed in the New Croton Reservoir repeatedly from the Fall of 2001 to the Spring of 2002 as a result of this construction site, despite vigorous enforcement actions by DEC and the Attorney General's Office, a full "stop work and remediate" order, and the emergency expenditure of approximately $1 million by DOT to deploy additional stormwater control measures.

Similar discharges occurred at the Hanna Country Inn and Golf Resort in Delaware County that is a short distance from the proposed project. The Hanna project involved the construction of an access road up a steep slope to a new club house. Even though this roughly 5 acre roadway excavation was the subject of a detailed SPPP approved by DEP, the site failed on repeated occasions from May of 2002 until at least the winter freeze of that year. Despite active monitoring and enforcement by City DEP, as well as extensive remedial programs by Hanna (e.g., staking sod along most of the slope) this site continued to discharge significant amounts of sediment into Hubble Hill Brook and then to the East Branch of the Delaware River and then to the Pepacton Reservoir. On numerous occasions as reported by City DEP staff and others, turbid flows from the Hanna Construction site gave the Hubble Hill Brook and the East Branch of the Delaware River the appearance of thick chocolate milk. The portion of the Hubble Hill Brook above the construction site was clear. Though it was not a large site, the clay/colloidal soils at the Hanna site combined with steep slopes and intense rainfalls to make the effective implementation of an erosion and sediment control plan exceedingly difficult. The relevant attributes of the Hanna site (steep slopes, problematic soils, intense rain events) are very similar to those of the project site.

Thus in accordance with DEC guidelines, there should be no deviation from the 5-acre standard, until a complete SPPP is submitted for the entire site, along with all supporting assumptions and calculations, in a manner that allows for effective evaluation. In addition, post-excavation "stop-work" authority should not be viewed as an effective back-up plan for the requested large excavations because very substantial volumes of turbid water frequently continue to discharge from problem construction sites despite enforcement actions and extensive remedial efforts by the site owner in response to enforcement. Construction phases could be limited to no more than 5 acres in any one reservoir drainage basin (e.g., the Ashokan or the Pepacton) at any one time for a total of 10 acres but should also be limited to levels below 5 acres on portions of the project site that are steeply sloped or have highly problematic soils. At a minimum, DEC should require the pilot testing of the erosion and sediment control plan on a small portion of the site (in a manner observed and verified by DEC and City DEP) prior to any grant of authority to the project sponsor to exceed the 5 acre standard.

10. Properly prepared site grading plans are needed. To the extent they are shown, the erosion and sediment control measures are presented on the "phasing" plans; these plans provide a large scale overview of what area is worked on during each phase of construction.

Phasing plans are not employed to govern actual project implementation by contractors. Rather, standard practice during construction is that the deployment of erosion and sediment control measures are depicted on the far more specific construction "grading" plans. The grading plans will be employed by the construction contractor to understand exactly what is to be accomplished and implemented. This failure, if not corrected, will confuse site contractors and frustrate effective implementation of the erosion and sediment control plan. The grading sheets should contain the appropriate tables and information describing the specific attributes of the erosion and sediment controls.

11. The erosion and sediment control mechanisms for the proposed site (stone check dams, silt fencing, temporary drainage swales, etc.,) should be designed for a minimum 2-year storm, which is 4 inches. Given the present status of the erosion and sediment control plan, it is not possible to determine the engineering criteria employed for the design of these measures, to the extent these measures are presented at all. The numerous steep drainage ditches need to be protected with stone lining or turf reinforcement mats.

12. A sediment removal plan is needed. The design goal for the sediment basins are properly targeted to capture the 10-year storm and the appropriate bare earth C soils curve number has been employed to determine storm flows. However, a detailed sediment removal plan for these basins is absent and must be presented. General Permit at Part III.D.2(a)(2).

13. A detailed plan for clearing and grubbing waste disposal is needed. The clearing and grubbing of this site would generate large quantities of waste materials (e.g., brush, sod and stumps) that would be many acres in size. Though the DEIS states that these materials will be buried, no waste areas are designated on the drawings. The high volume of wood wastes generated at this site has the potential to harm groundwater. The DEIS should address transporting the waste materials offsite. The waste material must not be buried in a ravine or in an area that could affect a drinking water well. If the waste material is to be buried onsite, an erosion and sediment control plan needs to be developed to account for additional deforestation and to address newly created stormwater concerns.

14. The DEIS should conduct on-site studies of project soils. Most of the soils at the project site have little or no percolation. Based on data provided in the DEIS for the soil test pits excavated on site, soils contain 50 to 60% silt and clay, and the clay content was between 12 and 22%. The very small size of these soil particles, which can flow through a size 200 micron sieve, means that they can remain suspended in water for a long period of time – with important implications for drinking water quality. It would be useful to better understand the actual suspension time by employing a hydrometer analysis. The results from this test will provide useful estimates concerning how long clay/silt soils should be expected to remain in suspension in still water and the rate of settling. (It would not provide useful information about settling rates in moving water). This information also will assist in the evaluation of whether the introduction of a chemical additive to detention ponds, as is proposed, will aid in removing clay particles from the water and will help determine the appropriate period of time that the water needs to be

retained in sediment basins before it will be clear enough to decant.

15. A detailed plan regarding use of a chemical additive for stormwater treatment that removes turbidity is needed. Should DEC decide to consider the use of a chemical additive to remove suspended clay and silt particles in detention basins, both laboratory "bench tests" and field tests need to be conducted to confirm the product's effectiveness on these soils. Field tests need to be run because the performance of chemical additives are affected by water temperature, clay type, flow rates, and chemical levels. The field tests are also necessary to determine whether the chemical additives will be decanted from the basins into area trout streams. If this chemical is placed in the detention ponds, it would appear highly likely that it will flow into area trout streams. Should there be a chemical discharge, the regulatory requirements associated with the addition of chemicals to area streams needs to be assessed, and a SPDES permit may be required.

16. A detailed plan for selecting a chemical additive for stormwater treatment that is safe to aquatic organisms is needed. The chemical additive that is proposed for use in detention ponds is soluble chitosan acetate. Tests need to be designed and run which will determine if this chemical will cause adverse impacts to the species that live in the trout streams that will receive stormwater flows from the project site. There is at least one detailed scientific study which found that the proposed chemical additive kills rainbow trout at fairly low running levels of 38 parts per billion over six days or at approximately one part per million over a few hours. G. Bullock, V. Blazer, S. Tsukuda, S. Summerfelt, Toxicity of Chitosan Acetate for Rainbow Trout (*Oncorhynchus mykiss*) Cultured in a Recycle System, published in the proceedings of the Twenty-Fourth Annual Eastern Fish Health Workshop (Atlantic Beach, N.C., March 9 to 11, 1999).[13]

17. A detailed plan to drain the detention ponds is needed. Draining detention ponds in a timely manner is an important practice that will better assure that the detention ponds have available capacity to retain stormwaters from the next storm. If the detention ponds are full, they will simply be by-passed and the stormwaters left untreated. As proposed, during construction, water would be pumped out of detention ponds and into a device called a "level spreader." The level spreader is a perforated plastic pipe that is proposed to run at level across a contour line of the mountain for long distances, often through forest. One of the level spreaders is to run some 1,000 feet. This practice is highly likely to fail. Placing the level spreader at *level* in the woods and along a mountainside will be exceedingly difficult, particularly given the trees, rock outcrops, topography curves and intermittent streams. The likely dips in the plastic piping will cause high pressure to build up and the piping to break. The resulting flow of water will likely cause severe hillside erosion at the point of failure. Therefore, some other workable method to decant the detention ponds should be developed and proposed.

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[13] The study's authors are from the U.S. Geologic Survey, Biological Resources Division, National Fish Health Research Laboratory, 1700 Leetown Road Kearneysville, W.V. and the Freshwater Institute, Shepherdstown W.V.

18. A detailed plan is needed for soil stockpiles. The project involves extensive construction excavations and grading throughout the project site. By necessity, large piles of earthen materials will be created and moved. Large piles of excavated soils, if not handled properly, have a significant potential to emit sediments during storms. The SPPP for the Phase 2 area does not take into account these stockpiles of excavated soils, describe their location or duration on grading sheets, or provide for any specific erosion control measures to stabilize these soil stock piles. This substantial omission is contrary to General Permit Part III.D.2.(a)(4) and good practice. The grading sheets should provide complete details with respect the manner in which these materials will be effectively managed as part of the overall SPPP. Moreover, while the various cuts and fills appear to be balanced, the timing and routing of excavated earthen materials is an important element of the program to control off-site sedimentation. The DEIS and the SPPP should contain far more detailed information so that it can be verified that the transfer of these materials will be managed effectively.

19. The numerous steep fill slopes proposed throughout the Project site must be carefully and individually evaluated. We were able to examine only a few of these fills for potential impacts on erosion and sedimentation. In the Belleayre Highlands map (SG-5) there are numerous slopes shown at 1.5 to 1 (one foot and a half horizontal to one foot vertical). This is extremely steep for fill slopes. Without information on the attributes of the fill material, a slope stability analysis is not possible and given the steepness, there is a risk of failure. One such fill is over 100 feet high and is topped with the weight of an access roadway. In addition, it appears that the project sponsor has proposed to place a level spreader to discharge stormwater on that slope – thereby adding large quantities of water from a detention pond in addition to natural rainfall. The weight and soaking effect of this water would likely further destabilize this slope – creating a possible safety risk to drivers, in addition to a risk of soil erosion. All steep fills on the site should be carefully evaluated for stability and more moderate grades or vertical retaining walls should be employed where appropriate. Level spreaders and other detention basin discharges should be removed from steep fill areas throughout the Project.

20. Significant erosion can occur from the unprotected portions of the project site. For example, a 1.38 acre area of exposed soil on sheet SG-5 has no identified erosion and sediment controls and drains to a roadside ditch. Calculations using the "Revised Universal Soil Loss Equation" show that 250 tons of soil will be lost from this area over the course of one construction season. This amount of soil is equivalent to the capacity of 10 large construction dump trucks. The 1.38 acre site is one of many uncontrolled areas where stormwater sediments can be transported off site without any containment. The SPPP should identify other such areas and present an adequate erosion and sediment control plan. Moreover, road side ditches throughout the proposed Project do not appear to include any erosion and sediment controls, a situation that should be rectified in a revised SPPP.

21. A revised grading and excavation schedule is needed. Grading and excavation operations should not be permitted outside of the growing season because vegetation will not be able to be effectively established to stabilize soils. This likely means that excavations and

grading should not take place at this high altitude site before April 15th and after October 1st.

22. Methods to stabilize site soil need to be tested in the field. The DEIS does not mention the use of straw mulch. Instead Soil Guard and Eco-Aegis are discussed. These products cement soil and alter infiltration, which means that the use of these agents may promote more runoff. Field tests need to be performed on whatever product is selected to confirm whether or not the sponsor's selected measure is adequate for this climatic region.

23. A revised schedule to stabilize soil with vegetative cover is needed. As a best management practice, the project sponsor should develop a program where all graded slopes are seeded within 7 days of final grade. Any slopes in excess of 3 to 1 should be seeded and stabilized with a rolled erosion control mat. Once a road slope is excavated, the cut should be shaped and seeded immediately.

24. No construction waste (e.g., asphalt shingles, fuels, lubricants, garbage, etc.) management plan is detailed in the SPPP as required by General Permit III.D.2(a)(4).

25. Waste water from concrete production needs to be treated prior to release. Water will be used on site to wash aggregate to produce concrete. Wastewater from this process and from concrete truck washout facilities contains fine suspended material that needs to be treated separately from other site stormwater. The DEIS does not address this issue.

26. Although water quality volume ("WQV") computations are presented in the DEIS for the overall project, they are not presented for each sub-catchment. This information was not provided for the Phase 2 SPPP. This prevents an evaluation of whether the post construction stormwater quality measures were properly sized. These computations, as well as those for calculating pollutant removal efficiencies, need to be provided in the DEIS.

27. Water quality treatment volumes comparing rainfall and snow melt are needed. The computations used to compare the water quality treatment volume between rainfall and snow melt is absent from the DEIS and needs to be included, as per the 2003 New York State Stormwater Management Design Manual (Appendix I). Without further explanation, the DEIS appears to use low values.

28. Times of concentration used in the DEIS appear to be incorrect. Times of concentration (Tc's) for the "hydrocad" routings appear to be much too long for the steep watershed slopes (e.g., for sub-catchment 22, the Tc is stated at 30.5 minutes). A similar TR-55 model analysis would estimate the Tc at only 9.6 minutes. A longer Tc results in much lower estimates of peak rates of post-development discharge flows ("Q.") Thus, discharge rates that are presented in the DEIS appear to be much lower than they should be. Higher values would demonstrate more severe erosive forces, particularly on steep slopes. The Tc values should be re-evaluated for the entire SPPP and accurate assumptions employed in the calculations.

29. The "n" coefficients used in the DEIS appear to be incorrect. The "n" coefficients, which measure the "roughness" or friction associated with surface stormwater flows, and used in the DEIS for overland flow computation, appear incorrect when compared to values presented in USDA SCS TR55, chapter 3. This raises questions regarding the validity of the final routing values employed in the stormwater models. With the confused methods that were presented in the DEIS, it cannot be verified whether this value was correctly calculated. An incorrect "n" value would result in incorrect velocity and erosive force values, thereby making inaccurate the engineering calculations that serve as a predicate for the engineered design of stormwater controls. This value should be re-assessed and recalculated for the entire SPPP.

IV.

ANALYSIS OF SECONDARY GROWTH IMPACTS AND RECOMMENDATION THAT A DETAILED CUMULATIVE IMPACT ANALYSIS BE UNDERTAKEN TO ASSESS THE LONG-TERM IMPACTS OF GROWTH ON DRINKING WATER QUALITY.

This office requested that Dr. Gerrit Knaap, Director of the National Center for Smart Growth Education and Research at the University of Maryland (with the assistance of Terry Moore and others at Dr. Knaap's selected consulting firm, ECONorthwest), review the DEIS for the proposed Project as it relates to secondary and cumulative growth impacts. The large regional nature of this Project raised concerns that the Project might itself, or in combination with other developments, create a situation that injures drinking water quality.

As documented in Part II above, much of the entire Catskill portion of the Watershed, in addition to the project site, contains steep slopes, clay or colloidal-type soils, and intensive rainfall events (Exhibit 3, Table 9). A number of the relevant water bodies, particularly in the Catskill portion of the Watershed, are already impaired or stressed by pollutant loadings.

We requested that Dr. Knaap independently review and critique the secondary growth analysis conducted in the DEIS, identify points of concern or agreement, and conduct his own assessment of secondary impacts using data and economic models that are professionally appropriate and justified. We also requested that Dr. Knaap conduct an evaluation of whether the DEIS, which does not contain a cumulative impact analysis, should have done so given an economic evaluation of likely growth within the Watershed. The goal of Dr. Knaap's assessments was to provide projected estimates concerning likely off-site acres of land (i) that may be subject to construction disturbance and (ii) that may be converted to new impervious surfaces both as a result of the Project alone and in conjunction (cumulatively) with other projects. We were interested in understanding potential growth over the 10, 20 and 50 year period. Dr. Knaap's report, with associated appendices, is attached as Exhibit 4 and is incorporated into these comments.

With respect to the secondary growth impact assessment contained in the DEIS, Dr.

Knaap found numerous specific disagreements but largely concurred in the DEIS's basic conclusion: that the Project, standing alone, is not likely to cause extensive levels of new impervious surfaces and construction disturbances in off-site areas. Dr. Knaap's projections of new construction are higher than those contained in the DEIS, but not of a magnitude that we would characterize as significant.

The assessment of potential cumulative impacts does raise significant concerns. Dr. Knaap's report identifies the potential for sizeable amounts (many squares miles) of new acres of impervious surfaces and construction disturbances cumulatively in Watershed over time due to likely development pressure. The key finding of Dr. Knaap is that the DEIS is deficient because it failed to require a detailed cumulative impact analysis to better determine the full extent of growth impacts so as to better guide decision-making on the large-scale regional development Project proposed in the DEIS. We recommend that a cumulative analysis be undertaken in a revised DEIS.

V.

REVIEW OF PROPOSED INTEGRATED PEST MANAGEMENT PROGRAM: PESTICIDE AND HERBICIDE USE.

A. Overview

In general, the DEIS contains language describing the elements of an Integrated Pest Management Program ("IPM") designed to minimize - but not eliminate - the use of chemical pesticides. A review of DEIS Section 2.4.8 provides some discussion of non-chemical management techniques, a statement that pesticide use will be the lowest choice in the hierarchy of pest management options and a claim that pesticides will be used only for curative, and not preventive, purposes. All are elements of a good IPM program. It took careful review, however, to find those assurances and piece them together into a coherent statement of pest management policy.

For instance, Section 2.4.8 "Golf Course Integrated Pest Management" starts at page 2-73 with a discussion of pesticides, and the methods used to select the products to be used. The concept of limiting chemical use to curative treatments is introduced after the discussion of the chemical selection process, and is not an unqualified commitment (i.e., 2.4.8.C: "In almost all instances, only affected greens and tees would be treated . . ."). The hierarchy of pest management options, and the preference for non-chemical methods is not clearly stated until 2.4.8.D.6 at page 2-88. If there is a real commitment to constructing, maintaining and operating the facility in accordance with IPM/ITM principles and practices, there should be a clear statement to that effect at the beginning of 2.4.8.

In the correct hierarchy of pest management options, chemical controls are not only placed last, but in that category, emphasis is placed on the role of toxicity and risk assessment in

the selection of specific products to be used. We were unable to find mention of that critical evaluation in the current DEIS. As is set forth in our specific comments below, the evaluation of the health and environmental risks of the pesticides proposed for use is seriously flawed by critical omissions.

B. Specific DEIS Comments

1. Inert Ingredients are not identified; their impacts are not assessed. The DEIS does not consider the potential impacts of "inert" ingredients, which generally comprise at least half of the formulated product. The narrative generally refers to pesticide products or pesticides (e.g., 2.4.8.B), but the assessments of toxicity and mobility deal only with active ingredients. (See also, Appendix 14, section 2.4 and Appendix 15). In fact, the only product identification is in Table 2-8 (page 2-90), where the absence of useful information on the inert ingredients formulated in the products proposed for use is clear. Although the inert ingredients are "not listed" that does not mean that they are not present.

The products identified in Table 2-8 are not the only ones which contain the listed active ingredients. Other products with the same active ingredients may well contain different formulations of inert ingredients. Will the products identified for each active ingredient be the only ones used, or will other formulations of the same active ingredients be applied? Note also, that inerts are not considered in the risk assessments summarized in Appendix 15. Without the identity of the inerts, the value of any health or environmental risk assessment is, at best, seriously compromised.[14]

2. There is little discussion of the health effects associated with the active ingredients proposed for use. EPA has identified two of the active ingredients proposed for use as "likely to be carcinogenic to humans." These are the insecticide ethoprop, and the herbicide oxadiazon. An additional half dozen active ingredients have been identified by EPA as "possible human carcinogens" (Fungicides propiconazole and vinclozolin, insecticides acephate and bifenthrin, and herbicides prodiamine and trifluralin.) There is no discussion of the carcinogenic potential of these compounds, and no justification for their use at the golf course, or in the Watershed, in light of their carcinogenicity.

Two of the insecticides proposed for use (acephate and ethoprop) are organophosphates - a class of pesticides whose neurotoxic effects are well documented, widely known and the subject of current reevaluation by EPA. Although still underway, the EPA reassessment has already resulted in substantial new restrictions on the use of several organophosphates. The

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[14]Bensulide is listed as an inert ingredient of the herbicide "Balan" in Table 2-8. Benefin is identified as the active ingredient. Both bensulide and benefin are herbicides, and bensulide is listed on page 2-86 and in Appendix 15 as a recommended herbicide. The identification of bensulide as an inert almost certainly is an error.

DEIS does not discuss the neurotoxic potential of these compounds, and does not justify their use at the golf course or in the Watershed in light of their neurotoxicity.

Of course, with little or no information about the inert ingredients formulated in the products proposed for use there is no discussion of their carcinogenicity, neurotoxicity or other chronic health effects.

3. LC_{50} is a crude instrument for the assessment of environmental risk. The assessment of environmental risk attributable to pesticide runoff is based on a comparison of maximum runoff concentrations to LC_{50} values for fish and aquatic invertebrates. Eight pesticides were eliminated as candidates for use because their maximum modeled runoff concentration exceeded one or more LC_{50} values. While it is appropriate that short term mortality of 50% of resident aquatic fauna is deemed unacceptable, there is no other threshold of damage applied. Chronic toxic effects of the pesticides on aquatic organisms is not addressed. Neurotoxicity might alter individual behavior and ability to survive long term in the natural habitat. Mutagenicity, teratogenicity and endocrine disruption can all diminish reproductive success. These chronic effects, not reflected in short term individual mortality can nonetheless result in the loss of local natural populations in a relatively short period of time, although measured in months or years and not hours or days as is the case with experimentally derived LC_{50} values.

Of course, with little or no information about the inert ingredients formulated in the products proposed for use there is no discussion of their environmental effects, even by such a crude measure as LC_{50} values.

4. There appears to be no adequate provision for monitoring ground and surface water resources for pesticides and fertilizers during the "operational phase." While modeling may provide the basis for the initial selection of chemicals and treatment regimes, it should not be the final determinant of long term operations. Provisions for ongoing ground and surface water monitoring for active and inert pesticidal ingredients, their degradation products as well as nutrients, should be included in the operational plans for the golf course. The deep ground water wells that have been proposed for use in operational monitoring are deficient as they will provide little to no useful information concerning impacts. The deep ground water to be tested is drawn from locations that are likely to be by-passed by ground water which is closer to the surface. It is the ground water that is closer to the surface that is most likely to be impacted. Shallow groundwater monitoring wells should be employed for comprehensive testing.

C. Specific Comments on Appendix 14

1. Historical uses do not justify development of the new course. The existence of other golf courses in the area "up to the 1960's" provides little comfort as to the current site suitability. The suite of chemicals used for turf management would have been quite different, as

were the regulatory requirements and oversight practices. Were these golf courses maintained to the standards of the proposed course? Is there any monitoring data to support the implied conclusion that the previous golf courses did not adversely impact the local environment?

2. The risks and costs associated with the use of chemical controls are substantially understated. The discussion at Section 3.4 ignores a number of important considerations. While chemical controls may reduce labor costs, they also increase material costs and the probability of adverse effects on human health and environmental quality, thereby increasing liability costs. More important, the conclusion that the association of pesticide residues with adverse environmental impacts resulted only from improper use or over use is unsupported and unsupportable. The history of pesticides for which the registrations have been canceled or the uses modified after original registration demonstrate the fact that unanticipated adverse effects occur under the conditions of use originally accepted by EPA and DEC. In fact, federal regulations speak clearly on this point in the prohibition of any label claims as to the safety of the pesticide or its ingredients, even with a qualifying phrase such as "when used as directed." 40 CFR § 156.10(a).

3. The discussion of Biological Controls is inappropriately argumentative and belies a questionable commitment to their inclusion in the pest management program. In counterpoint to the overly sympathetic introduction to chemical controls (see above) biological controls are introduced with mention of "pseudo-factual reports" about pesticides and the unsupported conclusion that biological controls are "complex, not totally effective and not always predictable." One could easily say the same of chemical controls, based on the need for repeated re-treatment, the proposal of alternative chemical controls for specific pests, and the many instances in which unanticipated adverse effects have occurred after use of chemical pesticides in accordance with label instructions. Biological controls are not presented in the context of valuable tools for turf management, but rather as "[o]ne approach that may provide some level of relief for turf managers . . ." from increased pressure to reduce pesticide applications (see section 3.4 at top of page 26).

4. Misleading terminology is used throughout Sections 4, 5 and 6 to describe the chemicals proposed for control. In many instances, the reference to "products" is in fact a reference to an active ingredient without acknowledgment that the active ingredient is not used in isolation, but rather formulated with other ingredients generally not identified on the label and not included in the modeling and toxicological evaluations presented in this DEIS.

5. The prioritization of control options in Sections 4, 5 and 6 is not clear, and does not reflect a commitment to the use of chemical pesticides only as a last resort. Generally, options are presented in a sequence of "cultural," "biological" and "chemical." It is not clear here that the options will be implemented in that order, and what criteria will be used to judge that one option has proven inadequate and justify the implementation of the next option in the hierarchy for each specific pest. In some instances, chemical control seems to be the intended management tool to the exclusion of other options. For example, in section 6.3.6 chemical

treatment is listed as the second option, before at least two cultural controls. Cultural Strategy V for annual bluegrass, "Apply a preemergence herbicide . . ." is a chemical strategy, not a cultural one.

Similarly, in the discussion of control options for White Grubs (see 5.5.1 at page 50), parasitic wasps are discussed as the third option and parasitic nematodes as the fourth option. While the text notes that parasitic wasp populations may take 2 to 3 years to reach effective levels, there appears to be no plan to establish the wasps during the construction or early days of operation of the course. Without such preparation, it seems unlikely that parasitic wasps can play a meaningful role in the control of white grubs, and chemical controls will be used instead.

6. Record keeping, as described in the DEIS, is inadequate to assess the efficacy of pest management strategies. The brief discussion of record keeping in Appendix 14, section 3.3.3 (p. 24) and the accompanying Figure 4 deal only with records of scouting. While these are useful in determining when and if control measures are needed, they do not help with subsequent analysis of their effect. If any control methods are implemented as a result of scouting/monitoring then there should be a record of what was done, and what effect resulted. These records would not necessarily be required for those preventive measures that are part of the construction and routine operation of the course, but should be generated and kept for all actions taken in response to a pest infestation. These records will document the efficacy of treatments, chemical or otherwise, and should be a valuable resource to the golf course management and others. To maximize their utility, the records should be publicly available.

7. There is no provision for notice to golfers, other visitors and neighbors, when chemical pesticides are applied. Given the known and potential adverse health effects associated with chemical pesticides, adequate notice should be given to those who work at the golf course, those who use it and those who reside on neighboring property. This can be accomplished by signs posted around treated areas and by notices displayed prominently at key locations, such as the first and ninth tees. Neighbors should receive advanced notice of applications to allow them to take precautions as they see fit.

D. Specific Comments on Appendix 15: Fertilizer and Pesticide Risk Assessment

1. General Comment. To comment comprehensively on the modeling described in Appendix 15, it would be necessary to research each of the models used in some depth, and better understand all of the inputs used and assumptions made. Lacking time and resources for this kind of in-depth review, we can provide only the following general observations and comments. In no case did the modeling consider either pesticide degradation products or inert ingredients of pesticide products, which, as discussed above, is a severe shortcoming for an analyses described as a "risk assessment."

2. WINPST Modeling. In Section 2 (p.2) and 2.1 (p.3) the USDA's WINPST model is described as an initial screening tool for determining overall pesticide mobility. It is unclear why

the WINSPT modeling was even conducted, because there is no indication that any pesticides were accepted or rejected for use based on this exercise. Although the properties of four different soil series were reportedly modeled, Attachment 1 presents only the results for one soil series. Although the modeling produces indices of both pesticide mobility and hazard (hazard potential is based upon toxicological data in an internal WINPST database), the hazard rankings are ignored. The writers apparently prefer to compare LEACHM and GLEAMS generated concentration results to drinking water standards and LC_{50} values than to consider in any way the hazard potential results generated by the WINPST modeling. This results in the retention of at least nine pesticides that WINPST predicts will present a high hazard to humans and/or fish. No basis is given for ignoring these results.

3. LEACHM Modeling. The modeling utilized 1996 precipitation records, with 1996 being described as a high-precipitation year. The precipitation records are not provided, and so it is not clear whether precipitation was in fact heavy during the pertinent time periods when pesticide applications were modeled (April - October).

Although soils were identified and mapped in the field by the LA Group soil scientists, the modeling incorporated characteristics of type location soils reported in the Greene County Soil Conservation Service publications and the National Resources Conservation Service. Site specific soil characteristics could well have been determined but were not. The modeling apparently did not consider the effects of golf course construction activities on soil parameters (disturbance/cut-and-fill/artificially constructed soils for tees and greens where heavy pesticide applications are the rule).

The criteria applied to retain or reject pesticide products was: "Only the products that did not leach at all through the soil profiles and the products that had undiluted leachate concentrations below drinking water standards are recommended for use based on this portion of the this risk assessment." Claims of the conservativeness of the chosen criteria aside, the use of these criteria seems to assume no uncertainty concerning either model results or the protectiveness of the applicable drinking water standard (which in most instances are the New York State Department of Health "default"standard of 50 parts per billion for unspecified contaminants). A more conservative approach would eliminate those products that were predicted to have undiluted leachate concentrations at 10% or more of the drinking water standard. EPA HALS could and should be considered as well.

4. GLEAMS Modeling. Section 4.3 (p. 20) reports that, "Of the 53 pesticide active ingredients analyzed, *all but two* [emphasis added] were present to some degree in the worst case modeling . . . ." The criteria applied to reject pesticides was a concentration in undiluted runoff equal to or greater than the LC_{50} for the pesticide in question. As discussed above, the LC_{50} is questionable as a protective criteria in any event, and the application of the criteria assumes no uncertainty concerning model results or toxicological effects other than death. To better account for all uncertainties and unknowns like sub-lethal effects and effects on different life stages, undiluted runoff concentrations that are greater than 10% of the LC_{50} could be used.

E. Conclusion.

The attached spreadsheet (Exhibit 5) summarizes an alternative pesticide retention/rejection scheme. Products in blue font are selected for use both in Appendix 15 and by application of the comments above. Products stricken out in red font are those that were retained in Appendix 15 but would be rejected based on the comments above. Products stricken out in black font are those that were rejected both in Appendix 15 and by application of the above comments. The purpose of this spreadsheet is to demonstrate how arbitrary the selection criteria used in Appendix 15 are. The pest management plan should be re-done with more consistent and conservative methods and incorporating a clear commitment to IPM.

VI.

ASSESSMENT OF ADEQUACY OF THE DEIS REVIEW OF THE DESTRUCTION AND DEFORESTATION OF HEADWATER WETLANDS ON THE PROJECT SITE.

A. Introduction and Recommendations

Wetlands provide flood control, wildlife habitat, and improve drinking water quality by retaining phosphorus and processing nitrogen, trapping sediments, removing and transforming human and animal wastes, and degrading certain pollutants. Any disturbance to wetlands or their adjacent "buffer" areas within the Watershed is highly disfavored. The restoration or re-creation of wetlands that have been disturbed is usually unsuccessful.

Within the New York City Watershed, wetlands play a particularly important water quality protection function, and they comprise only a small fraction of the total land area. In short, the Project can and should be re-designed pursuant to SEQRA so that there is no disturbance or destruction of the 4.5 acres of wetlands or the associated buffer area (an area that is generally 100 feet in width) contrary to what is presently proposed. Moreover, as presented below, there are significant factual and technical disputes over the scope and existence of certain wetlands and water courses on the Project site. These disputes must be resolved prior to the EIS process being found to be complete so that decisions are made on an accurate factual record.

The U.S. Fish and Wildlife Service ("FWS"), with the assistance of City DEP, conducted an inventory of wetlands located within the Watershed as part of the National Wetlands Inventory. Tiner, R.W., Atlas of National Wetlands Inventory Maps for Watersheds of the New York City Water Supply System (1996). This inventory of wetlands that generally are 1 acre or more in size was developed through the interpretation of aerial photographs taken in 1986 and 1987, as well as through partial on-ground verification. The inventory found that within the Delaware portion of the Watershed, wetlands, exclusive of streams, rivers, lakes, reservoirs, and reservoir shores comprise only about .81% of the total area. In the Catskill portion of the Watershed, wetlands, including large reservoir shore areas but excluding streams, rivers, lakes

and reservoirs comprise about 1.06% of the total area. This is a low level of wetland coverage. The Croton portion of the Watershed, for example, is approximately 7% wetland.

Given the importance of wetlands for water quality protection and the location and scale of the proposed development, potential impacts to wetlands are an important component of this DEIS. As is discussed in more detail below, however, the DEIS is deficient in this area because the document:

1. Fails to analyze the adverse environmental impacts of the proposed filling of 1.47 acres of wetlands, the removal of trees from forested swamps and stream corridors totaling 2.84 acres, and the destruction of associated wetland buffer area;

2. Fails to discuss why the wetland impacts could not be avoided through alternative project size or layout;

3. Fails to clearly describe the area of affected wetlands by erroneously excluding from the substantive discussion of wetlands in the DEIS the so-called "isolated" wetland areas;

4. Does not accurately depict existing site conditions because it excludes stream corridors that drain wetland complex ## 33-35 and wetland complex ##19-22, and apparently connect those purported "isolated" wetlands to Birch Creek and Emory Brook, respectively;

5. Fails to differentiate between the "waters of the United States" regulatory jurisdiction of the U.S. Army Corps of Engineers under the federal Clean Water Act and the analysis of adverse impacts to wetlands for purposes of SEQRA; and

6. Does not propose any wetland replacement for the area of wetlands proposed to be filled or cleared by creating, expanding or enhancing wetlands elsewhere in the affected watersheds, proposing instead to "mitigate" the wetland impacts by preserving other existing wetlands on the development's property, but for which there appears to be no reasonably foreseeable plans to fill or alter.

B. Federal Regulation of Wetlands

Separate and apart from SEQRA, filling or clearing wetlands in New York State may be subject to regulation under federal law. Federal Clean Water Act jurisdiction over "waters of the United States," includes wetlands. The Clean Water Act mandates that the federal government "restore and maintain the chemical, physical, and biological integrity of the Nation's waters."

The U.S. Army Corps' program to implement that mandate with respect to wetlands is specified under Section 404 of the Clean Water Act, 33 U.S.C. § 1344. Rather than being subject to New York State programs, small headwater wetlands like those at issue here are regulated under the federal Clean Water Act.

U.S. Army Corps regulations adopted under the Clean Water Act define "waters of the United States" to include, among other wetlands, wetlands that are themselves tributaries or are adjacent (bordering, contiguous or neighboring) to tributaries of traditional navigable waters, and wetlands that are themselves water, or are adjacent to other water, "the use, degradation, or destruction of which could affect interstate or foreign commerce including any such waters which are or could be used by interstate or foreign travelers for recreational or other purposes . . ," 33 C.F.R. §§ 328.3(a)(3); 328(a)(5) and (7) and 328.3(c).

Not all water, however, is included within the "waters of the United States" and regulated under the Clean Water Act. In *Solid Waste Agency of Northern Cook County v. U. S. Army Corps of Engineers* ("*SWANCC*"), 531 U.S. 159 (2001), the United State Supreme Court ruled that water that collected in abandoned pits from a defunct sand and gravel mine, creating a scattering of permanent and seasonal ponds, were not "waters of the United States." Courts have recognized, however, that *SWANCC* created a narrow exception to the broad scope of the original definition.

C. DEIS Analysis of Wetlands.

The DEIS addresses wetlands in Section 3.5.2 (pages 3-89 through 3-96), and incorporates material submitted to the U.S. Army Corps of Engineers regarding wetlands delineation (a delineation report identifies, maps, and discusses the wetlands on site) and permitting under the federal Clean Water Act as Appendix 17.

The DEIS includes no further analysis of wetlands other than present the material submitted to and accepted by the U.S. Army Corps of Engineers. That approach is not adequate for compliance with SEQRA because it erroneously delegates all relevant wetlands issues and decision-making to the U.S. Army Corps, a federal agency that is not subject to SEQRA, and improperly narrows the scope of the issues in terms of both geographic area and subject matter.

For example, the summary in the DEIS states that "the project requires the placement of clean fill in jurisdictional wetlands totaling 0.0993 acre." (DEIS at 3-94.) Yet material in Appendix 17 makes clear that the projected impacts to wetlands include the filling (destruction) of an additional 1.47 acres of wetlands. (Appendix 17A at 19, table 19). There is, however, no mention or analysis in the DEIS of the adverse impacts of that projected filling of those wetlands, apparently under the belief that the additional 1.47 acres of wetlands was outside the definition of "waters of the United States" for purposes of Army Corps jurisdiction. That omission in the DEIS appears to be both factually and legally unsupported. Factually, as described below, information from scientists from FWS and DEP suggests that there are additional wetlands.

Legally, it is not dispositive to a SEQRA analysis whether or not a wetland is regulated by the Corps of Engineers (or DEC or any other agency); SEQRA demands an analysis of the site regardless of other statutory requirements. Here, the DEIS does not discuss the fact that a much larger area of wetlands is projected to be filled, does not analyze the adverse environmental impacts of such filling, and provides no analysis of avoiding or mitigating those impacts. Those elements must be part of the SEQRA review of this project regardless of federal regulatory jurisdiction.

Those same requirements also apply to the projected clearing of trees from almost 3 acres of forested swamps and stream corridors. While the wetland tree removal protocols convinced the Army Corps that the clearing activity would not itself require an Army Corps' permit, those "how it will be done" protocols do not present a SEQRA analysis of the habitat or other environmental impacts of removing the trees from forested swamps and stream corridors, alternatives to avoid the impacts, or practicable ways to mitigate unavoidable impacts.

D. The DEIS Omits Stream Corridors Found by FWS and the City DEP.

The developer's wetland delineation report was submitted to the U.S. Army Corps of Engineers. On August 16, 2000, an Army Corps official met with the project sponsor to examine the wetlands on site. The FWS became involved with this project when asked to review a Pre-Construction Notification Permit Application (Number 2000-00748-YS) by the Army Corps. In response, a biologist from the FWS inspected portions of the proposed project site for wetlands. In addition, wetland scientists from the DEP also inspected the proposed project site for wetlands and water courses.

Based on site wetland investigations conducted by scientists representing both the FWS and DEP, the wetlands section of the DEIS is factually incorrect and deficient because it does not identify all of the water courses or streams on site. Without a thorough and accurate accounting of the water courses and streams on the project site, the DEIS cannot properly present the environmental impacts and mitigation measures associated with the proposed development.

1. FWS Site Inspection. Following the field inspection, the FWS sent a letter dated July 11, 2003 to the Army Corps identifying a number of potential inconsistencies concerning site wetlands. One week later the Army Corps filed an internal "memorandum for record" document entitled "Statement of Findings for Application No. 2000-00748-YS by Crossroads Ventures, LLC". The FWS letter to the Army Corps challenged whether all of the wetlands at the site had been properly delineated. According to the FWS:

> Direct wetland impacts are associated with the construction of road crossings over four stream and wetland complexes. Project plans also include numerous crossings of streams and wetlands by golf course paths. Numerous road crossings are also planned over non-jurisdictional wetlands. At least 13 crossings were noted on the project plans of both streams and wetlands. It is unclear if all of the

streams including the ephemeral and intermittent streams have been shown on the plans. We recently visited the project site and found channels and discernable bed and banks located downslope of mapped channels. For example, we observed channels south of Gunnison Road adjacent to proposed golf tee #5, which are not shown on the plans. If all of the water courses have not been documented, then not all of the impacts have been considered. Intermittent and ephemeral streams provide important functions on the landscape such as carrying storm flows and providing habitat for life cycles of some species of fish and invertebrates. (Emphasis added.)

The importance of the FWS observations concerning unmapped water courses or streams is two-fold. First, accurate assessment of the potential impacts of filling or clearing wetlands cannot be performed if water courses and streams downslope from the impacted wetland areas — the stormwater pathways from those impacted areas – are not accurately mapped and depicted in the DEIS. Second, if the relevant wetland areas are drained by streams or water courses, then those wetlands would likely constitute "waters of the United States" that would also require an Army Corps' permit before they legally could be filled.

The Army Corps' response to FWS was that the FWS was mistaken concerning the location of the stream in question and that it was "confident that all waters of the United States were identified within the project area." The Army Corps was correct that the stream in question was not south of Gunnison Road at proposed golf tee #5. (The area of concern being questioned by the FWS was actually south of Gunnison Road, near the green at hole 13, as well as north of Gunnison Road).

In an effort to resolve this contradiction, a freedom of information act request was sent to both the FWS and the Army Corps concerning the proposed project wetlands. After reviewing the files, a March 30, 2004 telephone conversation with the FWS biologist who had walked the site both north and south of Gunnison Road revealed the following observations down slope from wetland complex ##19-22: drift patterns, drainage patterns, erosion, defined bed and bank, exposed roots, rocks and deposited sediment. These factors in concert with the site topographic map tend to indicate that the wetland complex ## 19-22 is connected to the north to this drainage channel, which likely connects to a tributary of Emory Brook under high precipitation conditions. Wetlands identified on either side or parallel to this wetland complex were not classified as isolated in the DEIS. Wetland #16 located to the west, and wetland # 23 located to the east, both flow into a tributary of Emory Brook, which is a tributary of the Pepacton Reservoir. This factual issue needs to be resolved before the EIS process under SEQRA is concluded.

2. DEP Site Inspection. Independent of the FWS review, the DEP wrote a letter to the Army Corps dated December 8, 2003, disagreeing with some of their jurisdictional determinations concerning wetlands at the project site. The DEP confirmed FWS's suspicion that the area north (downslope) of wetland complex ## 19-22 was not properly delineated or mapped as an "isolated" wetland. DEP scientists field identified those wetlands as tributaries of

Emory Brook. The DEP also found that the area north of wetland complex ## 33-35, on the eastern portion of the site, was not properly characterized. According to the site DEP's inspection, these three wetlands are tributaries to Birch Creek, which in turn is a tributary of the Ashokan Reservoir. This factual issue also needs to be resolved before the EIS process under SEQRA is concluded.

E. The Proposed Wetland Mitigation is Inadequate

To the extent that filling wetlands cannot practicably be avoided, the adverse impacts of the lost wetland functions and values must be mitigated under SEQRA unless demonstrated to be impracticable, by replacing the wetland area to be filled by restoring a larger area of former wetland or expanding a larger area of existing wetland within the same tributary system. To the extent that clearing trees from forested swamps and stream corridors cannot practicably be avoided, those impacts must also be mitigated, unless demonstrated to be impracticable. The mitigation proposed in the DEIS, to preserve other wetlands existing on site for which there appears to be no reasonably foreseeable plans to fill or alter, does not meet SEQRA's requirement that "to the maximum extent practicable, adverse environmental effects revealed in the environmental impact statement process will be minimized or avoided." ECL § 8-0109(8).

* * * * *

Respectfully submitted,

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7. IMPORTANCE OF TURBIDITY

7.1 Overview

Section 2 of this guidance manual is included to present an overview on the definition and sources of turbidity. Understanding turbidity, its causes and sources, and the significance to human health will provide the background on which the new turbidity standards are based.

7.2 Turbidity: Definition, Causes, and History as a Water Quality Parameter

Turbidity is a principal physical characteristic of water and is an expression of the optical property that causes light to be scattered and absorbed by particles and molecules rather than transmitted in straight lines through a water sample. It is caused by suspended matter or impurities that interfere with the clarity of the water. These impurities may include clay, silt, finely divided inorganic and organic matter, soluble colored organic compounds, and plankton and other microscopic organisms. Typical sources of turbidity in drinking water include the following (see Figure 7-1):

- Waste discharges;
- Runoff from watersheds, especially those that are disturbed or eroding;
- Algae or aquatic weeds and products of their breakdown in water reservoirs, rivers, or lakes;
- Humic acids and other organic compounds resulting from decay of plants, leaves, etc. in water sources; and
- High iron concentrations which give waters a rust-red coloration (mainly in ground water and ground water under the direct influence of surface water).
- Air bubbles and particles from the treatment process (e.g., hydroxides, lime softening)

Simply stated, turbidity is the measure of relative clarity of a liquid. Clarity is important when producing drinking water for human consumption and in many manufacturing uses. Once considered as a mostly aesthetic characteristic of drinking water, significant evidence exists that controlling turbidity is a competent safeguard against pathogens in drinking water.

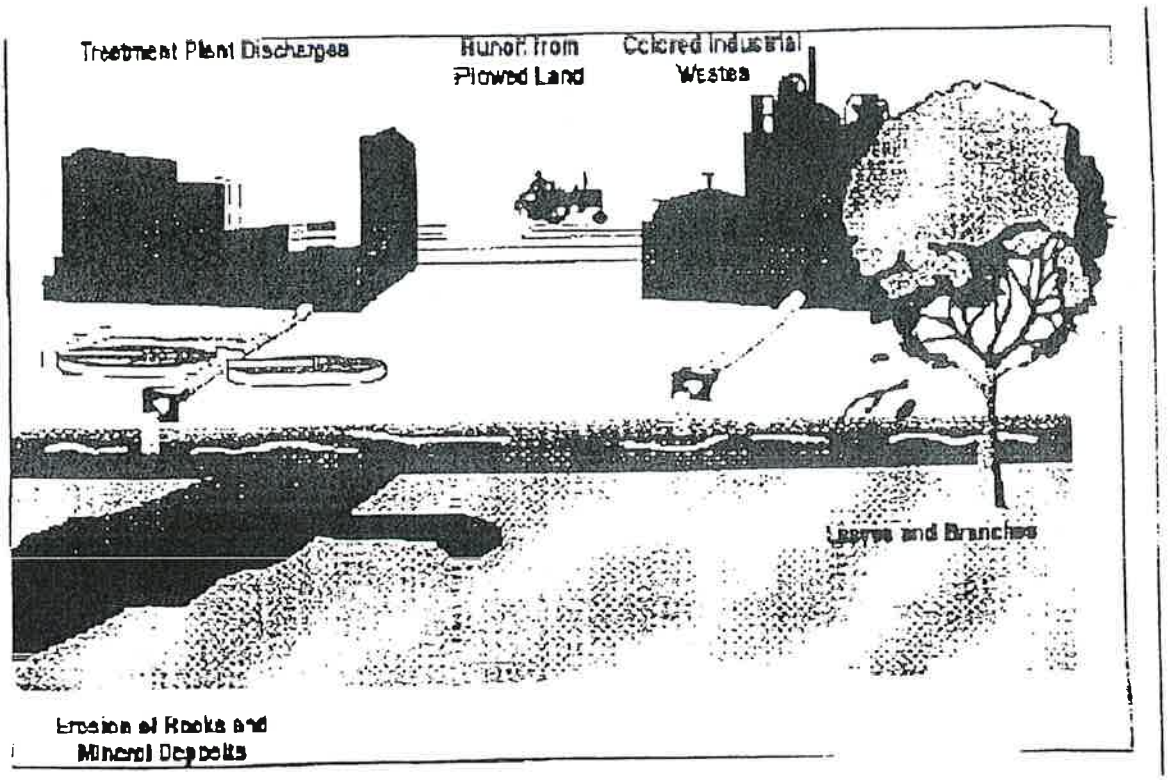
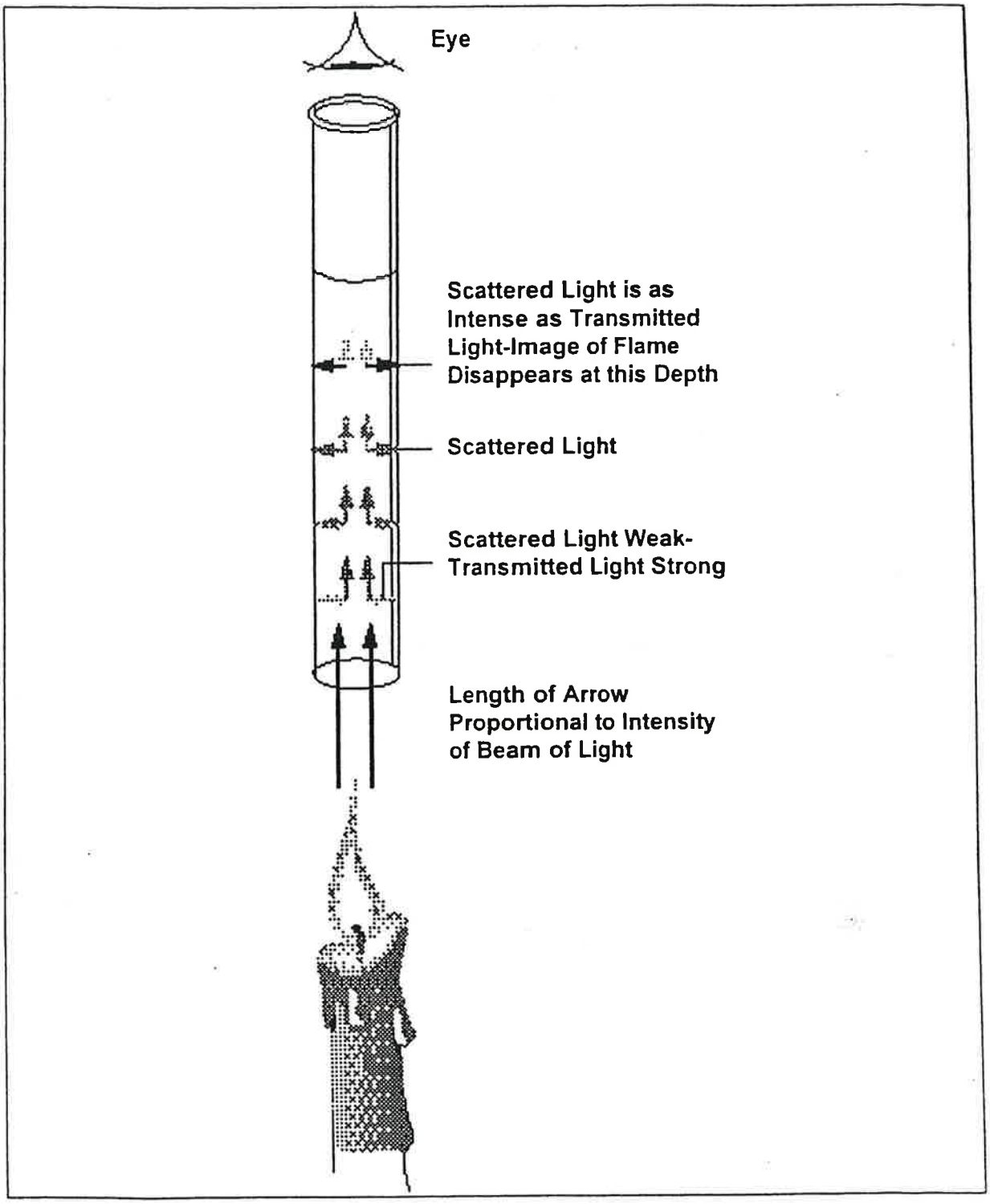


Figure 7-1. Typical Sources of Turbidity in Drinking Water

The first practical attempts to quantify turbidity date to 1900 when Whipple and Jackson developed a standard suspension fluid using 1,000 parts per million (ppm) of diatomaceous earth in distilled water (Sadar, 1996). Dilution of this reference suspension resulted in a series of standard suspensions, which were then used to derive a ppm-silica scale for calibrating turbidimeters.

The standard method for determination of turbidity is based on the Jackson candle turbidimeter, an application of Whipple and Jackson's ppm-silica scale (Sadar, 1996). The Jackson candle turbidimeter consists of a special candle and a flat-bottomed glass tube (Figure 7-2), and was calibrated by Jackson in graduations equivalent to ppm of suspended silica turbidity. A water sample is poured into the tube until the visual image of the candle flame, as viewed from the top of the tube, is diffused to a uniform glow. When the intensity of the scattered light equals that of the transmitted light, the image disappears; the depth of the sample in the tube is read against the ppm-silica scale, and turbidity was measured in Jackson turbidity units (JTU). Standards were prepared from materials found in nature, such as Fuller's earth, kaolin, and bed sediment, making consistency in formulation difficult to achieve.



Source: Sadar, 1996.

Figure 7-2. Jackson Candle Turbidimeter

In 1926, Kingsbury and Clark discovered formazin, which is formulated completely of traceable raw materials and drastically improved the consistency in standards formulation. Formazin is a suitable suspension for turbidity standards when prepared accurately by weighing and dissolving 5.00 grams of hydrazine sulfate and 50.0 grams of hexamethylenetetramine in one liter of distilled water. The solution develops a white hue after standing at 25 °C for 48 hours. A new unit of turbidity measurement was adopted called formazin turbidity units (FTU).

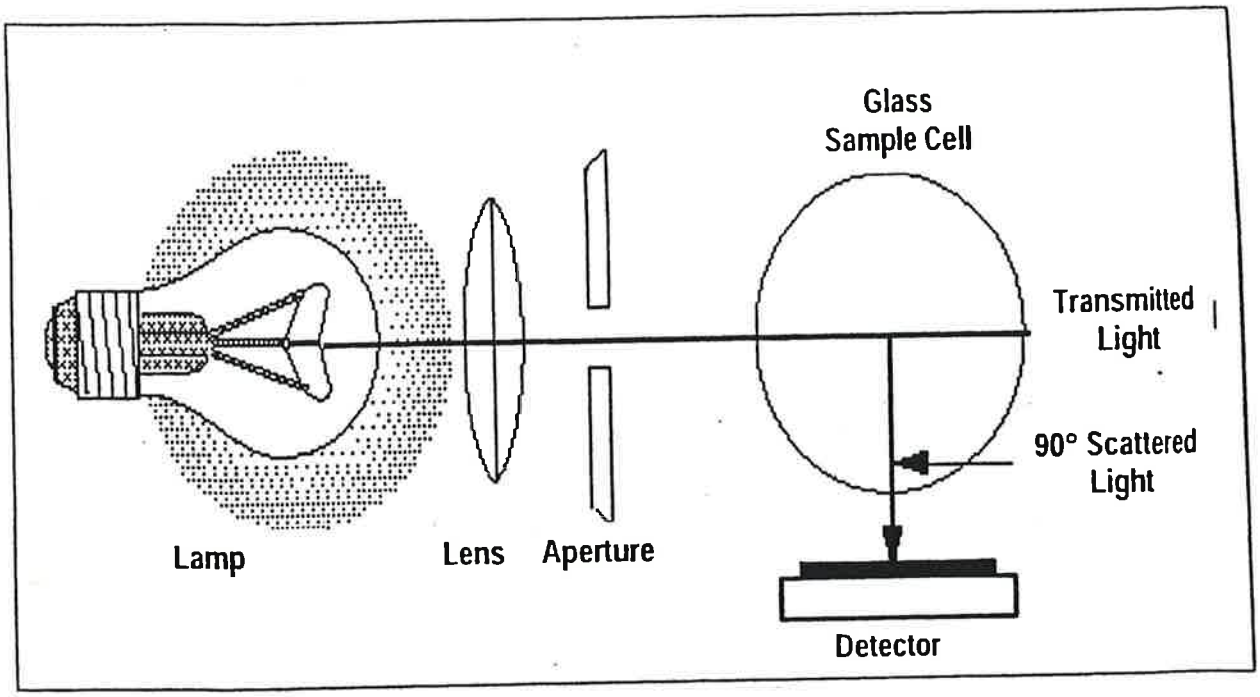
Even though the consistency of formazin improved the accuracy of the Jackson Candle Turbidimeter, it was still limited in its ability to measure extremely high or low turbidity. More precise measurements of very low turbidity were needed to define turbidity in samples containing fine solids. The Jackson Candle Turbidimeter is impractical for this because the lowest turbidity value on this instrument is 25 JTU. The method is also cumbersome and too dependent on human judgement to determine the exact extinction point.

Indirect secondary methods were developed to estimate turbidity. Several visual extinction turbidimeters were developed with improved light sources and comparison techniques, but all were still dependent of human judgement. Photoelectric detectors became popular since they are sensitive to very small changes in light intensity. These methods provided much better precision under certain conditions, but were still limited in ability to measure extremely high or low turbidities.

Finally, turbidity measurement standards changed in the 1970's when the nephelometric turbidimeter, or nephelometer, was developed which determines turbidity by the light scattered at an angle of 90° from the incident beam (Figure 7-3). A 90° detection angle is considered to be the least sensitive to variations in particle size. Nephelometry has been adopted by *Standard Methods* as the preferred means for measuring turbidity because of the method's sensitivity, precision, and applicability over a wide range of particle size and concentration. The nephelometric method is calibrated using suspensions of formazin polymer such that a value of 40 nephelometric units (NTU) is approximately equal to 40 JTU (AWWARF, 1998). The preferred expression of turbidity is NTU.

7.3 Turbidity's Significance to Human Health

Excessive turbidity, or cloudiness, in drinking water is aesthetically unappealing, and may also represent a health concern. Turbidity can provide food and shelter for pathogens. If not removed, turbidity can promote regrowth of pathogens in the distribution system, leading to waterborne disease outbreaks, which have caused significant cases of gastroenteritis throughout the United States and the world. Although turbidity is not a direct indicator of health risk, numerous studies show a strong relationship between removal of turbidity and removal of protozoa.



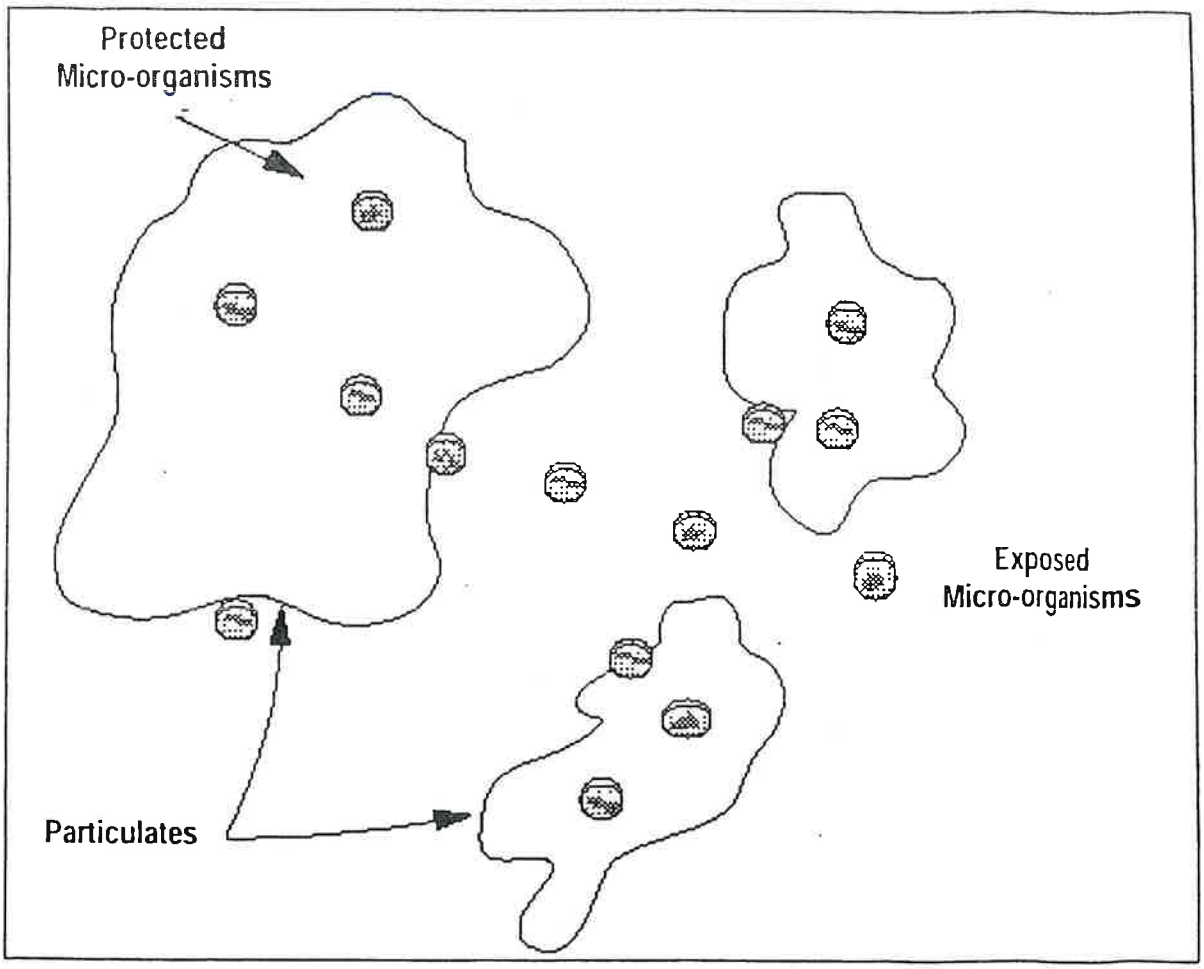
Source: Sadar, 1996; photo revised by SAIC, 1998.

Figure 7-3. Nephelometric Turbidimeter

The particles of turbidity provide "shelter" for microbes by reducing their exposure to attack by disinfectants (Figure 7-4). Microbial attachment to particulate material or inert substances in water systems has been documented by several investigators (Marshall, 1976; Olson et al., 1981; Herson et al., 1984) and has been considered to aid in microbe survival (NAS, 1980). Fortunately, traditional water treatment processes have the ability to effectively remove turbidity when operated properly.

7.3.1 Waterborne Disease Outbreaks

Notwithstanding the advances made in water treatment technology, waterborne pathogens have caused significant disease outbreaks in the United States and continue to pose a significant problem. Even in developed countries, protozoa have been identified as the cause of half of the recognized waterborne outbreaks (Rose et al., 1991). The most frequently reported waterborne disease in the United States is acute gastrointestinal illness, or gastroenteritis (Huben, 1991). The symptoms for this disease include fever, headache, gastrointestinal discomfort, vomiting, and diarrhea. Gastroenteritis is usually self-limiting, with symptoms lasting one to two weeks in most cases. However, if the immune system is suppressed, as with the young, elderly and those suffering from HIV or AIDS, the condition can be very serious and even life threatening. The causes are usually difficult to identify but can be traced to various viruses, bacteria, or protozoa.



Source: LeChevallier and Norton, 1991.

Figure 7-4. Particles of Turbidity May Provide Protection for Microorganisms

Giardia and *Cryptosporidium* are the two most studied organisms known to cause waterborne illnesses. These two protozoa are believed to be ubiquitous in source water, are known to occur in drinking water systems, have been responsible for the majority of waterborne outbreaks, and treatments to remove and/or inactivate them are known to be effective for a wide range of waterborne parasites (LeChevallier and Norton, in Craun, 1993). *Giardia* and *Cryptosporidium* have caused over 400,000 persons in the United States to become ill since 1991, mostly due to a 1993 outbreak in Milwaukee, Wisconsin.

Giardia and viruses are addressed under the 1989 SWTR. Systems using surface water must provide adequate treatment to remove and/or inactivate at least 3-log (99.9%) of the *Giardia lamblia* cysts and at least 4-log (99.99%) of the enteric viruses. However, *Cryptosporidium* was not addressed in the SWTR due to lack of occurrence and health effects data. In the mid-1980's, the United States experienced its first recognized waterborne disease outbreak of cryptosporidiosis (D'Antonio et al., 1985). It was soon discovered that the presence of *Cryptosporidium* in drinking water, even in very low

concentrations, could be a significant health hazard (Gregory, 1994). In 1993, a major outbreak of cryptosporidiosis occurred even though the system was in full compliance with the SWTR. Several outbreaks caused by this pathogen have been reported (Smith et al., 1988; Hayes at al., 1989; Levine and Craun, 1990; Moore et al., 1993; Craun, 1993). The ESWTR's primary focus is to establish treatment requirements to further address public health risks from pathogen occurrence, and in particular, *Cryptosporidium*.

Table 7-1 displays several instances of past outbreaks of cryptosporidiosis in systems using surface water as a source, along with general information about the plant and turbidity monitoring. In three out of four of the cases displayed in the table (Milwaukee, Jackson County, and Carrollton), turbidity over 1.0 NTU was occurring in finished water during the outbreaks.

Table 7-1. Cryptosporidium Outbreaks vs. Finished Water Turbidity

Location of Outbreak	Year	General Plant Information	Turbidity Information
Las Vegas, Nevada (CDC, 1996)	1993-1994	No apparent deficiencies or problems with this community system; SWTR compliant; system performed pre-chlorination, filtration (sand and carbon), and filtration of lake water; outbreak affected mostly persons infected with the human immunodeficiency virus (HIV)	The raw water averaged 0.14 NTU between January 1993 and June 1995, with a high of 0.3 NTU; the maximum turbidity of finished water during this time was 0.17 NTU.
Milwaukee, Wisconsin (CDC, 1996, Logsdon, 1996)	1993	Community system; SWTR compliant; however, deterioration in source (lake) raw-water quality and decreased effectiveness of the coagulation-filtration process	Dramatic temporary increase in finished water turbidity levels; reported values were as high as 2.7 NTU. (Turbidity had never exceeded 0.4 NTU in the previous 10 years.)
Jackson County, Oregon (USEPA, 1997)	1992	Poor plant performance (excessive levels of algae and debris); no pre-chlorination before filtration	Earlier in the year when outbreak occurred, filtered water had averaged 1 NTU or greater.
Carrollton, Georgia (USEPA, 1997, Logsdon, 1996)	1987	Conventional filtration plant; sewage overflowed into water treatment intake, followed by operational irregularities in treatment; filters were placed back into service without being backwashed.	Filtered water turbidity from one filter reached 3 NTU about three hours after it was returned to service without being washed.

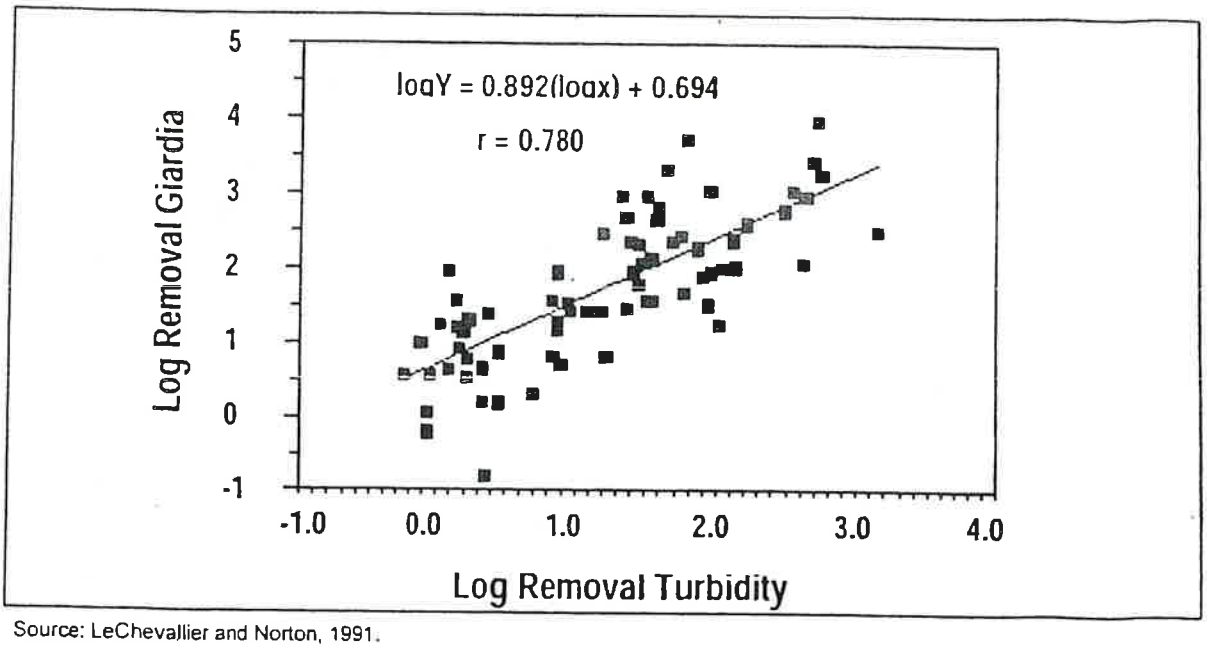
7.3.2 The Relationship Between Turbidity Removal and Pathogen Removal

Low filtered water turbidity can be correlated with low bacterial counts and low incidences of viral disease. Positive correlations between removal (the difference between raw and plant effluent water samples) of pathogens and turbidity have also been observed in several studies. In fact, in every study to date where pathogens and turbidity occur in the source water, pathogen removal coincides with turbidity/particle removal (Fox, 1995).

As an example, data gathered by LeChevallier and Norton (in Craun, 1993) from three drinking water treatment plants using different watersheds indicated that for every log removal of turbidity, 0.89 log removal was achieved for the parasites *Cryptosporidium*

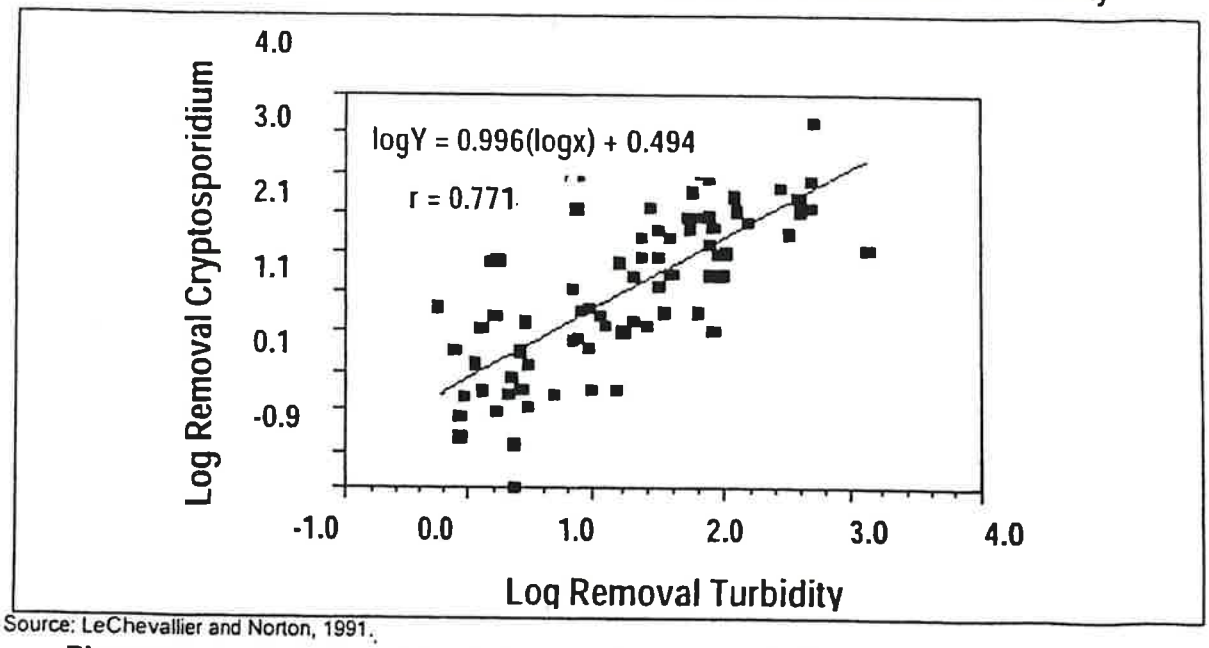
and *Giardia* (Figures 7-5 and 7-6). Of course, this exact relationship does not hold for all treatment plants. Table 7-2 lists several other studies in addition to LeChevallier and Norton's, and their conclusions on the relationship of turbidity to protozoan removal.

All studies in Table 7-2 show turbidity as a useful predictor of parasite removal efficiency. This evidence suggests that although a very low turbidity value does not completely ensure that particles are absent, it is an excellent measure of plant optimization to ensure maximum public health protection.



Source: LeChevallier and Norton, 1991.

Figure 7-5. Relationship Between Removal of *Giardia* and Turbidity



Source: LeChevallier and Norton, 1991.

Figure 7-6. Relationship Between Removal of *Cryptosporidium* and Turbidity

Table 7-2. Studies on the Relationship between Turbidity Removal and Protozoa Removal

Reference/Study	Discovery/Conclusion on Turbidity
Patania et al., 1995*	Four systems using rapid granular filtration, when treatment conditions were optimized for turbidity and particle removal, achieved a median turbidity removal of 1.4 log and median particle removal of 2 log. The median cyst and oocyst removal was 4.2 log. A filter effluent turbidity of less than 0.1 NTU or less resulted in the most effective cyst removal, by up to 1.0 log greater than when filter effluent turbidities were greater than 0.1 NTU (within the 0.1 to 0.3 NTU range).
Nieminski and Ongerth, 1995*	Pilot plant study: Source water turbidity averaged 4 NTU (maximum = 23 NTU), achieving filtered water turbidities of 0.1-0.2 NTU. *Cryptosporidium* removals averaged 3.0 log for conventional treatment and 3.0 log for direct filtration, while *Giardia* removals averaged 3.4 log for conventional treatment and 3.3 log for direct filtration. Full scale plant study: Source water had turbidities typically between 2.5 and 11 NTU (with a peak level of 28 NTU), achieving filtered water turbidities of 0.1-0.2 NTU. *Cryptosporidium* removals averaged 2.25 log for conventional treatment and 2.8 log for direct filtration, while *Giardia* removals averaged 3.3 log for conventional treatment and 3.9 log for direct filtration.
Ongerth and Pecoraro, 1995*	Using very low-turbidity source waters (0.35 to 0.58 NTU), 3 log removal for both cysts were obtained, with optimal coagulation. (With intentionally suboptimal coagulation, the removals were only 1.5 log for *Cryptosporidium* and 1.3 log for *Giardia*.)
LeChavallier and Norton (in Craun, 1993)	Data gathered from three drinking water treatment plants using different watersheds indicated that for every log removal of turbidity, 0.89 log removal was achieved for *Cryptosporidium* and *Giardia*.
Nieminski, 1992	A high correlation (r^2=0.91) exists between overall turbidity removal and both *Giardia* and *Cryptosporidium* removal through conventional water treatment.
Ongerth, 1990	*Giardia* cyst removal by filtration of well-conditioned water results in 90% or better turbidity reduction, which produces effective cyst removal of 2-log (99%) or more.
LeChavallier et al., 1991*	In a study of 66 surface water treatment plants using conventional treatment, most of the utilities achieved between 2 and 2.5 log removals for both *Cryptosporidium* and *Giardia*, and a significant correlation (p=0.01) between removal of turbidity and *Cryptosporidium* existed.
LeChavallier and Norton, 1992*	In source water turbidities ranging from 1 to 120 NTU, removal achieved a median of 2.5 log for *Cryptosporidium* and *Giardia* at varying stages of treatment optimization. The probability of detecting cysts and oocysts in finished water supplies depended on the number of organisms in the raw water; turbidity was a useful predictor of *Giardia* and *Cryptosporidium* removal.
Foundation for Water Research, 1994*	Raw water turbidity ranged from 1 to 30 NTU, and *Cryptosporidium* removal was between 2 and 3 log. Investigators concluded that any measure which reduces filter effluent turbidity should reduce risk from *Cryptosporidium*.
Hall et al., 1994	Any measure which reduces filtrate turbidity will reduce the risk from *Cryptosporidium*; a sudden increase in the clarified water turbidity may indicate the onset of operational problems with a consequent risk from cryptosporidiosis.
Gregory, 1994	Maintaining the overall level of particulate impurities (turbidity) in a treated water as low as possible may be an effective safeguard against the presence of oocysts and pathogens.
Anderson et al., 1996	In a pilot plant study, the removal of particles > 2 m was significantly related to turbidity reduction r=0.97 (p<0.0001); the removal of *Cryptosporidium* oocysts may be related to the removal of *Giardia*, r=0.79 (p<0.14); the reduction of turbidity may be related to the removal of *Giardia* cysts, r=0.67 (p<0.13) and *Cryptosporidium* oocysts (p<0.08)

* as discussed in EPA's Notice of Data Availability (USEPA, 1997)

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Microbial Load of Drinking Water Reservoir Tributaries during Extreme Rainfall and Runoff

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Hygienic and microbiological examinations of watercourses are usually not carried out during heavy rainfall and runoff events. After rainfall or snowmelt, there are often massive increases in turbidity in flooding creeks in mountain ranges, which are frequently interpreted as an indication of microbial contamination. The aim of this study was to quantify the microbial loads of watercourses during such runoff events and to compare these loads with loads occurring during regular conditions. In a 14-month monitoring period we investigated the microbial loads of three tributaries of different drinking water reservoirs. A total of 99 water samples were taken under different runoff conditions and analyzed to determine physical, chemical, bacterial, and parasitic parameters. Thirty-two water samples were considered event samples during nine measuring series. The criteria for events, based on duration and intensity of precipitation, water depth gauge measurements, and dynamics, had been fixed before the investigation for each creek individually. Of the physical and chemical parameters examined, only the turbidity, pH, and nitrate values differed clearly from the values obtained for regular samples. Most of the bacteriological parameters investigated (colony, *Escherichia coli*, coliform, fecal streptococcal, and *Clostridium perfringens* counts) increased considerably during extreme runoff events. If relevant sources of parasitic contamination occurred in catchment areas, the concentrations of *Giardia* and *Cryptosporidium* rose significantly during events. The results show that substantial shares of the total microbial loads in watercourses and in drinking water reservoirs result from rainfall and extreme runoff events. Consequently, regular samples are considered inadequate for representing the microbial contamination of watercourse systems. The procedures for raw water surveillance in the context of multiple-barrier protection and risk assessment ought to include sampling during extreme runoff situations.

In some regions of Germany surface reservoirs are the main source of drinking water. In the state of North Rhine-Westphalia, 60% of the drinking water production in 1999 was based on surface water resources (2). Surface water bodies are presumed to be more vulnerable to fecal contamination than groundwater reservoirs due to the absence of natural soil protection and filtration and the possibly short distances between the occurrence of contamination and water extraction. It is argued that especially in the case of heavy rainfall the microbial loads of running waters may suddenly increase substantially and reach reservoir bodies very quickly (18, 19). For this reason monitoring microbiological raw water quality is an essential component of the protection strategy in catchment areas of surface drinking water reservoirs (8). In Germany, catchment areas of surface water supplies are usually protected by buffer zones, and the intensity of protection increases with proximity to the water body. Protection of entire catchment areas is the first step of the multiple-barrier protection concept (22, 33), which demands integrated water management from precipitation to the tap. As a second step, there are regular microbiological surveys of raw water before treatment. However, the samples may be taken without regard to meteorological and hydrological conditions, since sampling under extreme rainfall and runoff conditions is not required (12, 33). In fact, exceeded limits due to flooding, natural disasters, or unusual weather conditions are not taken into consideration (12, 30).

Some studies have shown that there are correlations between microbial loads of stream water and the conditions mentioned above (1, 9, 10, 28, 31), and the question is whether dry-weather sampling provides representative data for microbial contamination of reservoir tributaries throughout the year (5, 17, 31), since the (Enhanced) Surface Water Treatment Rule of the U.S. Environmental Protection Agency includes an action level of 30 parasites per 100 liters of raw water and no parasites per 100 liters of finished water (17, 20, 28). In this study we investigated the association of several parasitic and bacterial parameters with rainfall, runoff, and specific conditions in catchment areas of drinking water reservoirs in order to understand what factors are associated with peaks of contamination (4, 20).

MATERIALS AND METHODS

An investigation of the microbial loads of three tributaries of different drinking water reservoirs and the land use patterns in their drainage areas was performed. In a 14-month monitoring period (January 1997 to February 1998), 99 water samples were taken from the main tributaries under different runoff conditions and analyzed to determine physical, chemical, bacterial, and parasitic parameters. A total of 32 water samples, taken during nine sampling series, could be classified as event samples (ES). An analysis of the dynamics of these samples

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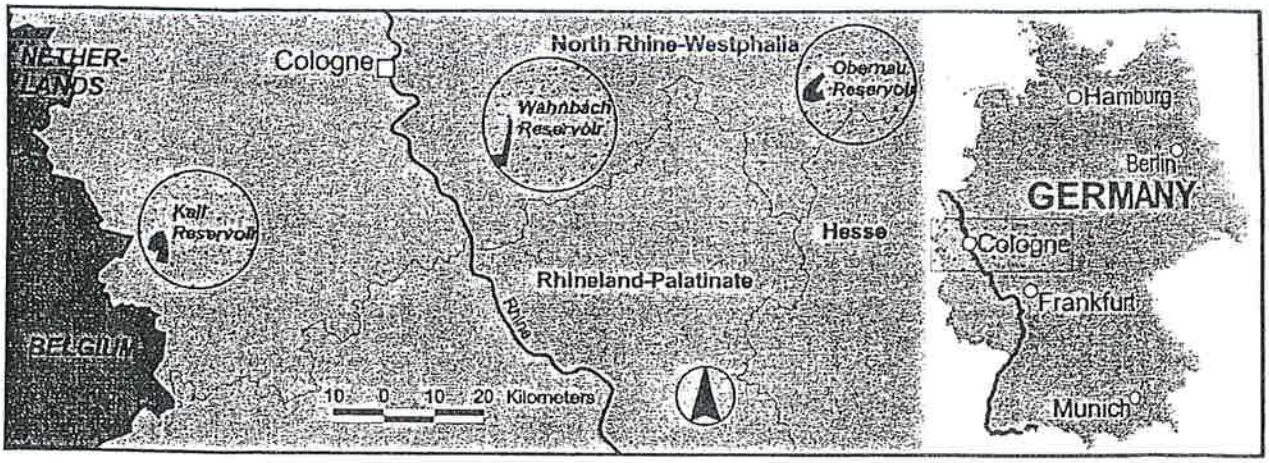


FIG. 1. Locations of the three drinking water reservoirs investigated.

during extreme runoff conditions and a statistical comparison of ES with regular samples (RS) were carried out to assess the influence of flood periods on total annual contamination loads.

Selection of sample locations. For this investigation, the main tributaries of three different drinking water reservoirs were chosen (Fig. 1). To guarantee precise sample reproducibility, the sampling points were located directly above the reservoirs, in the vicinity of water gauges.

The sampling points and tributary areas selected reflected different catchment area conditions. One watercourse represented a catchment area where to a large extent there was no anthropogenic influence (Nauholzbach). The second tributary represented a catchment area heavily influenced by pasture land for dairy farming (Kall), whereas the third tributary was chosen in order to monitor additional effects of treated wastewater discharge. Thus, the catchment areas of the tributaries investigated had very different geoecological structures, and they have been characterized in detail previously (19).

The catchment area of the Nauholzbach (3.27 km^2), a tributary of the Obernau reservoir, is almost completely covered with forest (98%) and is rarely affected by agriculture or settlement. The density of fallow deer (15 animals/km^2), however, exceeds the ecologically tolerable limit, 5 to 10 animals/km^2.

The catchment area of the Kallbach, the main tributary of the Kall reservoir, extends over 19.7 km^2 of hilly landscape. Moors and wetlands were formed in this area because of the prevailing climatic, geological, soil, and morphological conditions. Water flows mainly on or just beneath the surface. A wide drainage system has changed the runoff conditions substantially. As a result, during heavy rainfall runoff increases very rapidly. Agricultural land use (exclusively pasture land for dairy farming) comprises 56.3% of the Kall study area, whereas 19% is forest with a relatively low density of fallow deer (four to five animals/km^2). Eighteen farms have local sewage treatment facilities. A total of 3,500 people live in the catchment area. All nonfarming households are connected to public sewage systems. The processed wastewater is piped out of the Kall catchment area. Ten percent of the area belongs to Belgium and because of this is not subject to national water protection regulations.

The Wahnbach study area comprises 45 km^2. The soils are mainly formed by loess and are intensively used for agriculture (63% of the area). Erosion is a major problem. Woodland covers 21% of the catchment area. A total of 16,000 people live in numerous small settlements, some of which still are not connected to public wastewater treatment systems. Two sewage plants in the catchment area discharge their treated wastewater into the Wahnbach tributary right above the reservoir.

Criteria for sampling during extreme rainfall and runoff events. For each site investigated, criteria for event sampling could be defined based on long-term flood-monitoring data. Continuous precipitation was used as a general criterion. However, a rapid increase in water depth exceeding a flood threshold value was decisive for obtaining an ES. For each creek, specific values for the summer and winter seasons could be derived from long-term water depth measurements. Additionally, the steepness of the water level increase played an important role in defining flood events, because the level is affected by the kind, amount, and course of precipitation, as well as by site-specific environmental factors. Frequently, water levels rise more rapidly after a heavy rainfall in the summer than in the winter.

Meteorological and hydrological parameters. Rainfall and air temperature data recorded at representative weather stations and continuous runoff records for the creeks investigated were utilized for characterization of the site-specific water balance. The data were used to calculate weekly sums (precipitation) or weekly arithmetic means (temperature, runoff). Long-term monthly means for rainfall and air temperature were used to evaluate the hydrologic and meteorological situation during the study period. In addition, air temperature, rainfall, water depth, and runoff velocity were recorded during sampling. In the case of event sampling, supplementary records for rainfall and runoff conditions with high temporal resolution (0.5-h records) were obtained retrospectively from the reservoir operating authorities.

Water sampling, preparation, and analysis. At the onset of an event with heavy rainfall and runoff, an ES series was initiated. One series included up to five single water samples obtained at 1- to 2-h intervals. When an RS (RS were taken every 2 weeks) coincided with an event, the sample was considered an ES.

Parasitological sampling was carried out by using a wound polypropylene cartridge filter with a nominal pore size of 1 μm. The filter case was connected to a water pump which pumped about 500 liters of water through the filter. The flow rate was adjusted to 2 liters/min. When the flow rate fell below 2 liters/min, sampling was stopped. Turbidity and pH values were obtained on site. For further chemical and bacteriological analyses, water was pumped into suitable receptacles. The material was cooled, immediately transported into the laboratory, and processed on the same day.

Physical and chemical parameters were analyzed according to the German regulations for water, sewage, and sludge analysis (32). General colony counts at 20 and 37°C (CC 20°C and CC 37°C, respectively) were obtained by the pour plate method (12), whereas coliforms, *Escherichia coli*, *Clostridium perfringens*, and fecal streptococci were identified by membrane filtration (11, 30). The parasites *Giardia lamblia* and *Cryptosporidium* spp. were recovered quantitatively by using the method of Her Majesty's Stationery Office comprising filtration, density flotation, and immunofluorescence (15).

Statistical methods. To compare the ES and RS results, arithmetic means and parameter maxima were calculated separately for RS and ES obtained from each creek. The ES and RS results were assumed to be *t* distributed and were analyzed

TABLE 1. Synopsis of ES series

Series	Date (mo/day/yr)	Creek	Samples	Type of runoff
A	10/09/1997	Nauholzbach	A.1-A.3	(First) outgoing flood
B	12/12/1997	Nauholzbach	B.1-B.4	Rising flood
C	02/12/1997	Kall	C.1-C.5	Peak
D	03/19/1997	Kall	D.1-D.5	Peak
E	10/09/1997	Kall	E.1	Outgoing flood
F	02/05/1997	Wahnbach	F.1	Rising flood
G	10/09/1997	Wahnbach	G.1-G.4	Peak
H	10/10/1997	Wahnbach	H.1-H.5	Outgoing flood
I	12/11/1997	Wahnbach	I.1-I.4	Outgoing flood

TABLE 2. Data for RS and ES obtained in 1997 and 1998

Location	Samples	No. of samples	Arithmetic mean (maximum)							
			Turbidity (NTU)	pH	Runoff (liters/s)	Nitrate (mg/liter)	Nitrite (mg/liter)	Ammonia (mg/liter)	Total phosphorus (mg/liter)	Borate (mg/liter)
Nauholzbach	RS	16	1.30 (3.80)	7.18 (7.50)	49.29 (190.00)	6.84 (10.90)	0.00 (0.02)	0.00 (0.00)	0.01 (0.05)	0.00 (0.04)
	ES	7	47.38 (93.80)	6.98 (7.30)	139.06 (317.00)	11.43 (13.90)	0.00 (0.00)	0.00 (0.00)	0.09 (0.40)	0.02 (0.04)
Kall	RS	26	3.57 (10.20)	7.43 (7.70)	290.78 (1,783.32)	13.94 (22.20)	0.01 (0.09)	0.04 (0.19)	0.01 (0.10)	0.07 (0.11)
	ES	11	28.25 (54.30)	7.05 (7.40)	1,276.78 (2,732.00)	10.58 (15.40)	0.07 (0.13)	0.24 (0.46)	0.08 (0.30)	0.11 (0.18)
Wahnbach	RS	25	11.45 (36.00)	7.55 (8.00)	459.54 (2,118.00)	17.22 (33.90)	0.10 (0.40)	0.15 (1.46)	0.15 (0.62)	0.13 (0.27)
	ES	14	56.99 (125.30)	7.33 (7.50)	1,040.46 (2,747.00)	10.43 (20.10)	0.09 (0.14)	0.34 (1.70)	0.25 (0.50)	0.18 (0.35)

for independence from the other samples by using the one-sided t test for two spot checks with different variances (24). The level of significance [$P(\alpha)$] was calculated after determination of the degrees of freedom. A $P(\alpha)$ value of <0.05 was considered significant.

To assess the contributions of chemical, bacterial, and parasitic loads during heavy rainfall and runoff events to the total loads in each drinking water reservoir, theoretical quantitative loads during an average event (means for all ES; medians for bacteriological and parasite parameters) were compared to loads determined for regular conditions (means for all RS; medians for bacteriological and parasite parameters). For the calculations, an event was assumed to last 12 h. The mean load for a 12 h-event was determined from the ES mean values. The contribution of this average 12-h event load to a theoretical annual load without events was calculated. This theoretical share was divided by the 12-h value expected under the assumption that runoff and parameter concentrations were constant throughout the year, as follows: 12-h expected value ($EV_{12\ h}$) = $1/(365.24 \times 24/12) \times 100 = 0.137\%$. Finally $EV_{12\ h}$ was corrected by considering the increased runoff under event conditions. In this way the factor $EV_{12hCorr}$ was obtained, which quantified the additional load due to the increases in parameter concentrations.

RESULTS

During a 14-month investigation in which there were nine extreme rainfall and runoff events, a total of 32 ES were collected (Table 1). Within the framework of ES collections seven ES series were obtained. In two cases (E.1 and F.1) ES collections coincided with RS collections. The results obtained with 67 RS collected at the same sites during the same time period were available for comparison.

Comparison with RS. The results of the comparisons of ES and RS are shown in Table 2.

(i) Physical and chemical parameters. At the Nauholzbach the most conspicuous changes in concentration compared to the RS concentrations occurred with regard to the turbidity. While the turbidity never exceeded 3.8 nephelometric turbidity units (NTU) in 16 RS, it increased to a maximum of 93.8 NTU during the events; the arithmetic mean for seven ES was 47.4 NTU (arithmetic mean for RS, 1.3 NTU). The nitrate concentrations for ES always exceeded the mean of the nitrate concentrations for RS, and the nitrate concentrations for 57% of the ES exceeded the maximum nitrate concentration observed in RS.

At the Kall there was also a massive increase in turbidity compared to the RS values. The mean increased from 3.57 to 28.25 NTU. Clear increases in concentration were also observed for nitrite, ammonia, total phosphorus, and borate. On the other hand, the means and maxima for pH and nitrate concentration were below the corresponding values obtained for the RS.

At the Wahnbach, the mean turbidity (11.45 to 57 NTU) and the maximum turbidity (36.0 to 125.3 NTU) increased to extreme values during events. In contrast, the pH and nitrate concentration were clearly less than the corresponding values for the RS. The concentrations of nitrite, ammonia, total phosphorus, and borate changed only slightly.

(ii) Bacteriological parameters. At the Nauholzbach, the concentrations of quantitatively identified bacteriological parameters (CC 20°C, CC 37°C, *E. coli*, coliforms, fecal streptococci, *C. perfringens*) increased during extreme rainfall and runoff events; the medians increased about 1 to 2 $\log_{10}$, and the maximum values increased about 1 $\log_{10}$.

At the Kall and Wahnbach, the median and maximum concentrations of quantitatively identified bacteriological parameters increased about 1 to 2 $\log_{10}$.

(iii) Parasitological parameters. At the Nauholzbach, the median *Cryptosporidium* concentrations in ES reached 11.4 oocysts/100 liters, in contrast to the 2.4 oocysts/100 liters in RS. *Giardia* cysts were not regularly recovered.

At the Kall, the median concentrations of *Cryptosporidium* oocysts (ES, 14.3 oocysts/100 liters; RS, 2.65 oocysts/100 liters) and the maximum concentrations of *Cryptosporidium* oocysts (ES, 65.6 oocysts/100 liters; RS, 10.3 oocysts/100 liters) increased substantially during events, whereas the frequencies of recovery of *Giardia* cysts were low and no recognizable tendencies were identified.

At the Wahnbach, the median concentrations of *Cryptosporidium* oocysts (ES, 17 oocysts/100 liters; RS, 1.3 oocysts/100 liters) and *Giardia* cysts (ES, 12.4 cysts/100 liters; RS, 1.1 cysts/100 liters) in ES were clearly higher than those in the corresponding RS. The maximum concentrations also occurred in ES. In ES the *Cryptosporidium* concentrations reached 147.1 oocysts/100 liters (RS, 23.1 oocysts/100 liters), and the *Giardia* concentrations reached 21.6 cysts/100 liters (RS, 9.1 cysts/100 liters).

(iv) Student's t test for significant differences between ES and RS. At the Nauholzbach during extreme rainfall and runoff events, the turbidity and nitrate concentration increased significantly, but the pH was significantly lower. The total bacteriological parameters showed significant increases, whereas the parasite load did not increase significantly due to the high standard deviation for the RS (Table 3).

At the Kall, the values for some physical and chemical parameters (turbidity and nitrite, ammonia, total phosphorus, and borate concentrations) increased significantly during events; the pH and the nitrate concentration, however, decreased significantly. Of the bacteriological parameters, only CC 20°C, CC 37°C, and the *C. perfringens* count increased significantly, as the concentration of *Cryptosporidium* did, whereas there was not a significant change in the *G. lamblia* concentration (Table 4).

TABLE 2—*Continued*

Median (maximum)							
CC 20°C (CFU/ml)	CC 37°C (CFU/ml)	*E. coli* (CFU/100 ml)	Coliforms (CFU/100 ml)	Fecal streptococci (CFU/100 ml)	*C. perfringens* (CFU/100 ml)	*Giardia* (cysts/100 liters)	*Cryptosporidium* (oocysts/100 liters)
444.50 (1,730.00)	69.50 (339.00)	22.00 (148.00)	1,110.00 (15,000.00)	7.50 (400.00)	1.50 (31.00)	0.00 (1.10)	2.40 (52.20)
3,480.00 (10,629.00)	327.00 (849.00)	190.00 (650.00)	12,200.00 (42,000.00)	130.00 (620.00)	82.00 (155.00)	0.00 (0.00)	11.40 (35.50)
595.00 (46,300.00)	185.00 (12,000.00)	133.00 (11,000.00)	1,880.00 (400,000.00)	54.00 (11,000.00)	22.50 (198.00)	0.95 (11.10)	2.65 (10.30)
50,500.00 (114,000.00)	5,550.00 (37,000.00)	1,300.00 (3,800.00)	19,800.00 (63,000.00)	540.00 (4,600.00)	250.00 (900.00)	0.00 (21.00)	14.30 (65.60)
1,110.00 (16,500.00)	332.00 (1,850.00)	490.00 (5,100.00)	3,800.00 (74,000.00)	130.00 (2,200.00)	130.00 (900.00)	1.10 (9.10)	1.30 (23.10)
37,400.00 (77,000.00)	8,010.00 (14,700.00)	13,700.00 (34,500.00)	88,000.00 (1,180,000.00)	13,600.00 (77,000.00)	430.00 (2,500.00)	12.40 (21.60)	17.05 (147.10)

At the Wahnbach, the turbidity and the borate concentration increased significantly in ES; the pH and nitrate concentration, however, decreased significantly. All of the bacteriological and parasitological concentrations increased significantly (Table 5).

Dynamics of parameters during extreme rainfall and runoff events. ES series were used to record the various runoff situations during different phases of the events (Table 1). Sometimes the rising flood was registered, and sometimes the outgoing flood was registered. However, in all events, samples were immediately connected to the first wave and sometimes included the peak of the flood (Fig. 2 to 4).

(i) Physical and chemical parameters. Most of the parameters (pH and nitrate, nitrite, ammonia, total phosphorus, and borate concentrations) remained relatively constant during an extreme rainfall and runoff event. Except for turbidity, the ranges of values remained narrow. At the Nauholzbach, the turbidity in ES series A was highest at the beginning of the sampling period, and the turbidity in ES series B was highest at the end of the sampling period. At the Kall, the turbidity was highest at the beginning of the ES series C sampling period and in the middle of the ES series D sampling period. At the Wahnbach, turbidity decreased in ES series H, which correlated with the outgoing flood. Therefore, in all ES series the highest turbidity values were recorded temporally close to the peak of the flood.

(ii) Bacteriological parameters. At the Nauholzbach the values for CC 20°C, CC 37°C, *E. coli*, coliforms, and fecal streptococci increased slightly but continuously in ES series A. *C. perfringens* was not detected. There was no visible trend at all in ES series B.

At the Kall, the values for all bacteriological parameters examined remained nearly constant in ES series C. In ES series D, the maximum values for CC 20°C, *E. coli*, and coliforms were reached close to the peak, but there was no uniformity or meaningful trend.

At the Wahnbach, the variance was very low. However, for ES series H the lowest values for most of the parameters occurred at the beginning, immediately after the peak was passed.

(iii) Parasitological parameters. At the Nauholzbach, the concentration of *Cryptosporidium* oocysts increased continuously in ES series A and reached the maximum value when runoff became greater again. During ES series B, the maximum concentration occurred in the rising flood (Fig. 2). *Giardia* cysts were not recovered.

At the Kall, the concentration of *Cryptosporidium* oocysts decreased in ES series C with the outgoing flood, and *Giardia*

TABLE 3. Analysis of assumed *t*-distributed RS and ES at the Nauholzbach gauge for independence from each other, using the one-sided *t*-test for two spot checks with different variances (1997 data)

Parameter	RS (n = 16)			ES (n = 7)			*t* test *t* (empirical)	df (empirical)	$P(\alpha)$ (one sided)[a]
	Arithmetic mean	Maximum	SD	Arithmetic mean	Maximum	SD			
Turbidity (NTU)	1.30	3.80	0.92	47.38	93.80	37.22	3.275	6.004	0.008[b]
pH	7.18	7.50	0.19	6.98	7.30	0.25	1.819	10.311	0.049[c]
Runoff (liters/s)	49.29	190.00	56.25	139.06	317.00	113.84	1.983	7.748	0.044[b]
Nitrate (mg/liter)	6.84	10.90	2.70	11.43	13.90	2.34	4.128	15.217	0.000[b]
Nitrite (mg/liter)	0.00	0.02	0.01	0.00	0.00	0.00	1.000	15.000	0.167
Ammonia (mg/liter)	0.00	0.00	0.00	0.00	0.00	0.00			
Total phosphorus (mg/liter)	0.01	0.05	0.02	0.09	0.40	0.16	1.325	6.068	0.117
Borate (mg/liter)	0.00	0.04	0.01	0.02	0.04	0.02	1.605	9.049	0.071
CC 20°C (CFU/ml)	673.06	1,730.00	534.50	5,509.86	10,629.00	3,746.37	3.401	6.143	0.007[b]
CC 37°C (CFU/ml)	100.94	339.00	93.64	439.43	849.00	205.85	4.166	7.477	0.002[b]
E. coli (CFU/100 ml)	33.81	148.00	36.87	235.71	650.00	190.69	2.779	6.263	0.016[b]
Coliforms (CFU/100 ml)	3,300.75	15,000.00	4,464.67	17,114.29	42,000.00	11,844.61	2.994	7.009	0.010[b]
Fecal streptococci (CFU/100 ml)	41.56	400.00	99.27	207.14	620.00	205.48	2.031	7.670	0.041[b]
C. perfringens (CFU/100 ml)	4.06	31.00	7.75	66.71	155.00	65.95	2.506	6.097	0.023[b]
Giardia (cysts/100 liters)	0.11	1.10	0.30	0.00	0.00	0.00	1.396	15.000	0.091
Cryptosporidium (oocysts/100 liters)	7.18	52.20	13.18	15.30	35.50	11.85	1.461	14.709	0.083

[a] Values were considered significantly different if the $P(\alpha)$ value was <0.05.
[b] The ES values were significantly greater than the RS values.
[c] The ES values were significantly less than the RS values.

TABLE 4. Analysis of assumed *t*-distributed RS and ES at the Kall gauge for independence from each other, using the one-sided *t* test for two spot checks with different variances (1997 data)

Parameter	RS (n = 26)			ES (n = 11)			*t* test *t* (empirical)	df (empirical)	$P(\alpha)$ (one sided)[a]
	Arithmetic mean	Maximum	SD	Arithmetic mean	Maximum	SD			
Turbidity (NTU)	3.57	10.20	2.53	28.25	54.30	15.99	5.092	10.254	0.000[b]
pH	7.43	7.70	0.15	7.05	7.40	0.17	6.362	18.468	0.000[c]
Runoff (liters/s)	290.78	1,783.32	363.55	1,276.78	2,732.00	948.54	5.685	11.515	0.000[b]
Nitrate (mg/liter)	13.94	22.20	3.15	10.58	15.40	4.16	2.405	16.061	0.014[c]
Nitrite (mg/liter)	0.01	0.09	0.02	0.07	0.13	0.03	5.169	16.120	0.000[b]
Ammonia (mg/liter)	0.04	0.19	0.06	0.24	0.46	0.18	3.632	11.167	0.002[b]
Total phosphorus (mg/liter)	0.01	0.10	0.03	0.08	0.30	0.10	2.299	10.969	0.022[b]
Borate (mg/liter)	0.07	0.11	0.02	0.11	0.18	0.03	3.961	15.217	0.001[b]
CC 20°C (CFU/ml)	3,623.50	46,300.00	9,864.96	49,109.09	114,000.00	30,359.10	4.862	11.084	0.000[b]
CC 37°C (CFU/ml)	787.42	12,000.00	2,321.39	10,797.27	37,000.00	11,589.17	2.841	10.409	0.009[b]
E. coli (CFU/100 ml)	929.38	11,000.00	2,316.65	1,340.91	3,800.00	1,040.45	0.745	36.958	0.230
Coliforms (CFU/100 ml)	27,396.38	400,000.00	85,304.60	20,890.91	63,000.00	21,107.60	0.363	31.788	0.359
Fecal streptococci (CFU/100 ml)	601.38	11,000.00	2,156.15	919.09	4,600.00	1,259.27	0.559	33.771	0.290
C. perfringens (CFU/100 ml)	37.96	198.00	48.28	316.00	900.00	240.12	3.808	10.412	0.002[b]
Giardia (cysts/100 liters)	1.67	11.10	2.55	3.08	21.00	6.27	0.722	11.708	0.243
Cryptosporidium (oocysts/100 liters)	3.03	10.30	2.80	22.32	65.60	17.75	3.585	10.253	0.002[b]

[a] Values were considered significantly different if the $P(\alpha)$ value was <0.05.
[b] The ES values were significantly greater than the RS values.
[c] The ES values were significantly less than the RS values.

cysts were not found (Fig. 3). In ES series D, the *Cryptosporidium* concentration decreased while the peak of the wave passed. *Giardia* cysts were detected discontinuously; the highest concentration occurred at the peak of the flood.

At the Wahnbach, the highest *Cryptosporidium* concentrations in ES series G and H occurred close to the peak of the flood, and the concentrations decreased rapidly thereafter. *Giardia* cysts were recovered discontinuously without any trend (Fig. 4). In ES series I, the concentrations of *Cryptosporidium* oocysts and *Giardia* cysts decreased with the rising flood; the maximum concentrations were found in the first ES collected in this ES series.

Giardia cysts were regularly detected only at the Wahnbach, whereas *Cryptosporidium* oocysts were recovered at each creek. Most maximum values occurred immediately before the peak of the flood was reached.

Contributions of heavy rainfall and runoff events to the total loads in drinking water reservoirs. The contributions of heavy rainfall and runoff events to the total loads in drinking water reservoirs are shown in Table 6.

At the Nauholzbach, within 12 h under assumed average event conditions (n = 7), 0.77% of the theoretical annual runoff (calculated for a year without any runoff events) drained into the reservoir. The additional nitrate load was very small, whereas the share of total phosphorus was 10.5% (13.6 times the $EV_{12hCorr}$). Some of the additional bacterial load was much

TABLE 5. Analysis of assumed *t*-distributed RS and ES at the Wahnbach gauge for independence from each other, using the one-sided *t* test for two spot checks with different variances (1997 data)

Parameter	RS (n = 25)			ES (n = 14)			*t* test *t* (empirical)	df (empirical)	$P(\alpha)$ (one sided)[a]
	Arithmetic mean	Maximum	SD	Arithmetic mean	Maximum	SD			
Turbidity (NTU)	11.45	36.00	8.19	56.99	125.30	31.12	5.372	14.173	0.000[b]
pH	7.55	8.00	0.25	7.33	7.50	0.16	3.404	38.362	0.001[c]
Runoff (liters/s)	459.54	2,118.00	448.31	1,040.46	2,747.00	608.07	3.130	22.227	0.002[b]
Nitrate (mg/liter)	17.22	33.90	6.82	10.43	20.10	5.27	3.466	35.378	0.001[c]
Nitrite (mg/liter)	0.10	0.40	0.09	0.09	0.14	0.04	0.469	38.337	0.321
Ammonia (mg/liter)	0.15	1.46	0.35	0.34	1.70	0.61	1.061	18.610	0.151
Total phosphorus (mg/liter)	0.15	0.62	0.16	0.25	0.50	0.18	1.610	26.392	0.060
Borate (mg/liter)	0.13	0.27	0.06	0.18	0.35	0.08	2.218	23.985	0.018[b]
CC 20°C (CFU/ml)	2,132.88	16,500.00	3,449.77	34,542.86	77,000.00	22,355.75	5.389	13.401	0.000[b]
CC 37°C (CFU/ml)	468.40	1,850.00	378.73	8,547.14	14,700.00	3,344.97	9.005	13.216	0.000[b]
E. coli (CFU/100 ml)	913.28	5,100.00	1,252.98	19,471.43	34,500.00	11,870.37	5.832	13.187	0.000[b]
Coliforms (CFU/100 ml)	13,714.80	74,000.00	20,136.04	264,428.57	1,180,000.00	417,695.21	2.244	13.039	0.021[b]
Fecal streptococci (CFU/100 ml)	266.40	2,200.00	443.30	20,457.14	77,000.00	25,138.54	3.005	13.005	0.005[b]
C. perfringens (CFU/100 ml)	190.92	900.00	226.01	880.00	2,500.00	900.59	2.814	14.065	0.007[b]
Giardia (cysts/100 liters)	2.13	9.10	2.48	10.60	21.60	7.25	4.232	14.980	0.000[b]
Cryptosporidium (oocysts/100 liters)	3.60	23.10	6.37	27.48	147.10	37.69	2.352	13.482	0.018[b]

[a] Values were considered significantly different if the $P(\alpha)$ value was <0.05.
[b] The ES values were significantly greater than the RS values.
[c] The ES values were significantly less than the RS values.

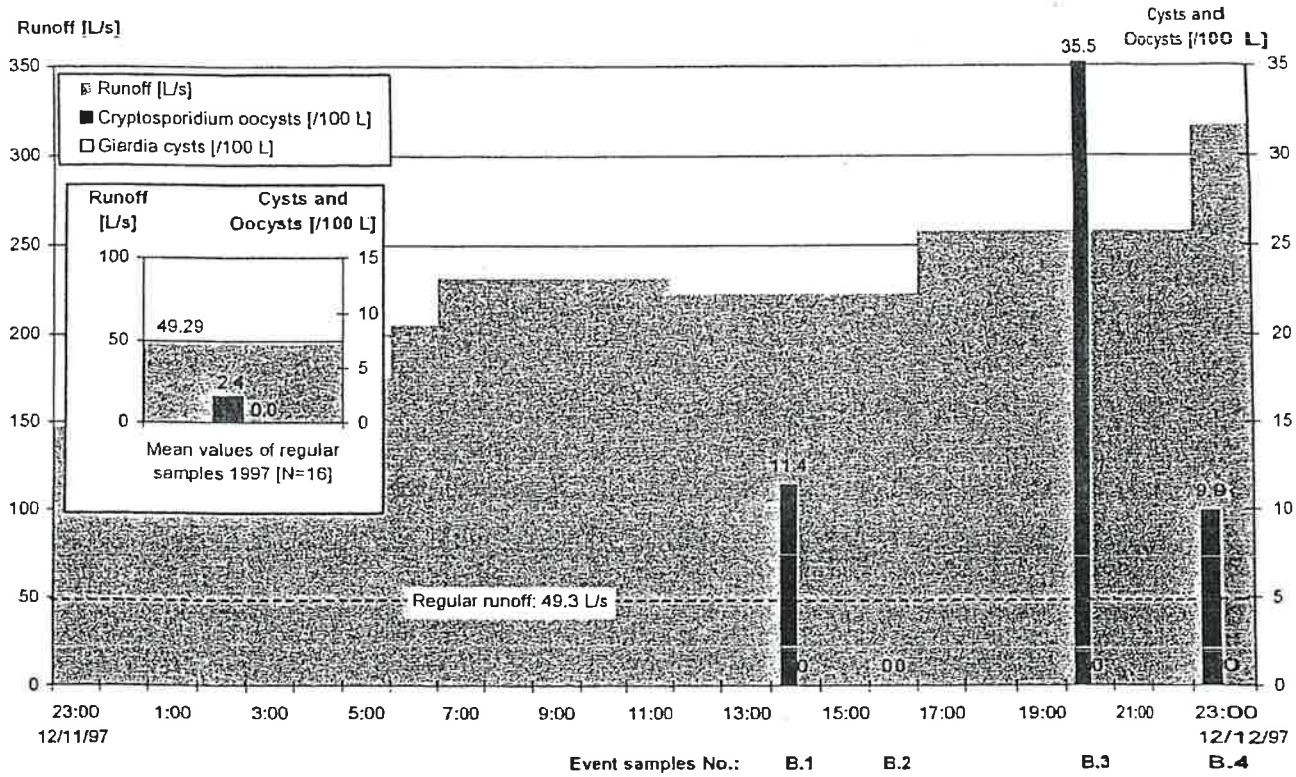


FIG. 2. Parasite concentrations at the Nauholzbach gauge during ES series B (12 December 1997).

higher (42.2% for clostridia [54.7 times the $EV_{12hCorr}$]). The *Cryptosporidium* load also exceeded the expected value (3.7% [4.75 times the $EV_{12hCorr}$]).

At the Kall, within 12 h under assumed average event conditions (n = 11), 0.6% of the theoretical annual runoff drained into the reservoir. Except for nitrate and *Giardia* cysts, the values for the parameters were many times the expected values. Dramatic excesses were found for CC 20°C and CC 37°C (51 and 18% [84.9 and 30 times the $EV_{12hCorr}$, respectively).

At the Wahnbach, within 12 h under assumed average event conditions (n = 14), 0.31% of the theoretical annual runoff drained into the reservoir. While the values for chemical parameters were only slightly higher or even lower (nitrate, nitrite) than the assumed values, the bacterial and parasite loads were dramatically higher (bacteria, 20 to 100 times the $EV_{12hCorr}$; parasites, >10 times the $EV_{12hCorr}$).

These results demonstrate that both absolutely and when values are corrected for runoff conditions, considerable additional loads are transported to drinking water reservoirs during heavy rainfall and runoff events.

DISCUSSION

The RS bacteriological analysis of the Kall and Wahnbach areas resulted in similar concentrations of fecal indicator bacteria, while the lowest level of bacterial contamination was seen at the Nauholzbach. *Cryptosporidium* spp. oocysts were frequently detected in all samples from the different tributaries; *Giardia* cysts, however, were detected less frequently (18). The ES indicated that the values and dynamics of turbidity and the bacterial and parasite loads were heavily influenced by specific hydrological conditions at the sites of the tributaries. The values for microbial parameters, especially the parasite load, increased to the maximum levels during heavy rainfall and runoff events. Even water samples from the Nauholzbach that were not affected by agriculture and settlement contained higher levels of microorganisms when there was precipitation.

The dynamics of the floods during the runoff events corresponded well with drastic increases in turbidity, whereas the changes in the concentrations of chemical parameters were nonspecific and some of these changes were not more than moderate. In most cases the concentrations of bacteriological parameters increased about 1 to 2 $\log_{10}$, with high variances. In the ES series, the dynamics, however, were low, in contrast to concentrations of parasite (oo)cysts, which followed the runoff dynamics. When parasites were detected in RS, the concentrations of the parasites in ES increased considerably.

Statistical analyses showed that there were significant differences between RS and ES which corresponded well with site-specific environmental factors. At the Nauholzbach with its forests, significant increases in the nitrate and microorganism loads indicated that there was erosion and resuspension of river bottom and drain sediment, whereas the parasite load did not reach the levels in the other tributaries despite the fact that it increased. At the Kall, increases in the values for chemical parameters (except nitrate concentration) confirmed that water drained from pasture land and drainage systems were activated. The relatively small amount of *Giardia* cysts was as-

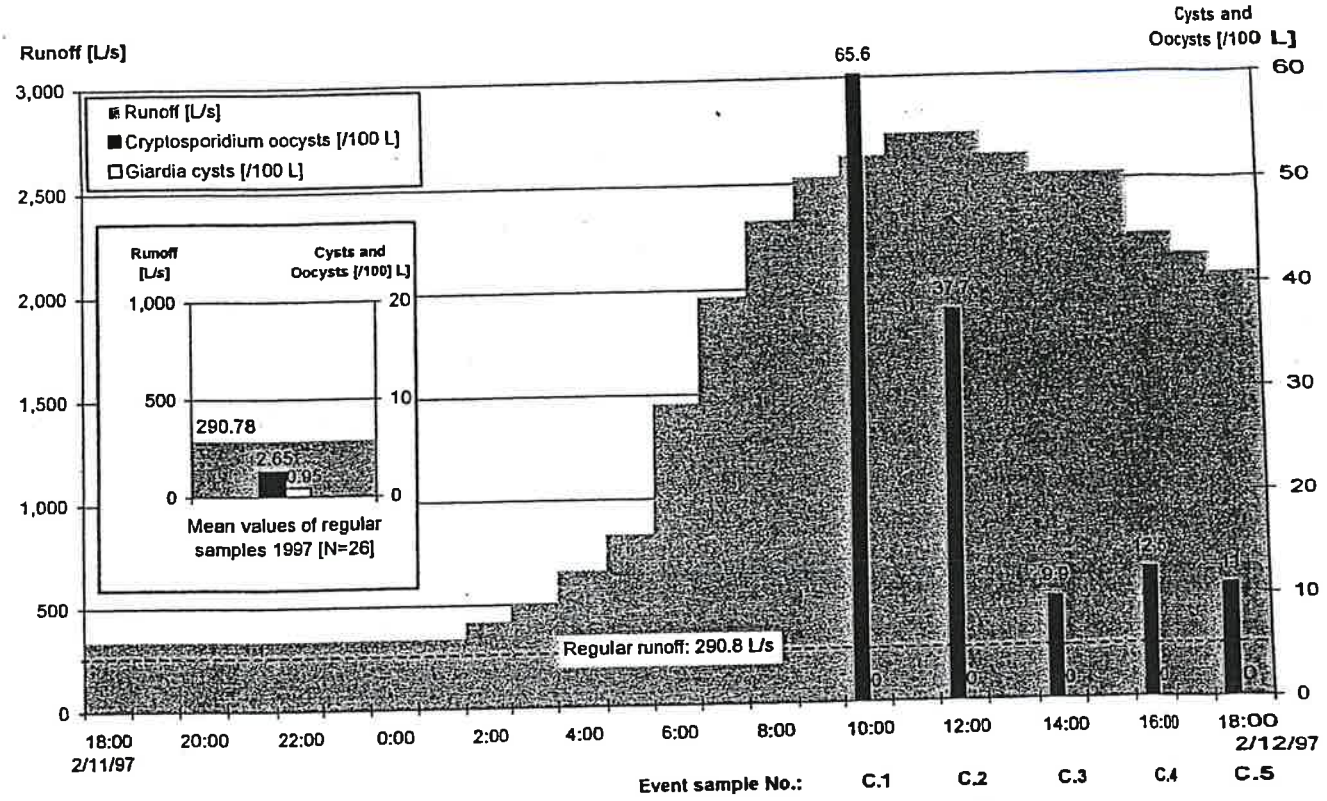


FIG. 3. Parasite concentrations at the Kall gauge during ES series C (12 February 1997).

sumed to result from processed sewage piped out of the Kall catchment area. At the Wahnbach, however, heavy loads of bacteria and both parasites reflected the influence of combined sewage overflows and discharges from sewage treatment plants on the creek.

Only moderate correlations between parasites and other parameters, such as fecal microorganisms, especially *C. perfringens* (1, 6, 9, 27, 28), turbidity (1, 9), or rainfall and runoff, which increased the concentrations of several feces-borne microorganisms (1, 9, 20), have been reported. Many studies did not detect any statistically significant correlations between parasites and other microbial, chemical, and hydrological parameters (4, 16, 29, 31). No significant correlation was found between *Cryptosporidium* oocyst concentrations and rainfall or river flow at 10 sites in the United Kingdom (3). Hsu et al. investigated small water systems in Taiwan for correlations with altitude and water quality parameters but found significant correlations only between *Giardia* and *Cryptosporidium* concentrations (16). Thurman et al. analyzed reservoirs and creeks at different sites in Australia for interactions among land use, rainfall, and water quality parameters but found no significance even though parasite and *E. coli* concentrations peaked after heavy rainfall (31).

Relationships between meteorological parameters and microbial loads of fecal origin have been described. The concentrations of *E. coli*, coliform bacteria, and enterococci, as well as turbidity, increased after rainfall (1, 9, 10, 28, 31). The concentrations of *Cryptosporidium* oocysts were found to be lower during dry periods, such as summer (14, 28). Additional loading from non-point-source runoff (5, 7, 10), as well as from river bottom resuspension, was determined to be responsible for the increases (6, 9, 13, 23, 25). As most of the *Giardia* cysts observed had a nonviable morphology, resuspension of stream bottom sediment or suspension of soil and aged fecal material was assumed to be the major contributor to rainfall-induced increases in parasite concentrations (1, 31). However, because of combined sewage overflows and reduced treatment of discharged wastewater during extreme runoff situations, sewage plants should not be excluded as point sources of parasite contamination (1, 5, 9, 14, 20, 21, 29).

It has been argued that the lack of significant associations between different environmental variables and the parasite loads detected in previous studies was due to inadequate study design; the parasite assay may have been inappropriate, the number of parasite samples may have been too limited, the sampling scheme may not have been designed to detect correlations, or extreme rainfall situations may not have been included (1). However, the intensity of correlations could also have been due to site-specific environmental factors or differences in parasite source contributions (5).

The design of our investigation was geared to the additional bacterial and parasite loads that occur during flood events and therefore took previous experience into account, as described below.

Relationships between concentrations of *Cryptosporidium* oocysts and *Giardia* cysts have been investigated in several studies. It has been demonstrated that *Cryptosporidium* oocysts occur almost ubiquitously at concentrations that correlate

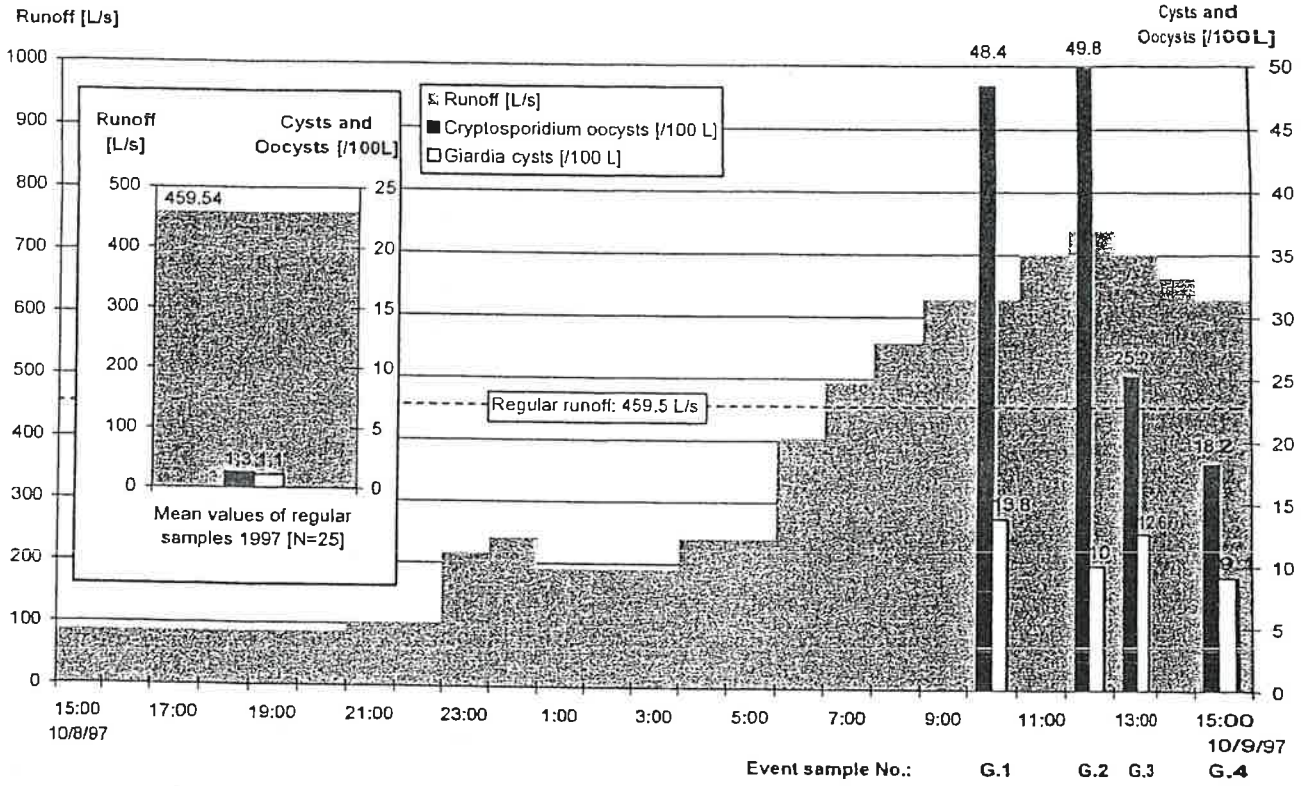


FIG. 4. Parasite concentrations at the Wahnbach gauge during ES series G (9 October 1997).

strongly with dairy farming and densities of fallow deer in the catchment area. In contrast, the occurrence of *Giardia* cysts is principally associated with the presence of sewage and beavers (1, 5, 14, 17, 20, 26, 28, 29). For this reason the geoecological situations in the catchment areas of the three tributaries were subjected to a small-scale systematic analysis using geographical information systems (18, 19). This geoecological characterization revealed that no area is entirely unaffected by human activity and that each catchment area of the surface reservoirs is differentiated by environmental conditions.

Relatively small but typical creeks that are used as sources for drinking water production in central Europe were selected because of their high sensitivity to changing conditions in the catchment area. Our results for small tributaries showed that there were significant relationships between parasite and bacterial loads and turbidity, as well as substantial loads added to the total annual loads during heavy rainfall and runoff events, in contrast to results obtained for some bigger rivers (1, 14, 29).

For event sampling, exact criteria were defined beforehand to allow specific sampling instead of continuous but nonspecific monitoring of water systems (1).

Several runoff events were studied by using close-mesh ES series to obtain information about runoff dynamics.

In addition to ES, RS were used for comparisons under identical sampling conditions.

To eliminate seasonal effects (14, 28), RS were collected during a 1-year period. Preparedness to take ES was maintained during the same period.

The numbers of ES and comparative RS were large enough so that we could perform separate analyses of rivers with different site characteristics (3, 31).

Floods make extremely large contributions to the bacterial and parasite loads of drinking water reservoirs. So far, this has been taken into account only minimally, particularly when the annual microbial load is considered. Accordingly, inclusion of ES in assessments of pressures on the quality of surface water used for drinking water production is imperative to get an impression of the watershed-specific potential microbial loads of tributaries. In this way, a realistic microbial risk assessment can be made to estimate maximum loads in raw water for drinking water treatment in case of a short circuit in a reservoir. To stay on the safe side, if treatment procedures do not manage maximum load situations, water authorities should not take raw source water during high-water situations or they should use facilities for bypassing reservoirs during flood events (20). Finally, national guidelines and international recommendations (e.g., World Health Organization guidelines) ought to integrate heavy rainfall and runoff events into the risk assessment process.

If there is a basic parasite load in watercourses, the concentrations of parasites increase to extreme values during flood situations. Parasite loads correspond well with runoff but cannot be adequately indicated by chemophysical or bacteriological parameters because turbidity is nonspecific and because fecal indicators do not necessarily correlate well with the occurrence of pathogens such as parasites. For this reason it has been concluded that reliance on the coliform group creates serious problems in measuring environmental quality and in

TABLE 6. Calculated contributions of an assumed average runoff event to the annual loads (1997) of the creeks investigated within 12 h

Location	Parameter	Assumed annual load[a]	Load of a 12-h event[b]	Contribution of a 12-h event to the annual load (%)[c]	Estimated value/ expected value[d]	Estimated value/corrected expected value[e]
Nauholzbach[f]	Runoff (liters)	1.56×10^{9}	1.20×10^{7}	0.77	5.64	1.00
	Nitrate (tons)	10.63	0.14	1.29	9.44	1.67
	Nitrite (kg)	1.94	0.00	0.00	0.00	0.00
	Ammonia (kg)	0.00	0.00			
	Total phosphorus (kg)	9.72	1.02	10.50	76.73	13.60
	CC 20°C (CFU)	6.91×10^{14}	4.18×10^{13}	6.05	44.17	7.83
	CC 37°C (CFU)	1.08×10^{14}	3.93×10^{12}	3.63	26.55	4.71
	E. coli (CFU)	3.42×10^{11}	2.28×10^{10}	6.67	48.73	8.64
	Coliforms (CFU)	1.73×10^{13}	1.47×10^{12}	8.49	62.01	10.99
	Fecal streptococci (CFU)	1.17×10^{11}	1.56×10^{10}	13.39	97.80	17.33
	C. perfringens (CFU)	2.33×10^{10}	9.85×10^{9}	42.22	308.44	54.67
	Giardia cysts	0	0			
	Cryptosporidium oocysts	3.73×10^{7}	1.37×10^{6}	3.67	26.80	4.75
Kall[g]	Runoff (liters)	9.18×10^{9}	5.52×10^{7}	0.60	4.39	1.00
	Nitrate (tons)	127.94	0.58	0.46	3.33	0.76
	Nitrite (kg)	127.05	3.81	3.00	21.91	4.99
	Ammonia (kg)	321.16	13.19	4.11	29.99	6.83
	Total phosphorus (kg)	119.99	4.46	3.72	27.17	6.19
	CC 20°C (CFU)	5.46×10^{15}	2.79×10^{15}	51.02	372.67	84.87
	CC 37°C (CFU)	1.70×10^{15}	3.06×10^{14}	18.03	131.73	30.00
	E. coli (CFU)	1.22×10^{13}	7.17×10^{11}	5.88	42.92	9.77
	Coliforms (CFU)	1.73×10^{14}	1.09×10^{13}	6.33	46.24	10.53
	Fecal streptococci (CFU)	4.96×10^{12}	2.98×10^{11}	6.01	43.91	10.00
	C. perfringens (CFU)	2.06×10^{12}	1.38×10^{11}	6.68	48.79	11.11
	Giardia cysts	8.72×10^{7}	0	0.00	0.00	0.00
	Cryptosporidium oocysts	2.43×10^{8}	7.89×10^{8}	3.24	23.69	5.40
Wahnbach[h]	Runoff (liters)	1.45×10^{10}	4.49×10^{7}	0.31	2.26	1.00
	Nitrate (tons)	249.72	0.47	0.19	1.37	0.61
	Nitrite (kg)	1,450.16	4.05	0.28	2.04	0.90
	Ammonia (kg)	2,175.25	15.15	0.70	5.09	2.25
	Total phosphorus (kg)	2,233.25	11.17	0.50	3.65	1.61
	CC 20°C (CFU)	1.61×10^{16}	1.68×10^{15}	10.44	76.29	33.69
	CC 37°C (CFU)	4.81×10^{15}	3.60×10^{14}	7.48	54.63	24.13
	E. coli (CFU)	7.11×10^{13}	6.16×10^{12}	8.67	63.30	27.96
	Coliforms (CFU)	5.51×10^{14}	3.96×10^{13}	7.18	52.43	23.16
	Fecal streptococci (CFU)	1.89×10^{13}	6.11×10^{12}	32.43	236.86	104.62
	C. perfringens (CFU)	1.89×10^{13}	1.93×10^{11}	1.03	7.49	3.31
	Giardia cysts	1.60×10^{8}	5.57×10^{6}	3.49	25.52	11.27
	Cryptosporidium oocysts	1.89×10^{8}	7.66×10^{6}	4.07	29.69	13.12

[a] Estimate for the average load of RS.
[b] Estimate for the average load of ES.
[c] Assumed value for an annual load without events (expected value, 0.137%).
[d] Assumed value for regular runoff.
[e] Corrected value considering the increased runoff.
[f] For Nauholzbach 16 RS and 7 ES were used.
[g] For Kall 26 RS and 11 ES were used.
[h] For Wahnbach 25 RS and 14 ES were used.

assessing risks for public health (9). Consequently, regular examination of surface water used for drinking water production should include parasitological tests for risk characterization.

Natural conditions, as well as human activities, in catchment areas of surface reservoirs significantly affect the quality and safety of running and stored water (4, 5, 20, 26). This study shows that for every situation at a watercourse an individual analysis has to be carried out, taking into account geoecological conditions in catchment areas as well as variability in precipitation and runoff. It is important to evaluate systematically the environmental conditions of the catchment areas and their roles in microbial contamination of surface water, in addition to routine analytical monitoring of chemical and microbial parameters of water samples.

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The Elderly and Waterborne *Cryptosporidium* Infection: Gastroenteritis Hospitalizations before and during the 1993 Milwaukee Outbreak

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We used the Temporal Exposure Response Surfaces modeling technique to examine the association between gastroenteritis-related emergency room visits and hospitalizations in the elderly and drinking water turbidity before and during the 1993 Milwaukee waterborne *Cryptosporidium* outbreak. Before the outbreak, the rate of such events increased with age in the elderly ($p<0.001$), suggesting that the elderly are at an increased risk. During the outbreak, strong associations between turbidity and gastroenteritis-related emergency room visits and hospitalizations occurred at temporal lags of 5–6 days (consistent with the *Cryptosporidium* incubation period). A pronounced second wave of these illnesses in the elderly peaked at 13 days. This wave represented approximately 40% of all excess cases in the elderly. Our findings suggest that the elderly had an increased risk of severe disease due to Cryptosporidium infection, with a shorter incubation period than has been previously reported in all adults and with a high risk for secondary person-to-person transmission.

The elderly are a population at higher risk for infections (1). Changes in immune system and gastrointestinal functions occur with aging, leading to increased susceptibility to enteric infections (2–4). The elderly, along with children and pregnant women, are recognized by the U.S. Environmental Protection Agency as being sensitive subpopulations for waterborne diseases (5). Other researchers have recognized the elderly population as a potential sentinel group for surveillance of cryptosporidiosis (6). However, the degree of this increased sensitivity to specific gastrointestinal infections is not well characterized. In the United States, most prospective studies of enteric disease in the elderly were conducted two decades ago or earlier, when diagnostic techniques were limited, and many pathogens such as *Cryptosporidium, Cyclospora,* microsporidia, and *Escherichia coli* O157:H7 were not widely recognized and routinely diagnosed (7–9). Although diagnostic techniques have improved, a substantial proportion of gastrointestinal illness in the elderly and general population remains routinely undiagnosed. For example, a recent prospective study of gastroenteritis in sentinel general practices in the Netherlands found that the causative agent could be detected in only 40% of all patients (10).

Contaminated drinking water is a well-documented route of transmission for *Cryptosporidium parvum* (11). Disinfecting water by using chlorination does not inactivate this parasite, making water filtration essential in protecting public water supplies. In the spring of 1993, Milwaukee had an outbreak of waterborne cryptosporidiosis associated with increased contamination of source water and a breakdown in the water filtration process at the Howard Avenue Water Treatment Plant (the south plant) (12), causing a sharp increase in finished water turbidity. More than 400,000 persons became ill, and >100 immunocompromised persons died as a result of *Cryptosporidium* infection. This epidemic was the largest outbreak of waterborne disease reported in the United States.

In our previous studies, we demonstrated that the increased rates of acute gastrointestinal illness (gastroenteritis) in Milwaukee were significantly associated with increased drinking water turbidity (13–15). During the outbreak period, the association between drinking water turbidity and physician-diagnosed gastroenteritis was the strongest at a time lag of 7 days in children and 8–9 days in adults (15). These time lags correspond to typical incubation periods for *Cryptosporidium*. While experimental animal data demonstrate that the incubation period of cryptosporidiosis is related to immune status and dose of the pathogen (16–18), little direct information for sensitive human subpopulations exists except for persons with AIDS and malnourished children (19).

Our goal was to identify the specific features of the epidemic response in the elderly during the Milwaukee outbreak of cryptosporidiosis in 1993. We sought to identify 1) the magnitude of the association between increased drinking water turbidity and increased rate of gastroenteritis; 2) the median lag between exposure and illness, corresponding to the incubation period; and 3) the magnitude of the secondary spread. We hypothesized that the Milwaukee elderly might be more susceptible to *Cryptosporidium* infection than the nonelderly population. This higher susceptibility could, in principle, be reflected by a shorter time lag for the elderly during the epidemic, a higher overall increase in the rate of gastroenteritis

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associated with increased turbidity, and an association between the rate of gastroenteritis and older age. In addition, a pronounced second postexposure peak in infections could represent a higher risk for person-to-person transmission among the elderly. Since many elderly live together in nursing homes, the risk for secondary transmission may be increased as well. We used the Health Care Financing Administration (HCFA) database and novel analytical techniques to investigate the temporal, spatial, and demographic patterns in hospitalizations and emergency room visits for acute gastrointestinal illness (GIH events) among the elderly.

Data and Methods

Hospitalization and Emergency Room Visits

We extracted all available records of GIH events in persons who were ≥65 years of age and resided in Milwaukee County, Wisconsin, from the HCFA database for the 480-day period from January 1, 1992, through April 24, 1993. The dataset included age, zip code, type of admission, and International Classification of Disease (ICD)-9 code. We abstracted data on ICD codes 007 through 009, 558.9, and 787.0. These codes include most cases of acute gastrointestinal illness reflected in the HCFA database.

To estimate the daily rate of reported cases of acute gastroenteritis per 100,000 elderly persons, we abstracted data from the 1990 Census for five age groups (65–69, 70–74, 75–79, 80–84, and ≥85 years of age) for each zip code in Milwaukee County. To estimate the endemic and epidemic daily rate of GIH events, we divided the study time into two parts: pre-outbreak (452 days; January 1, 1992–March 27, 1993) and outbreak (28 days; March 28, 1992–April 24, 1993).

We divided Milwaukee zip codes into three categories according to the drinking water source: the north area (the Linnwood Water Treatment Plant), the south area (the Howard Avenue Water Treatment Plant), and the central area, where water from these two plants is mixed. We estimated mean daily rate of GIH events in each area before and during the outbreak and examined geographic distribution of daily rate of gastroenteritis by using the ARC/View 3.2 GIS software (ESRI, Redlands, CA).

Association between GIH Infections and Drinking Water Turbidity

As a surrogate measure of exposure to *Cryptosporidium* oocysts, we used daily maximum effluent water turbidity (provided by the Milwaukee Water Works) at the south water treatment plant. To examine temporal associations between effluent water turbidity and gastrointestinal illness, we generated a time series of daily counts of gastroenteritis in the south and central areas, which was regressed to a time series of turbidity data. We performed the analysis by using a Generalized Additive Model (GAM) with a nonparametric "loess" smoother for the exposure variable and a set of linear autoregressive components. The number of autoregressive components was selected by using the bias-corrected Akaike Information Criterion (13,14). To cover the range of possible incubation periods of cryptosporidiosis (19), we conducted this analysis for time lags between exposure and illness from 0 to 18 days, one lag at a time.

To test for the significance of regression slopes, reflecting the relationship between turbidity and daily rate of GIH events at the lags consistent with the incubation period for cryptosporidiosis, we repeated this analysis with the Generalized Log-linear Models (GLM). Although we expected to see the strongest association at lags of 5–9 days, we did not force the model to follow the lag structure based on a theoretical distribution of incubation periods in the population but allowed an equal probability for any lag to be influential on the outcome. Model diagnostics and significance of regression slopes for correspondent lags were tested within the GLM framework. Lags with statistically significant slope estimates for turbidity were identified.

To visualize the lagged relationship between exposure and gastrointestinal illness, we produced the temporal exposure response surface (TERS), which reflected the changes in lagged daily rates of gastroenteritis associated with changes in turbidity. Instead of plotting 18 dose-response curves (one for each lag), we assembled them in a three-dimensional surface aligned by turbidity values. The lags at which both the GLM and GAM models predicted the strongest impact of increased turbidity on the rate of GIH events after adjusting for time varying covariates were marked on the TERS plot.

For each time lag from 0 to 18 days, we estimated the excess daily rate of gastroenteritis associated with four levels of turbidity: 0.0–0.29, 0.3–0.49, 0.5–0.99, and 1.0–2.0 Nephelometric Turbidity Units (NTU). For a given lag, the excess rate estimate reflects the difference between the predicted epidemic daily rate at a given level of turbidity and the disease-endemic daily rate during the pre-outbreak period. All analysis was performed with S-plus 4.5 statistical software (Insightful Inc., Seattle, WA).

Results

Daily rates of GIH events per 100,000 elderly persons by age category are listed in Table 1. During and before the outbreak, the age-specific rates of GIH events exhibited similar positive trends; on average, daily rates increased by 0.44 GIH events per 100,000 persons for every 10 additional years of age (p=0.001). During the outbreak, the daily rate was substantially higher in every age category (paired t test, p=0.002) than during the pre-outbreak period.

The geographic distribution of GIH events rates for the pre-outbreak period by zip code are shown in Figure 1. This spatial distribution of rates does not suggest any consistent spatial pattern. Before the outbreak, rates of GIH events in the elderly were similar in south, central, and north areas (Table 2). During the outbreak, rates of GIH events in elderly persons increased in all three water supply areas, but the increase was much stronger in the southern and central areas than in the northern

ble 1. Daily rates of gastroenteritis-related emergency room visits and hospitalizations per 100,000 elderly persons by age category before and during the 1993 outbreak of cryptosporidiosis, Milwaukee, Wisconsin

		Before outbreak (452 d)		During outbreak (28 d)	
Age group (y)	Elderly population	No. cases	Daily rate/100,000	No.cases	Daily rate/100,000
65–69	39,561	66	0.37	15	1.35
70–74	33,019	108	0.72	17	1.84
75–79	26,188	97	0.82	12	1.64
80–84	17,584	93	1.17	16	3.25
85+	14,150	81	1.27	9	2.27
All	130,502	445	0.75	69	1.89

area (Figure 2 and Table 2). The daily rate of GIH events in the elderly residing in the southern area during the outbreak was 2.6 times higher than in the northern area.

The time-series analysis employed turbidity data from the south plant and GIH events data from the south and central areas, which were supplied completely or partially by this plant. The mean (± standard deviation) daily rates of GIH events in these areas before and during the outbreak were 0.74 (±0.94) and 2.48 (±2.07), respectively. Before the outbreak, the daily rate did not exceed 2.5 cases per day in 98% of days. However, during the outbreak, in 7 of 28 days, the daily rate was >2.5 cases per day. Before March 1993, daily turbidity never exceeded 0.25 NTU. Time series of daily rates of GIH events in the south and central areas and daily maximum effluent turbidity for a 60-day period, including the outbreak, are shown in Figure 3.

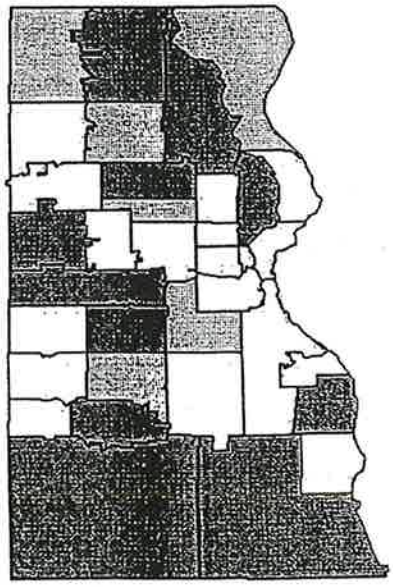


Figure 1. Geographic distributions of age-adjusted daily rate of gastroenteritis-related emergency room visits and hospitalizations per 100,000 elderly persons for the pre-outbreak period (January 1, 1992–March 27, 1993), Milwaukee, Wisconsin.

For the pre-outbreak period, we have not found any statistically significant associations between elevated water turbidity and rates of GIH events at any time lag. During the outbreak, statistically significant associations between elevated water turbidity and rates of GIH events were detected at time lags of 5, 6, 7, and 13 days by both the GLM and GAM models. As expected, no association existed between the exposure and the outcome (GIH events) on the same day, at a zero time lag. Associations at other lags from 1 to 18 days were positive but not statistically significant (Figure 4). Based on GLM analysis, the 95% confidence interval for the relative risk associated with 1 NTU increase in turbidity at time lags of 5 and 6 days was 1.54 to 4.48.

The results of modeling of the temporal relationship between turbidity and GIH events in the elderly during the outbreak period are demonstrated by the TERS surface on Figure 4. The strongest association between increased water turbidity and increased rates of GIH events was observed at a lag of 6 days, and the second highest peak was at a lag of 13 days. This second peak is temporally consistent with secondary person-to-person transmission. The flat portion of the surface reflects the absence of any associations at low levels of turbidity (<0.5 NTU) at any lag.

The estimates of excess daily rate of GIH events in the elderly (the difference between the GAM-predicted daily rate during the outbreak and the pre-outbreak daily rate of 0.75 cases/100,000 persons) associated with four levels of turbidity at time lags from 0 to 18 days are shown in Table 3. The lags that had significant regression slopes in the GLM model are marked in this table. The maximum impact of turbidity on the rate of GIH events in the elderly was associated with turbidity values above the turbidity standard of 1 NTU. At a 6-day lag, turbidity >1 NTU was associated with four additional cases of GIH events per day per 100,000 elderly persons. At a 13-day lag, turbidity contributed 2.7 additional GIH events per day per 100,000 elderly persons.

On the basis of crude estimates of rates (Table 2), of 55 GIH events in the elderly recorded by the HCFA database during 28 days of the outbreak in south and central water supply areas, 39

Table 2. Daily rates of gastroenteritis-related emergency room visits and hospitalizations in the elderly by water supply area before and during the 1993 outbreak of cryptosporidiosis, Milwaukee, Wisconsin

Water supply area	No. zip codes	No. elderly	Before outbreak		During outbreak	
			No. cases	Daily rate/100,000	No. cases	Daily rate/100,000
North	13	50,747	182	0.79	14	0.99
Central	6	18,533	50	0.60	11	2.12
South	15	61,165	213	0.77	44	2.57

(71%) exceeded the pre-outbreak level. On the basis of the estimates of GIH excess rates in the elderly (Table 3), the total excess rate associated with turbidity >1 NTU at time lags from 0 through 18 days was 37.5 per 100,000. This rate translates into 30 excess cases of emergency room visits and hospitalizations in the 79,698 elderly in south and central Milwaukee associated with turbidity >1 NTU. Of these 30 excess cases, 18 cases (60%) occurred at time lags from 0 through 10 days postexposure (primary cases), and 12 cases (40%) occurred at time lags from 11 through 18 days postexposure (secondary cases).

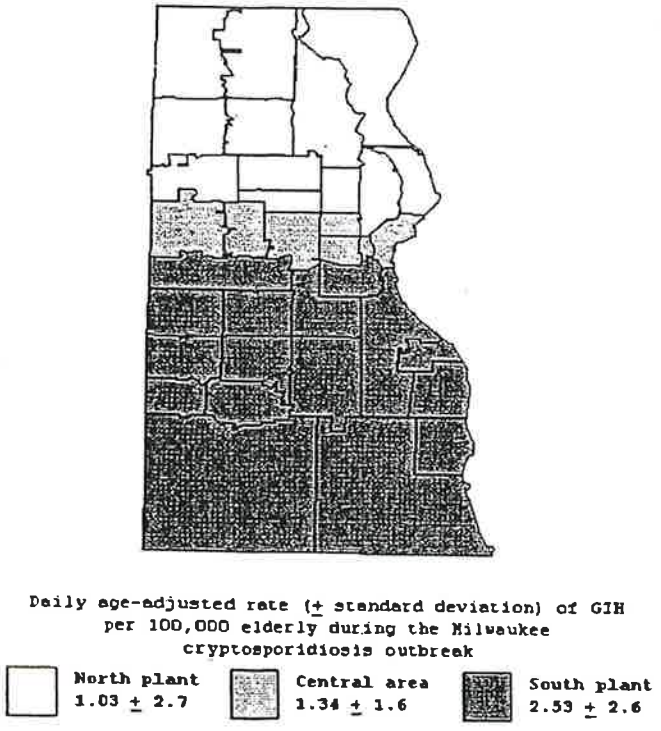


Figure 2. Age-adjusted daily rates of gastroenteritis-related emergency room visits and hospitalizations per 100,000 elderly persons during the cryptosporidiosis outbreak (March 28, 1993–April 24, 1993) in three drinking water service areas (north, central, and south), Milwaukee, Wisconsin.

Discussion

Our first finding is a positive association between age and emergency room visits and hospitalizations due to acute gastroenteritis in elderly (persons ≥65 years of age) in Milwaukee. This association was significant by age group before the outbreak (p=0.001), and significant increases were present in each category during the epidemic (p=0.002) when compared to the pre-outbreak period. These increases are consistent with age-related susceptibility to gastrointestinal infections in the elderly. Our second finding is that statistically significant associations existed between elevated drinking water turbidity and increased rate of acute gastroenteritis in the elderly at time lags of 5, 6, 7, and 13 days during the epidemic but not in the pre-epidemic period.

In our previous study, we argued that the characteristic time lag period between a surrogate for exposure to *Cryptosporidium* oocysts, such as turbidity, and acute gastroenteritis is indicative of the incubation period for this pathogen (15). Our earlier analysis of the Milwaukee outbreak demonstrated that acute gastroenteritis cases in all adults peaked at 8–9 days postexposure to contaminated drinking water. For the purposes of comparison, we have produced the TERS plot, demonstrating the relationship between daily rates of emergency room visits and hospitalizations for gastroenteritis in all adults >17 years of age and drinking water turbidity (Figure 5) by using the datasets that we analyzed in our previous publications (13–15). In the current study, we found that the first peak in the rate in GIH events in the elderly occurred at time lags of 5–6 days (Figure 4). A comparison of these plots suggests a shorter median incubation period of cryptosporidiosis in the elderly than in all adults.

A difference in incubation periods, given the same pathogen, can be due either to a different dose of the pathogen or different host susceptibility. Experiments in genetically uni-

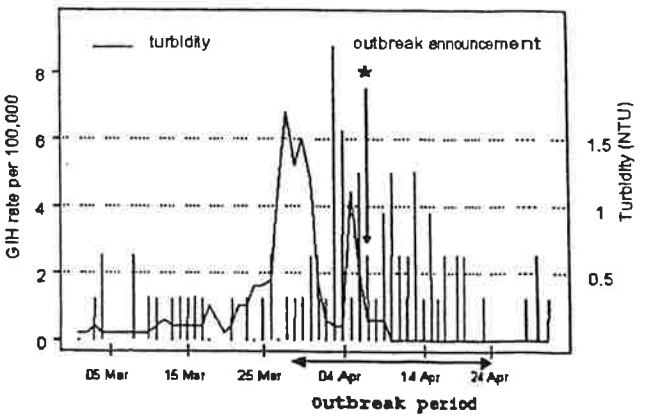


Figure 3. The fragment of the time series of daily rates of gastroenteritis-related emergency room visits and hospitalizations among Milwaukee elderly in the south and central water supply areas and daily water turbidity at the south treatment plant. The outbreak period (March 28, 1993–April 24, 1993) is indicated by blue lines; the day of announcement of the outbreak by the Milwaukee Health Department (April 7, 1993) is indicated by a green star.

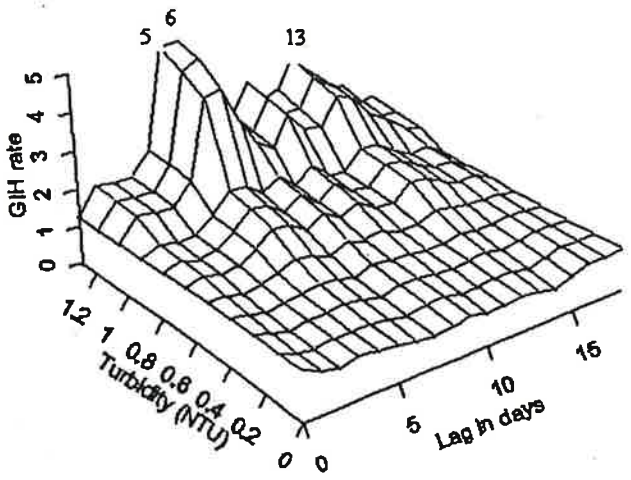


Figure 4. The temporal exposure response surface plot of the lagged association between daily rate of gastroenteritis-related emergency room visits and hospitalizations in the elderly in south and central water supply areas of Milwaukee, Wisconsin (per 100,000) and water turbidity (Nephelometric Turbidity Units) at the south plant.

form γ-interferon–deficient mice have shown that the prepatent and incubation periods for *Cryptosporidium* are inversely related to the dose of parasites and can be shortened by approximately 2 days by increasing the inoculum dose by an order of magnitude (17,18). In one human volunteer study (in which the participants were not genetically uniform), an inverse (but not statistically significant) relationship was found between the dose of oocysts administered and the time to onset of infection (20). However, in the absence of any evidence that the dose of *Cryptosporidium* delivered through the public drinking water supply was substantially different (and certainly not an order of magnitude greater) for the elderly than for all adults in Milwaukee, we conclude that the observed difference in median incubation periods is probably due to a higher inherent host susceptibility to *Cryptosporidium* infection in the elderly.

The second peak in GIH rates associated with increased water turbidity occurred at 13 days postexposure. We believe that this second peak reflects the wave of secondary transmission of cryptosporidiosis from primary waterborne cases to the elderly. First, this hypothesis is consistent with an approximate doubling of the 7-day mean incubation period of cryptosporidiosis reported from this and other epidemics of cryptosporidiosis (12,15,21–25). Second, in human volunteer experiments (18,20) and a variety of other outbreaks of cryptosporidiosis (19), incubation periods of ≥13 days were very unusual.

Our third finding relates to the magnitude of the second peak in GIH rate in the elderly, the peak of presumed second-

Table 3. Generalized Additive Mode estimates of excess daily rates of gastroenteritis-related emergency room visits and hospitalizations in the elderly in south and central water supply areas during the 1993 outbreak, Milwaukee, Wisconsin[a]

Lag (d)	0.0–0.29 NTU[b]	0.3–0.49 NTU	0.5–0.99 NTU	1.0–2.0 NTU
0	0.57	0.57	0.56	0.56
1	0.40	0.50	0.72	1.20
2	0.27	0.37	0.58	1.12
3	0.37	0.46	0.64	1.10
4	0.33	0.54	0.94	1.64
5[c]	0.31	0.66	1.38	**3.94**
6[c]	0.22	0.59	1.33	**4.10**
7[c]	0.15	0.44	1.02	**3.00**
8	0.24	0.61	1.30	1.97
9	0.29	0.54	0.97	1.79
10	0.17	0.54	1.28	2.53
11	0.18	0.45	0.95	1.97
12	0.24	0.46	0.87	2.01
13[c]	0.21	0.58	1.29	**2.68**
14	0.09	0.49	1.23	2.38
15	0.22	0.48	0.97	1.80
16	0.37	0.52	0.76	1.61
17	0.34	0.50	0.78	1.05
18	0.38	0.44	0.52	1.03
Average daily excess rate and standard deviation	0.28 (0.11)	0.51 (0.17)	0.95 (0.28)	1.97 (0.96)
Total excess rate for all lags	5.34	9.73	18.11	37.48

[a]Per 100,000 persons at 0–18 days lag postexposure at different levels of drinking water turbidity.
[b]NTU, Nephelometric Turbidity Units.
[c]Lags in bold had statistically significant regression slopes ($p < 0.05$).

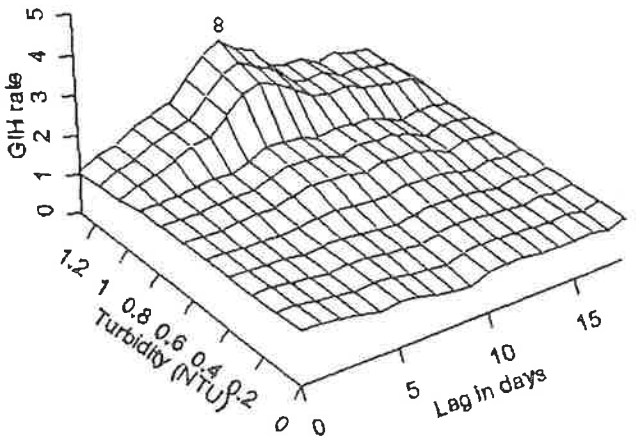


Figure 5. The temporal exposure response surface plot of the lagged association between daily rate of gastroenteritis-related emergency room visits and hospitalizations in all adults in the south and central water supply area of Milwaukee, Wisconsin (per 100,000) and water turbidity (Nephelometric Turbidity Units) at the south plant.

ary transmission. Approximately 40% of excess GIH events associated with turbidity >1 NTU occurred in time lags most consistent with secondary spread. Furthermore, the relative magnitude of the increase in gastroenteritis rate at time lags consistent with secondary spread was more pronounced in the elderly than in all adults >17 years of age. (Figures 4 and 5, respectively). This finding suggests that the elderly may have a relatively higher risk for secondary person-to-person transmission. This higher risk for secondary transmission could theoretically be caused by a higher susceptibility of the elderly, a higher likelihood of exposures, especially among the elderly residing in nursing homes, or both. Relatively little is known about the overall risk for secondary transmission of *Cryptosporidium* after its introduction during an epidemic (19,26,27). MacKenzie et al. reported a secondary transmission rate in visitors to and residents of Milwaukee of 4.2% to 5%, but that study did not focus on the elderly (24). Our results in no way contradict those data.

In a retrospective microbiologic review from Rhode Island, 13 (36%) of 36 hospitalized patients identified as having had cryptosporidiosis were 63–93 years of age, with a mean of 77 years of age, and 7 of the 13 were believed to have acquired the infection nosocomially (28). Little other information about this disease in the elderly is available. A random-digit telephone survey of Milwaukee residents (12) after the 1993 outbreak identified the elderly (>70 years of age) as the subgroup with the lowest attack rate of watery diarrhea (14% vs. 26% in the general population), yet Proctor et al. (6) found that diarrhea was highly prevalent in the elderly in nursing homes during the outbreak. These apparently discrepant results may be the natural result of studying different subgroups of the elderly. In our analysis, we used age-specific data on emergency room visits and hospital admissions among all elderly as captured by the HCFA database to demonstrate that age was a risk factor among the elderly for gastroenteritis both before and during the outbreak.

While the elderly in general are more susceptible to gastrointestinal infections than other adults, gastrointestinal infections are especially prevalent in those residing in nursing homes and other similar institutions. Infectious diarrhea is the fourth most common infectious disease in the elderly residing in long-term care facilities (7). Studies have estimated the incidence of infections to be 1 to 2.59 per person-year in the elderly living in nursing homes (4,5,29) versus 0.69 per person-year in the elderly living in the community (30). Outbreaks of infectious intestinal disease are common in nursing homes and are associated with high attack rates, prolonged duration, and high disease and death rates (29,31).

Cryptosporidiosis is underdiagnosed and underreported (32,33). Cryptosporidiosis is likely to be an unrecognized cause of diarrhea in the elderly, perhaps mimicking or occurring in combination with *Clostridium difficile* (28), a well-known agent of diarrheal illness in nursing homes. Diagnostic testing for cryptosporidiosis was rarely performed before and during the Milwaukee epidemic. As most cases of cryptosporidiosis were likely to be misdiagnosed as either noninfectious gastroenteritis or masked by other pathogens, we used all ICD-9 codes that could potentially reflect cases of waterborne cryptosporidiosis.

Human volunteer studies have also established that many persons infected with *Cryptosporidium* are asymptomatic or mildly ill (20,34). Thus, most cryptosporidiosis cases were not reflected in the HCFA database in which relatively severe cases (seeking medical attention or hospitalization) were captured. While this database does not permit us to comment on these mildly ill persons, it does allow us to study the severely ill.

Among the elderly, publicity about the outbreak may have caused an increased concern and increased hospital visits. However, the peak in gastrointestinal hospitalizations among the elderly occurred on April 3, four days before the Milwaukee Health Department reported the outbreak and 5 days after the peak in water turbidity (Figure 3). Therefore, our results are unlikely to be biased by the publicity of the outbreak. In time-series analysis, in which participants serve as their own controls, the responses on a given day are compared with responses in the same population (or sample) on specified previous days. Thus, interpersonal confounding factors and biases that frequently affect the results of cross-sectional and longitudinal studies with different exposure and control groups do not affect the results of time-series analysis. However, other factors that vary in time and are correlated with both the exposure and the outcome may indeed confound the results of time-series data analysis. Our final statistical model included the most influential time-varying factor, the day of the week. In addition, the model included a set of autoregressive components to control for potential lack of temporal independence of observations. The analysis of model residuals demonstrated the adequacy of this model.

While the breakdown in the water treatment filtration process may have allowed other pathogens to enter the public drinking water supply, no concrete evidence of other pathogens

been published. Thus, we suspect that most, if not all, of the increase in gastroenteritis detected in the elderly during this period was likely due to cryptosporidiosis. In nonoutbreak situations, cryptosporidiosis accounts for 0.5% to 5% of all cases of acute gastrointestinal illness (14,21,35). If we assume that most of the observed gastroenteritis increase in the elderly during the epidemic was due to *Cryptosporidium* infection, then the estimated magnitude of the increase in severe cryptosporidiosis cases in the elderly that resulted in hospitalization or emergency room visits is 30- to 300-fold.

The incidence of waterborne disease has been shown to be associated with the type of water supply; it is higher in communities with unfiltered surface water or mixed unfiltered surface and ground water supplies (36,37). Drinking water contamination with pathogens, such as *Giardia* and *Cryptosporidium*, has been shown to correlate with drinking water turbidity (38–40). In recognition of the importance of turbidity as an indicator of microbiologic safety of drinking water, the U.S. Environmental Protection Agency has recently released more stringent regulations to control drinking water turbidity (see Federal Register, 66:3770 and 67:1812, the Interim Enhanced Surface Water Treatment Rule and the Long Term 1 Enhanced Surface Water Treatment Rule, respectively) (41,42). Our analysis reflects the use of finished drinking water turbidity as a surrogate variable reflecting exposure to *Cryptosporidium* oocysts in water. The data on actual concentration of *Cryptosporidium* oocysts in tap water before and during the Milwaukee outbreak are not available because no prospective *Cryptosporidium* monitoring was conducted at that time.

The analytical tools we have developed in this and our previous studies allowed us to estimate the total number of attributable cases for primary waterborne exposures and for secondary transmission. In this study, we expanded our previously developed methods by estimating the excess cases associated with increased water turbidity. Standard epidemiologic investigations usually require a history of exposure to a known primary case of disease in order to link a secondary case to the outbreak. This requirement may result in an underestimation of secondary transmission, since the persons involved in this chain of transmission may not recall or recognize their contacts. Thus, the novel statistical technique that we applied for this analysis may have broad applicability to estimating the impact of secondary infections during outbreaks.

Acknowledgments

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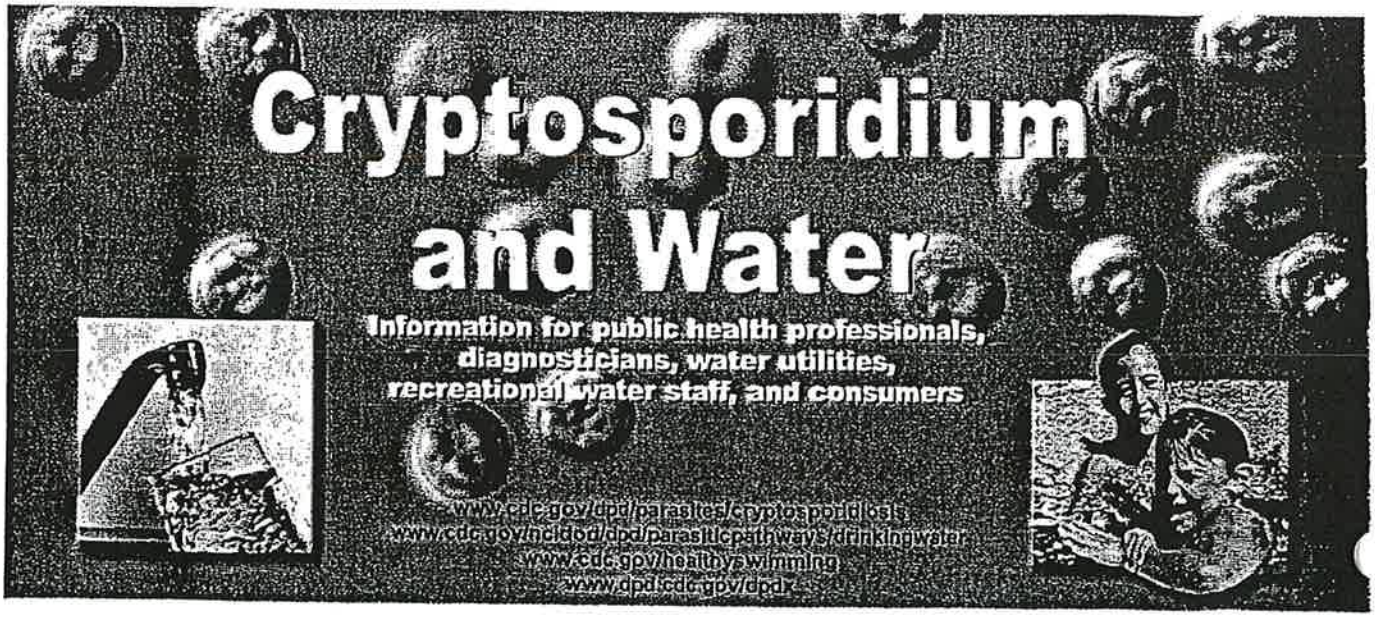
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2

Impervious cover is a powerful indicator of future stream quality

The Importance of Imperviousness

The emerging field of urban watershed protection often lacks a unifying theme to guide the efforts of its many participants—planners, engineers, landscape architects, scientists, and local officials. The lack of a common theme has often made it difficult to achieve a consistent result at either the individual development site or cumulatively, at the watershed scale.

In this article a unifying theme is proposed based on a physically defined unit—imperviousness. Imperviousness here is defined as the sum of roads, parking lots, sidewalks, rooftops, and other impermeable surfaces of the urban landscape. This variable can be easily measured at all scales of development, as the percentage of area that is not "green".

This research has yielded a surprisingly similar conclusion—stream degradation occurs at relatively low levels of imperviousness (10-20%).

Imperviousness is a very useful indicator with which to measure the impacts of land development on aquatic systems. Reviewed here is the scientific evidence that relates imperviousness to specific changes in the hydrology, habitat structure, water quality and biodiversity of aquatic systems. This research, conducted in many geographic areas, concentrating on many different variables, and employing widely different methods, has yielded a surprisingly similar conclusion—stream degradation occurs at relatively low levels of imperviousness (10-20%). Most importantly, imperviousness is one of the few variables that can be explicitly quantified, managed and controlled at each stage of land development. The remainder of this paper examines in detail the relationship between imperviousness and stream quality.

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The Components of Imperviousness

Imperviousness represents the imprint of land development on the landscape. It is composed of two primary components—the *rooftops* under which we live, work and shop, and the *transport* system (roads, driveways, and parking lots) that we use to get from one roof to another. As it happens, the transport component now often exceeds the rooftop component in terms of total impervious area created. For example, transport-related imperviousness comprised 63% to 70% of total impervious cover at the site in 11 residential, multifamily and commercial areas where it had actually been measured.[6] This phenomenon is observed most often in suburban areas and reflects the recent ascendancy of the automobile in both our culture and landscape. The sharp increases in per capita vehicle ownership, trips taken, and miles travelled have forced local planners to increase the relative size of the transport component over the last two decades.

Traditional zoning has strongly emphasized and regulated the first component (rooftops) and largely neglected the transport component. While the rooftop component is largely fixed in density zoning, the transport component is not. As an example, nearly all zoning codes set the maximum density for an area, based on dwelling units (rooftops). Thus, in a given area, no more than one single family home can be located on each acre of land, and so forth.

Thus a wide range in impervious cover is often seen for the same zoning category. For example, impervious area associated with medium density single family homes can range from 25% to nearly 60%, depending on the layout of streets and parking. This suggests that significant opportunities exist to reduce the share of imperviousness from the transport component.

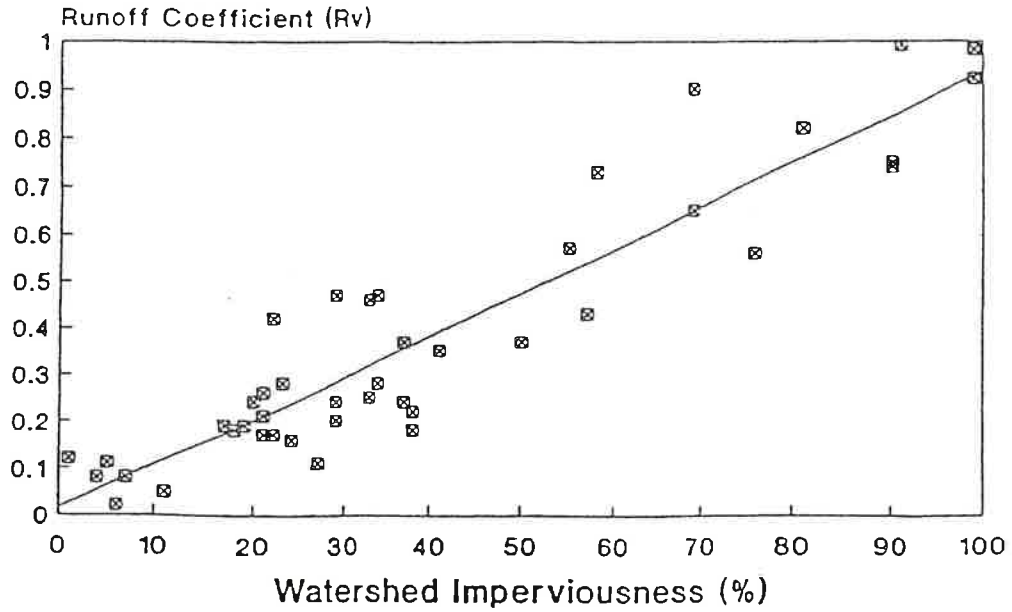
Imperviousness and runoff

The relationship between imperviousness and runoff may be widely understood, but it is not always fully appreciated. Figure 1 illustrates the increase in the site runoff coefficient as a result of site imperviousness, developed from over 40 runoff monitoring sites across the nation. The runoff coefficient ranges from zero to one and expresses the fraction of rainfall volume that is actually converted into storm runoff volume. As can be seen, the runoff coefficient closely tracks percent impervious cover, except at low levels where soils and slope factors also become important. In practical terms this means that the total runoff volume for a one-acre parking lot (Rv = 0.95) is about 16 times that produced by an undeveloped meadow (Rv = 0.06).

To put this in more understandable terms, consider the runoff from a one-inch rainstorm (see Table 1). The total runoff from a one-acre meadow would fill a standard size office to a depth of about two feet (218 cubic feet). By way of comparison, if that same acre was completely paved, a one-inch rainstorm would completely fill your office, as well as the *two* next to it. The peak discharge, velocity and time of concentration of stormwater runoff also exhibit a striking increase after a meadow is replaced by a parking lot (Table 1).

Because infiltration is reduced in impervious areas, one would expect groundwater recharge to be proportionately reduced. This, in turn, should translate into lower dry weather stream flows. Actual data, however, that demonstrate this effect is rare. Indeed, Evett et al.[8] could not find any statistical difference in low stream

Figure 1: Watershed imperviousness and the storm runoff coefficient



flow between urban and rural watersheds after analyzing 16 North Carolina watersheds. Simmons and Reynolds[26] did note that dry weather flows dropped 20 to 85% after development in several urban watersheds in Long Island, New York.

It should be noted that transport-related imperviousness often exerts a greater hydrological impact than the rooftop-related imperviousness. In residential areas, runoff from rooftops can be spread out over pervious areas, such as backyards, and rooftops are not always directly connected to the storm drain system. This may allow for additional infiltration of runoff. Roads and parking lots, on the other hand, are usually directly connected to the storm drain system.

Imperviousness and the Shape of Streams

Confronted by more severe and more frequent floods, stream channels must respond. They typically do so by increasing their cross-sectional area to accommodate the higher flows. This is done either through widening of the stream banks, downcutting of the stream bed, or frequently, both. This phase of channel instability, in turn, triggers a cycle of streambank erosion and habitat degradation.

The critical question is at what level of development does this cycle begin? Recent research models developed in the Pacific Northwest suggest that a threshold for urban stream stability exists at about 10% imperviousness[3,4] (Figure 2). Watershed development beyond this threshold consistently resulted in unstable and eroding channels. The rate and severity of channel instability appears to be a function of sub-bankfull floods, whose frequency can increase by a factor of 10 even at relatively low levels of imperviousness.[14,19,23]

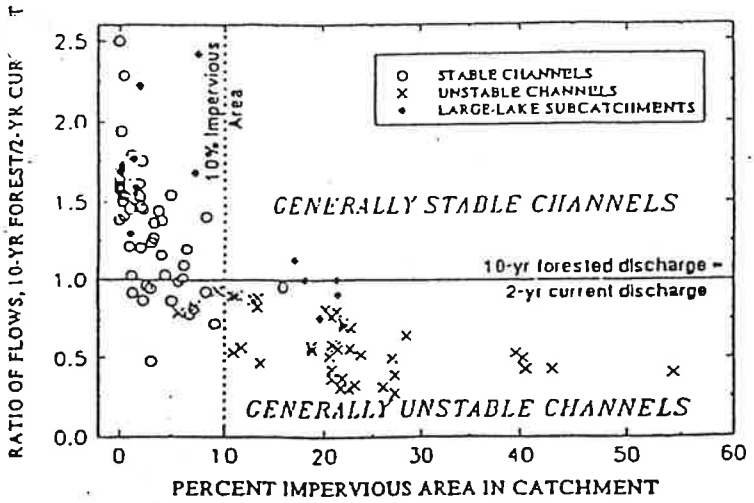
A major expression of channel instability is the loss of instream habitat structures, such as the loss of pool and riffle sequences and overhead cover, a reduction in the wetted perimeter of the stream and the like. A number of methods have been developed to measure the structure and quality of instream habitat in recent

Table 1: Comparison of one acre of parking lot versus one acre of meadow in good condition

Runoff or Water Quality Parameter	Parking Lot	Meadow
Curve number (CN)	98	58
Runoff coefficient	0.95	0.06
Time of concentration (minutes)	4.8	14.4
Peak discharge rate (cfs), 2 yr., 24 hr. storm	4.3	0.4
Peak discharge rate (cfs), 100 yr. storm	12.6	3.1
Runoff volume from one-inch storm (cubic feet)	3450	218
Runoff velocity @ 2 yr. storm (feet/second)	8	1.8
Annual phosphorus load (lbs/ac./yr.).	2	0.50
Annual nitrogen load (lbs/ac./yr.).	15.4	2.0
Annual zinc load (lbs/ac./yr.)	0.30	ND

Key Assumptions:
Parking lot is 100% impervious with 3% slope, 200 feet flow length, Type 2 Storm, 2 yr. 24 hr. storm = 3.1 inches, 100 yr. storm = 8.9 inches, hydraulic radius = 0.3, concrete channel, and suburban Washington 'C' values.
Meadow is 1% impervious with 3% slope, 200 foot flow length, good vegetative condition, B soils, and earthen channel.

Figure 2: Channel stability as a function of imperviousness
(Booth and Reinelt, 1993)



years.[10,13,21] Where these tools have been applied to urban streams, they have consistently demonstrated that a sharp threshold in habitat quality exists at approximately 10 to 15% imperviousness.[4,11,25] Beyond this threshold, urban stream habitat quality is consistently classified as poor.

Imperviousness and water quality

Impervious surfaces collect and accumulate pollutants deposited from the atmosphere, leaked from vehicles or derived from other sources. During storms, accumulated pollutants are quickly washed off and rapidly delivered to aquatic systems.

Habitat assessment tools have consistently demonstrated that a sharp threshold in habitat quality exists at approximately 10 to 15% imperviousness.

Monitoring and modeling studies have consistently indicated that urban pollutant loads are directly related to watershed imperviousness. Indeed, imperviousness is the key predictive variable in most simulation and empirical models used to estimate pollutant loads. For example, the Simple Method assumes that pollutant loads are a direct function of watershed imperviousness[23], as imperviousness is the key independent variable in the equation.

Threshold limits for maintaining background pollutant loads

Suppose that watershed runoff drains into a lake that is phosphorus-limited. Also assume that the present background load of phosphorus from a rural land use amounts to 0.5 lbs/ac/yr. The Simple Method predicts that the postdevelopment phosphorus load will exceed background loads once watershed imperviousness (I) exceeds 20 to 25% (Figure 3), thereby increasing the risk of nutrient overenrichment in the lake.

Urban phosphorus loads can be reduced when urban best management practices (BMPs) are installed, such as stormwater ponds, wetlands, filters or infiltration practices. Performance monitoring data indicates that BMPs can reduce phosphorus loads by as much as 40 to 60%, depending on the practice selected. The impact of this pollutant reduction on the postdevelopment phosphorus loading rate from the site is shown in Figure 3. The net effect is to raise the phosphorus threshold to about 35% – 60% imperviousness, depending on the performance of the BMP we install. Therefore, even when effective practices are widely applied, we eventually cross a threshold of imperviousness, beyond which we cannot maintain predevelopment water quality.

Imperviousness and stream warming

Impervious surfaces both absorb and reflect heat. During the summer months, impervious areas can have local air and ground temperatures that are 10 to 12 degrees warmer than the fields and forests that they replace. In addition, the trees that could have provided shade to offset the effects of solar radiation are absent.

Water temperature in headwater streams is strongly influenced by local air temperatures. Galli[9] reported that stream temperatures throughout the summer are increased in urban watersheds, and the degree of warming appears to be directly related to the imperviousness of the contributing watershed. He monitored five headwater streams in the Maryland Piedmont over a six-month period, the streams having differing levels of impervious cover (Figure 4). Each of the urban streams had mean temperatures that were consistently warmer than a forested reference stream, and the size of the increase (referred to as the delta-T) appeared to be a direct function of watershed imperviousness. Other factors, such as lack of riparian cover and ponds, were also demonstrated to amplify stream warming, but the primary contributing factor appeared to be watershed impervious cover.[9]

Imperviousness and stream biodiversity

The health of the aquatic ecosystem is a strong environmental indicator of watershed quality. A number of research studies have recently examined the links between imperviousness and the biological diversity in streams. Some of the key findings are summarized in Table 2.

Aquatic insects

The diversity, richness and composition of the benthic or streambed community has frequently been used to evaluate the quality of urban streams. Not only are aquatic insects a useful environmental indicator, but they also form the base of the stream food chain in most regions of the country.

Figure 3: The effect of impervious cover on urban phosphorus load under several scenarios, as computed by the Simple Method

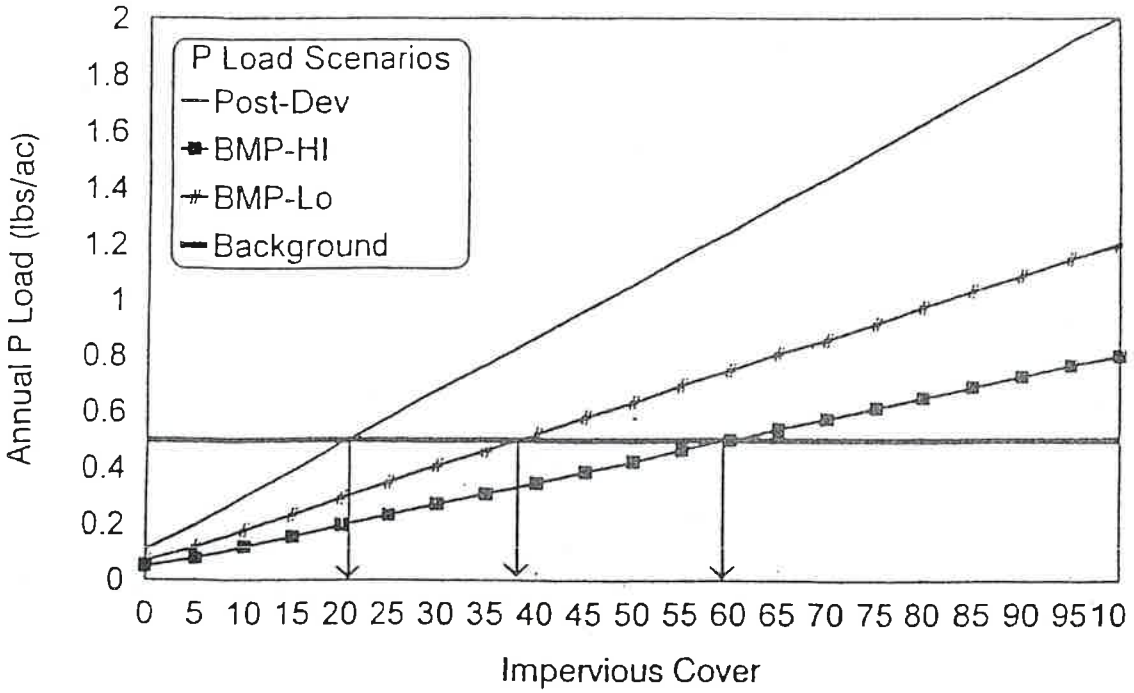
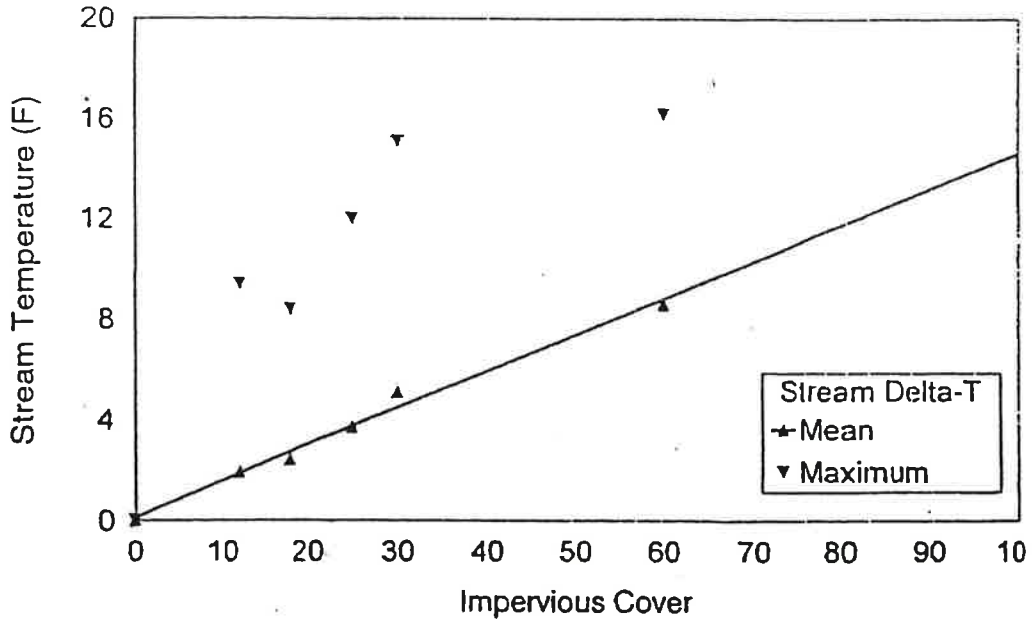
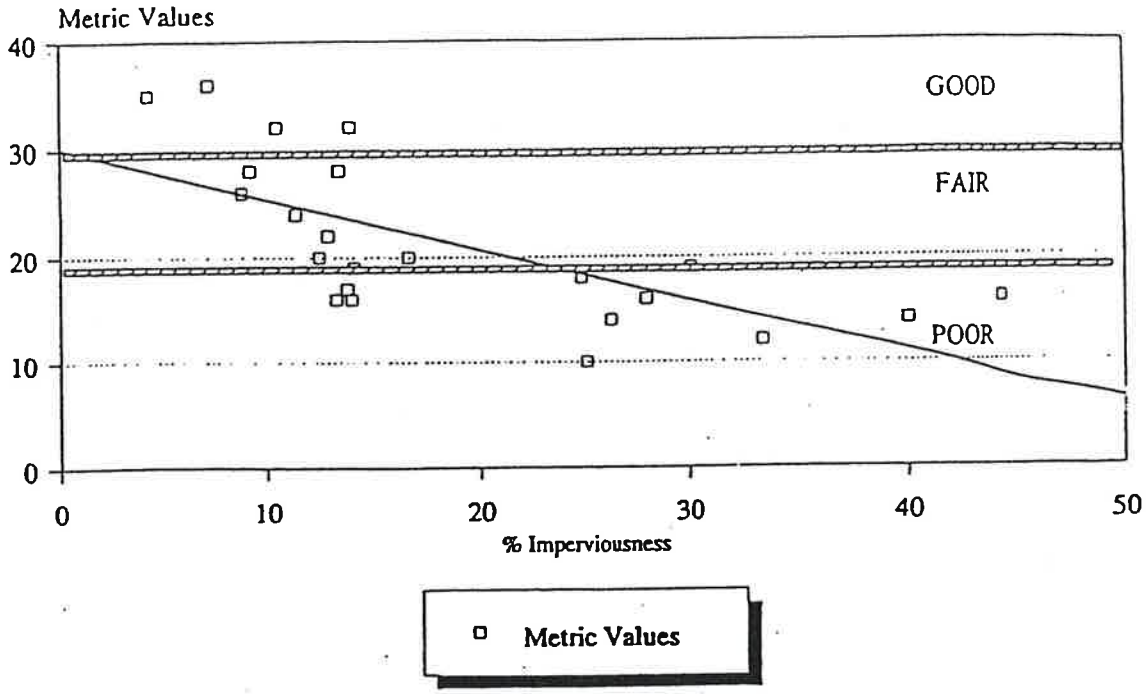


Figure 4: The effect of impervious cover on stream temperature *(Galli, 1991)*



Delta-t is the difference in mean or max stream temperature from a developed stream, compared to an undisturbed stream.

Figure 5: Impacts of imperviousness on macroinvertebrate communities in the headwater streams of the Anacostia River *(Schueler and Galli, 1992)*



Metric Values are based upon the sum of scores assigned for the following categories: EPTC balance, EPT Index, Average Generic Diversity, Chironomid Abundance, Taxonomic Richness (Family and Generic)

Klein[16] was one of the first to note that macroinvertebrate diversity drops sharply in urban streams in Maryland. Diversity consistently became poor when watershed imperviousness exceeded 10 to 15 percent. The same basic threshold has been reported by all other research studies that have looked at macroinvertebrate diversity in urban streams (Table 2).

It is clear that few, if any, urban streams can support diverse benthic communities at moderate to high levels of imperviousness (25% or more).

In each study, sensitive macroinvertebrates were replaced by ones that were more tolerant of pollution and hydrologic stress. Species such as stoneflies, mayflies, and caddisflies largely disappeared and were replaced by chironomids, tubificid worms, amphipods, and snails. Species that employ specialized feeding strategies—shredding leaf litter, grazing rock surfaces, filtering organic matter that flows by, and preying on other insects—were lost.

A typical example of the relationship between imperviousness and macroinvertebrate diversity is shown in Figure 5. The graph summarizes diversity trend for 23 sampling stations in headwater streams of the Anacostia watershed.[24] While good to fair diversity was noted in all headwater streams with less than 10% imperviousness, nearly all stations with 12% or more impervious cover recorded poor diversity. The same sharp drop in macroinvertebrate diversity at around 12 to 15% imperviousness was also observed in streams in the coastal plain and piedmont of Delaware.[25]

Other studies have utilized other indicators to measure the impacts of urbanization on stream insect communities. For example, Jones and Clark[15] monitored 22 stations in Northern Virginia and concluded that benthic insect diversity composition changed markedly after watershed population density exceeded four or more individuals per acre. The population density roughly translates to half-acre or one acre lot residential use, or perhaps 10 to 20 percent imperviousness.

Steedman[27] evaluated 208 Ontario stream sites, and concluded that benthic diversity shifted from fair to poor at about 35% urban land use. Since "urban land" includes both pervious and impervious areas, the actual threshold in the Ontario study may well be closer to 7 to 10% imperviousness.[4] Steedman also reported that urban streams with intact riparian forests had higher diversity than those that did not, for the same level of urbanization.

While the exact point at which stream insect diversity shifts from fair to poor is not known with absolute precision, it is clear that few, if any, urban streams can support diverse benthic communities at moderate to high levels of imperviousness (25% or more). Four different studies all failed to find stream insect communities with good or excellent diversity in any highly urban stream.[1,2,3,12]

Table 2: Review of key findings of urban stream studies examining the relationship of urbanization on stream quality

Ref.	Year	Location	Biological Parameter	Key Finding
3	1991	Seattle	Fish habitat/ channel stability	Channel stability and fish habitat quality declined rapidly after 10% imperv.
11	1994	Maryland	Brown trout	Abundance and recruitment of brown trout declines sharply at 10-15% imperv.
1	1981	Atlanta	Aquatic insects	Negative relationship between number of insect species and urbanization in 21 streams
15	1987	Northern Virginia	Aquatic insects	Urban streams had sharply lower diversity of aquatic insects when human population density exceeded 4 persons/acre. (estimated 15-25% imperv. cover)
17	1990	New York	Fish spawning	Resident and anadromous fish eggs and larvae declined sharply in 16 tributary streams greater than 10% imperv.
25	1994	Delaware	Aquatic insects	Insect diversity at 19 stream sites dropped sharply at 8 to 15% imperv.
25	1994	Delaware	Habitat quality	Strong relationship between insect diversity and habitat quality; majority of 53 urban streams had poor habitat
24	1992	Maryland	Fish	Fish diversity declined sharply with increasing imperv., loss in diversity began at 10-12% imperv.
24	1992	Maryland	Aquatic insects	Insect diversity metrics in 24 subwatersheds shifted from good to poor over 15% imperv.
2	1994	Maryland	Fish/insects	Fish, insect and habitat scores were all ranked as poor in 5 subwatersheds that were greater than 30% imperv.
16	1979	Maryland	Aquatic insects/fish	Macroinvertebrate and fish diversity declines rapidly after 10% imperv.
18	1993	Seattle	Fish	Marked shift from less tolerant coho salmon to more tolerant cutthroat trout populations noted at 10-15% imperv. at 9 sites
27	1988	Ontario	Aquatic insects	Strong negative relationship between biotic integrity and increasing urban land use/ riparian condition at 209 stream sites. Degradation begins at about 10% imperv.
20	1986	Seattle	Aquatic insects	Macroinvertebrate community shifted to chironomid, oligochaetes and amphipod species tolerant of unstable conditions.
28	1983	Seattle	Salmon	Marked reduction in coho salmon populations noted at 10-15% imperv. at 9 sites
29	1993	Seattle	Wetland plants/ amphibians	Mean annual water fluctuation was inversely correlated to plant and amphibian density in urban wetlands. Sharp declines noted over 10% imperv.
12	1986	NewJersey	Aquatic insects	Drop in insect taxa from 13 to 4 noted in urban streams
30	1991	Ohio	Aquatic insects/ fish	100% of 40 urban sites sampled had fair to very poor index of biotic integrity scores

Fish Surveys

The abundance and diversity of the fish community can also serve as an excellent environmental indicator. Surprisingly, relatively few studies have examined the influence of imperviousness on fish communities in headwater streams. The results of one study is illustrated in Figure 6. Four similar subwatersheds in the Maryland Piedmont were sampled for the number of fish species present. As the level of watershed imperviousness increased, the number of fish species collected dropped. Two sensitive species (trout and sculpin) were lost as imperviousness increased from 10 to 12% and four more were lost when impervious cover increased to 25%. Significantly, only two species remained in the fish community at 55% imperviousness. Sensitive species, defined as those with a strong dependence on the substrate for feeding and/or spawning, showed a more precipitous decline. Klein[16] found a similar relationship between fish diversity and watershed imperviousness in several dozen headwater streams in the Maryland Piedmont.

Salmonid fish species (trout and salmon) and anadromous fish species appear to be most negatively impacted by imperviousness. Trout have stringent temperature and habitat requirements, and seldom are present in mid-Atlantic watersheds where imperviousness exceeds 15%.[11] Declines in trout spawning success are evident above 10% imperviousness.[11] In the Pacific Northwest, Luchetti and Feurstenburg[18] seldom found sensitive coho salmon in watersheds beyond 10 or 15% imperviousness. Booth and Reinelt[4] noted that most urban stream reaches had poor quality fish habitat when imperviousness exceeded 8 to 12%.

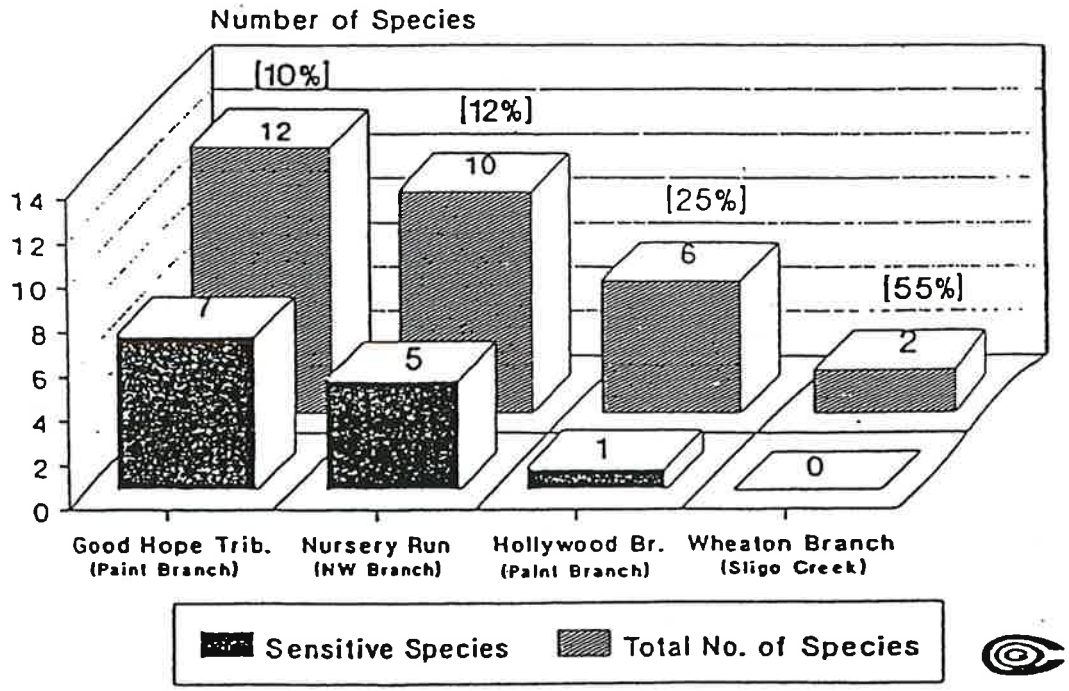
Fish species that migrate from the ocean to spawn in freshwater creeks are also very susceptible to impacts of urbanization such as fish barriers, pollution, flow changes, and other factors. For example, Limburg and Schmidt[17] discovered that the density of anadromous fish eggs and larvae declined sharply after a 10% imperviousness threshold was surpassed in 16 subwatersheds draining into the Hudson River.

The influence of imperviousness on other urban water resources

Several other studies point to the strong influence of imperviousness on other important aquatic systems such as shellfish beds and wetlands.

Even relatively low levels of urban development yield high levels of bacteria, derived from urban runoff or failing septic systems. These consistently high bacterial counts often result in the closure of shellfish beds in coastal waters and it is not surprising, that most closed shellfish beds are in close proximity to urban areas. Indeed, it may be difficult to prevent shellfish closure when more than one septic drain field is present per seven acres—a very low urban density.[7] Although it is widely believed that urban runoff accounts for

Figure 6: Fish diversity as a function of watershed imperviousness in four subwatersheds in the Maryland Piedmont *(Schueler and Galli, 1992)*



Numbers in brackets represent levels of watershed imperviousness.

Sources: 1) MdDNR, 1983 2) MdDNR, 1986 3) ICPRB, 1989

many shellfish bed closures (now that most point sources have been controlled), no systematic attempt has yet been made to relate watershed imperviousness to the extent of shellfish bed closures.

Taylor[29] examined the effect of watershed development on 19 freshwater wetlands in King County, Washington, and concluded that the additional stormwater contributed to greater annual water level fluctuations (WLF). When the annual WLF exceeded about 8 inches, the richness of both the wetland plant and amphibian community dropped sharply. This increase in WLF began to occur consistently when upstream watersheds exceeded 10 to 15% imperviousness.

Implications at the Watershed Level

The many independent lines of research reviewed here converge toward a common conclusion— that it is extremely difficult to maintain predevelopment stream quality when watershed development exceeds 10 to 15% impervious cover. What implications might this apparent threshold have for watershed planning?

Should low density or high density development be encouraged?

At first glance, it would seem appropriate to limit watershed development to no more than 10% total impervious cover. While this approach may be wise for an individual "sensitive" watershed, it is probably not practical as a uniform standard. Only low density development would be feasible under a ten percent zoning scenario, perhaps one-acre lot residential zoning, with a few widely scattered commercial clusters. At the regional scale, development would thus be spread over a much wider geographic area than it would otherwise have been. At the same time, additional impervious area (in the form of roads) would be needed to link the community together.

Paradoxically, the best way to minimize the creation of additional impervious area at the regional scale is to concentrate it in high density clusters or centers. The corresponding impervious cover in these clusters is expected to be very high (25% to 100%), making it virtually impossible to maintain predevelopment stream quality. A watershed manager must then confront the fact that to save one stream's quality it may be necessary to degrade another.

A second troubling implication of the impervious/stream quality relationships involves the large expanses of urban areas that have already been densely developed. Will it be possible to fully restore stream quality in watersheds with high impervious cover? Some early watershed restoration work does suggests that biological diversity in urban streams can be partially restored, but only after extensive stormwater retrofit and habitat structures are installed. For example, fish and macroinvertebrate diversity has been partially restored in one tributary of Sligo Creek, Maryland.[11] In other urban watersheds, however, comprehensive watershed restoration may not be feasible, due to a lack of space, feasible sites, or funding.

Paradoxically, the best way to minimize the creation of additional impervious area at the regional scale is to concentrate it in high density clusters.

A proposed scheme for classifying urban stream quality potential

The thresholds provide a reasonable foundation for classifying the potential stream quality in a watershed based on the ultimate amount of impervious cover. One such scheme is outlined in Table 3. It divides urban streams into three management categories based on the general relationships between impervious cover and stream quality:

1. Stressed streams (1 to 10% impervious cover)
2. Impacted streams (11 to 25% impervious cover)
3. Degraded streams (26 to 100% impervious cover)

The resource objective and management strategies in each stream category differ to reflect the potential stream quality that can be achieved. The most protective category are "stressed streams" in which strict zoning, site impervious restrictions, stream buffers and BMPs are applied to maintain predevelopment stream quality. "Impacted streams" are above the threshold and can be expected to experience some degradation after development (i.e., less stable channels and some loss of diversity). The key resource objective for these streams is to mitigate these impacts to the greatest extent possible, using effective BMPs.

The last category, degraded streams, recognizes that predevelopment channel stability and biodiversity cannot be fully maintained, even when BMPs or retrofits are fully applied. The primary resource objective shifts to protect downstream water quality by removing urban pollutants. Efforts to protect or restore biological diversity in degraded streams are not abandoned; in some priority subwatersheds intensive stream restoration techniques are employed to attempt to partially restore some aspects of stream quality. In other subwatersheds, however, new development (and impervious cover) is encouraged to take place so as to protect stressed and impacted streams.

Watershed-based zoning

Watershed-based zoning is based on the premise that impervious cover is a superior measure to gauge the impacts of growth, compared to population density, dwelling units or other factors. The key steps in

Table 3: A possible scheme for classifying and managing for headwater urban streams based on ultimate imperviousness

Urban Stream Classification	Stressed (0-10% Imperv.)	Impacted (11-25% Imperv.)	Degraded (26-100% Imperv.)
Channel stability	Stable	Unstable	Highly Unstable
Water quality	Good	Fair	Fair-Poor
Stream biodiversity	Good-Excellent	Fair-Good	Poor
Resource objective	Protect biodiversity and channel stability	Maintain critical elements of stream quality	Minimize downstream pollutant loads
Water quality objectives	Sediment and temperature	Nutrient and metal loads	Control bacteria
BMP Selection Factors	Secondary environmental impacts	Removal efficiency	Removal efficiency
Land Use Controls	Watershed-wide imp. cover limits (ICLs), site ICLs	Site imp. cover limits (ICLs)	Additional infill and redevelopment encouraged
Monitoring and enforcement	GIS monitoring of imp. cover, biomonitoring	Same as "Stressed"	Pollutant load modeling
Development rights	Transferred out	None	Transferred in
Riparian buffers	Widest buffer network	Average bufferwidth	Greenways

watershed-based zoning are as follows. *First*, a community undertakes a comprehensive physical, chemical and biological monitoring program to asses the current quality of its entire inventory of streams. The data are used to identify the most sensitive stream systems and to refine impervious/stream quality relationships. *Next*, existing imperviousness is measured and mapped at the subwatershed level. Projections of future impervious cover due to forecasted growth are also made at this time.

The *third* step involves designating the future stream quality for each subwatershed based on some adaptation of the urban stream classification scheme presented earlier. The existing land use master plan is then modified to ensure that future growth (and impervious cover) is consistent with the designated stream classification for each subwatershed.

The *final* step in the watershed-based zoning process involves the adoption of specific resource objectives for each stream and subwatershed. Specific policies and practices on impervious cover limits, BMPs, and buffers are then instituted to meet the stream resource objective, and these practices directly applied to future development projects.

Watershed-based zoning should provide managers with greater confidence that resource protection objectives can be met in future development. It also forces local governments to make hard choices about which streams will be fully protected and which will become at least partially degraded. Some environmentalists and regulators will be justifiably concerned about the streams whose quality is explicitly sacrificed under this scheme. The explicit stream quality decisions which are at the heart of watershed-based zoning, however, are preferable to the uninformed and random "non-decisions" that are made every day under the present zoning system.

A cautionary note

While the research on impervious cover and stream quality is compelling, it is doubtful whether it can serve as the sole foundation for legally defensible zoning and regulatory actions at the current time. One key reason is that the research has not been standardized. Different investigators, for example, have used different methods to define and measure imperviousness. Second, researchers have employed a wide number of techniques to measure stream quality characteristics that are not always comparable with each other. Third, most of the studies have been confined to few ecoregions in the country. Little research has been conducted in the Northeast, Southeast, Midwest, and semi-arid Western regions. Lastly, none of the studies has yet examined the effect of widespread application of BMPs on impervious cover/stream quality relationships. Until studies determine how much BMPs can "cheat" the impervious cover/stream quality relationship, it can be argued that structural practices alone can compensate for imperviousness effects.

On the positive side, it may be possible for a community to define the impervious cover/stream quality relationship in a short time and at relatively low cost. A suggested protocol for conducting a watershed monitoring study is presented in Table 4. The protocol emphasizes comparative sampling of a large population of urban subwatersheds of different increments of imperviousness (perhaps 20 to 50).

A rapid sampling program collects consistent data on hydrologic, morphologic, water quality, habitat and biodiversity variables within each subwatershed. For comparison purposes, series of undeveloped and undisturbed reference streams are also monitored. The sampling data are then statistically and graphically analyzed to determine the presence of imperviousness/stream quality relationships.

The protocol can be readily adapted to examine how BMPs can shift the stream quality/imperviousness relationship. This is done by adjusting the sampling protocol to select two groups of study subwatersheds—those that are effectively served by BMPs and those that are not.

Site designers can use a wide range of techniques to minimize impervious cover by 10 to 50%.

Minimizing impervious cover

Reducing impervious cover can be an effective element of the overall BMP system for a development site. As noted earlier, imperviousness need not be a fixed quantity. A site designer can utilize a wide range of techniques to minimize impervious cover at development site (Table 5) that collectively can reduce imperviousness by 10 to 50%. *(See Technical Notes 38 and 39 in this issue.)*

Table 4: Proposed protocol for defining functional relationships between watershed imperviousness and stream quality

- **General study design**
  A systematic evaluation of stream quality for a population of 20 to 50 small subwatersheds that have different levels of watershed imperviousness. Selected field measurements are collected to represent key hydrological, morphological, water quality, habitat and biodiversity variables within each defined subwatershed. The population of subwatershed data is then statistically analyzed to define functional relationships between stream quality and imperviousness.

- **Defining reference streams**
  Up to 5 non-urban streams in same geo-hydrological region, preferably fully forested, or at least full riparian forest coverage along same length. Free of confounding NPS sources, imperviousness less than 5%, natural channel and good habitat structure.

- **Basic Subwatershed Variables**
  Watershed area, standard definition and method to calculate imperviousness, presence/absence of BMPs.

- **Selecting subwatersheds**
  Drainage areas from 100 to 500 acres, known level of imperviousness and age, free of confounding sources (active construction, mining, agriculture, or point sources). Select three random non-overlapping reaches (100 feet) for summer and winter sampling of selected variables in each of five key variables groups:

  1. **Hydrology variables:** summer dry weather flow, wetted perimeter, cross-sectional area of stream, peak annual storm flow (if gaged).
  2. **Channel morphology variables:** channel alteration, height, angle and extent of bank erosion, substrate embeddedness, sediment deposition, substrate quality.
  3. **Water quality variables:** summer water temperature, turbidity, total dissolved solids, substrate fouling index, EP toxicity test, wet weather bacteria, wet weather hydrocarbon.
  4. **Habitat Variables:** pool-riffle ratio, pool frequency, depth and substrate, habitat complexity, instream cover, riffle substrate quality, riparian vegetative cover, riffle embeddeness
  5. **Ecological Variables:** fish diversity, macroinvertebrate diversity, index of biological integrity, EPA Rapid Bioasessment Protocol, fish barriers, leaf pack processing rate.

Table 5: Twenty-four strategies to minimize impervious area at the site level *(adapted from City of Olympia, 1994; Schueler. 1995; and PZC, 1992)*

1. Narrower residential road widths
2. Reduced road lengths
3. Hourglass streets
4. Cluster development
5. Shared driveways
6. Angled parking with one way traffic flow
7. Smaller parking stalls
8. Reduced parking space ratios for some uses
9. Shared parking facilities in commercial areas
10. Shorter residential driveways
11. Reduced cul-de-sac radii
12. Cul-de-sac donuts
13. Vertical parking structures
14. Two and three story buildings
15. Stream buffers
16. Grass swales rather than curb/gutters
17. Open space requirements (residential)
18. Open space landscaping requirements (comm).
19. Sidewalks only on one-side of street
20. Reduced side and rear yard setbacks
21. Decrease distance between lots (frontage)
22. Hammerhead-shaped turnarounds
23. Rear yard grading to buffer
24. Permeable spillover parking areas

Conclusion

Research has revealed that imperviousness is a powerful and important indicator of future stream quality and that significant degradation occurs ar relatively low levels of development. The strong relationship between imperviousness and stream quality presents a serious challenge for urban watershed managers. It underscores the difficulty in maintaining urban stream quality in the face of development.

At the same time, imperviousness represents a common currency that can be measured and managed by planners, engineers and landscape architects alike. It links activities of the individual development site with its cumulative impact at the watershed scale. With further research, impervious cover can serve as an important foundation for more effective land use planning decisions.

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Impervious Surface Coverage

The Emergence of a Key Environmental Indicator

Chester L. Arnold, Jr. and C. James Gibbons

Planners concerned with water resource protection in urbanizing areas must deal with the adverse impacts of polluted runoff. Impervious surface coverage is a quantifiable land-use indicator that correlates closely with these impacts. Once the role and distribution of impervious coverage are understood, a wide range of strategies to reduce impervious surfaces and their impacts on water resources can be applied to community planning, site-level planning and design, and land use regulation. These strategies complement many current trends in planning, zoning, and landscape design that go beyond water pollution concerns to address the quality of life in a community.

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Impervious land cover has long been characteristic of urban areas, but has only recently emerged as an environmental indicator. Natural resource planning using impervious surface coverage as a framework can be a pragmatic and effective way of addressing a host of complex urban environmental issues, particularly those related to the health of water resources.

Water resource protection at the local level is getting more complicated, largely due to the recognition of nonpoint source pollution, or polluted runoff, as a major problem. This diffuse form of pollution, now the nation's leading threat to water quality (Environmental Protection Agency 1994), is derived from contaminants washed off the surface of the land by stormwater runoff, and carried either directly or indirectly into waterways or groundwater. As programs directed at nonpoint source control cascade down from federal to state to local governments, the technical complexities involved with such control are further complicated by regulatory and management considerations.

Stormwater runoff problems are nothing new to local land-use decision-makers. However, the principal concern about runoff has always been safety, with the focus on directing and draining water off of paved surfaces as quickly and efficiently as possible. Once off the road and out of sight, stormwater has been largely out of mind—downstream consequences be damned (or dammed). Regulations have been expanded in recent years to include consideration of flooding and erosion, yet these factors fall far short of a comprehensive and effective approach to mitigating the water quality impacts of development.

How do planners and other local officials get a handle on protecting their local water resources? While no magic bullet exists to simplify all the complexities involved, an indicator is emerging from the scientific literature that appears to have all the earmarks of a useful tool for local planners—the amount of impervious, or impenetrable, surface. This article reviews the scientific underpinning, usefulness, and practical appli-

cation of impervious surface coverage as an urban environmental indicator.

People, Pavement and Pollution

Impervious surfaces can be defined as any material that prevents the infiltration of water into the soil. While roads and rooftops are the most prevalent and easily identified types of impervious surface, other types include sidewalks, patios, bedrock outcrops, and compacted soil. As development alters the natural landscape, the percentage of the land covered by impervious surfaces increases.

Roofs and roads have been around for a long time, but the ubiquitous and impervious pavement we take for granted today is a relatively recent phenomenon. A nationwide road census showed that in 1904, 93 percent of the roads in America were unpaved (Southworth and Ben-Joseph 1995). This changed with the early twentieth century ascendancy of the automobile over the railways, capped by the mid-century massive construction of the interstate highway system, which served to both stimulate and facilitate the growth of suburbia. From that point on, imperviousness became synonymous with human presence—to the point that studies have shown that an areas's population density is correlated with its percentage of impervious cover (Stankowski 1972).

Impervious surfaces not only indicate urbanization, but also are major contributors to the environmental impacts of urbanization. As the natural landscape is paved over, a chain of events is initiated that typically ends in degraded water resources. This chain begins with alterations in the hydrologic cycle, the way that water is transported and stored.

These changes, depicted in figure 1, have long been understood by geologists and hydrologists. As

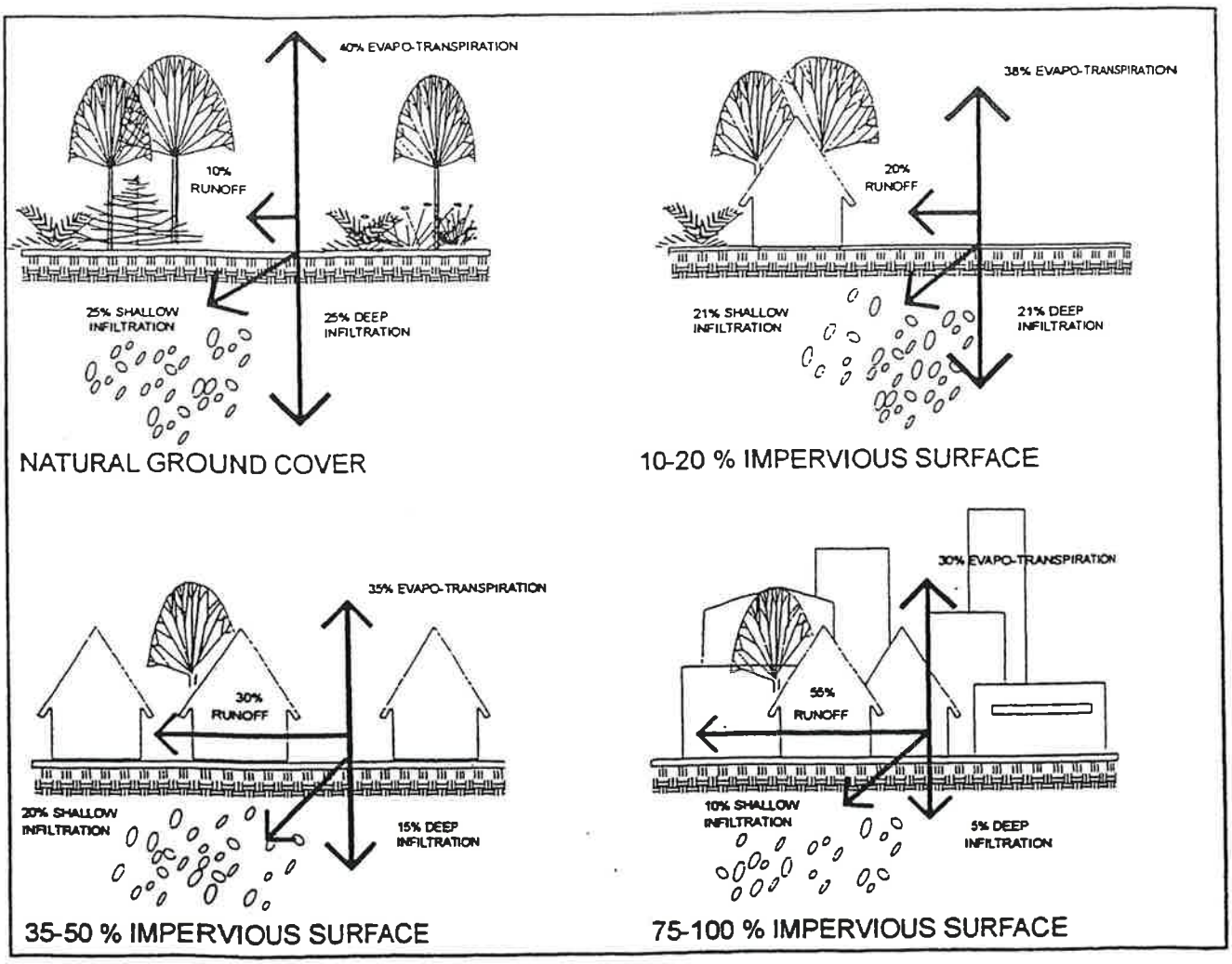


FIGURE 1. Water cycle changes associated with urbanization
Source: Environmental Protection Agency 1993a

impervious coverage increases, the velocity and volume of surface runoff increase, and there is a corresponding decrease in infiltration. The larger volume of runoff and the increased efficiency of water conveyance through pipes, gutters, and artificially straightened channels result in increased severity of flooding, with storm flows that are greater in volume and peak more rapidly than is the case in rural areas (Carter 1961; Anderson 1968; Leopold 1968; Tourbier and Westmacott 1981). The shift away from infiltration reduces groundwater recharge, lowering water tables. This both threatens water supplies and reduces the groundwater contribution to stream flow, which can result in intermittent or dry stream beds during low flow periods (Dunne and Leopold 1978; Harbor 1994).

Hydrologic disruption gives rise to physical and ecological impacts. Enhanced runoff causes increased erosion from construction sites, downstream areas and stream banks. The increased volume of water and sediment, combined with the "flashiness" of these peak discharges, result in wider and straighter stream channels (Arnold, Boison, and Patton 1982). Loss of tree cover leads to greater water temperature fluctuations, making the water warmer in the summer and colder in the winter (Galli 1991). There is substantial loss of both streamside (riparian) habitat through erosion, and in-stream habitat as the varied natural stream bed of pebbles, rock ledges, and deep pools is covered by a uniform blanket of eroded sand and silt (Schueler 1992). Engineered responses to flooding like stream diversion, channelization, damming, and piping further destroy stream beds and related habitats like ponds and wetlands. Finally, with more intensive land uses comes a corresponding increase in the generation of pollutants. Increased runoff serves to transport these pollutants directly into waterways, creating nonpoint source pollution, or polluted runoff.

Major categories of nonpoint source pollutants include pathogens (disease-causing microorganisms), nutrients, toxic contaminants, and debris. Pathogen contamination indicates possible health hazards, resulting in closed beaches and shellfish beds. Overabundance of nutrients such as nitrogen and phosphorous can threaten well water supplies, and in surface waters can lead to algal "blooms" that, upon decaying, rob the waters of life-sustaining oxygen. Toxic contaminants like heavy metals and pesticides pose threats to the health of aquatic organisms and their human consumers, and are often persistent in the environment. Debris, particularly plastic, can be hazardous to animal and human alike, and is an aesthetic concern. Sediment is also a major nonpoint source pollutant, both for its effects on aquatic ecology and because of the fact that many of the other pollutants tend to adhere to eroded soil particles (Environmental Protection Agency 1992, 1993a).

The results of polluted runoff are evident in every corner of the United States. According to the Environmental Protection Agency (1994), nonpoint source pollution is now the number one cause of water quality impairment in the United States, accounting for the pollution of about 40% of all waters surveyed across the nation. The effects of nonpoint source pollution on coastal waters and their living resources have been of particular concern (U.S. House of Representatives 1988; Environmental Protection Agency 1993a). Urban runoff alone ranks as the second most common source of water pollution for lakes and estuaries nationwide, and the third most common source for rivers (Environmental Protection Agency 1994).

As point source pollution is increasingly brought under control, the true impact of urban nonpoint source pollution is being recognized. For instance, even in an urbanized estuary like Long Island Sound, where the major environmental problems have been strongly linked to point source discharges from sewage treatment plants, an estimated 47% of the pathogen contamination is from urban runoff (Long Island Sound Study 1994).

Imperviousness as an Environmental Indicator

Planners wishing to protect their community's water resources against these threats may not know where to begin. The site-specific and diffuse nature of polluted runoff seems to demand extensive technical information on pollutant loadings, hydrologic modeling, and the effectiveness of various management practices. This information is difficult to acquire, not only because of the cost of such studies, but because nonpoint-source-related research and engineering are new and evolving fields.

Enter impervious surfaces. When doing community-level planning, or where detailed site information is unavailable, impervious coverage may often be the most feasible and cost-effective vehicle for addressing water pollution. Two major factors argue for its potential utility to the local planner.

First, imperviousness is integrative. As such, it can estimate or predict cumulative water resource impacts without regard to specific factors, helping to cut through much of the intimidating complexity surrounding nonpoint source pollution. Although impervious surfaces do not generate pollution, they: (1) are a critical contributor to the hydrologic changes that degrade waterways; (2) are a major component of the

intensive land uses that do generate pollution; (3) prevent natural pollutant processing in the soil by preventing percolation; and (4) serve as an efficient conveyance system transporting pollutants into the waterways. It is not surprising, then, that research from the past 15 years consistently shows a strong correlation between the imperviousness of a drainage basin and the health of its receiving stream (Klein 1979; Griffin 1980; Schueler 1987; Todd 1989; Schueler 1992; Booth and Reinfelt 1993; Schueler 1994a).

Figure 2 is a stylized graph of this general relationship, showing stream health decreasing with increasing impervious coverage of the watershed, or drainage basin, of the stream. The horizontal lines mark average threshold values of imperviousness at which degradation first occurs (10%), and at which degradation becomes so severe as to become almost unavoidable (30%). These thresholds serve to create three broad categories of stream health, which can be roughly characterized as "protected" (less than 10%), "impacted" (10%-30%), and "degraded" (over 30%).

Thresholds are always controversial and subject to change, yet it is important to note that to date, the threshold of initial degradation in particular seems to be remarkably consistent. The scientific literature includes studies evaluating stream health using many different criteria—pollutant loads, habitat quality, aquatic species diversity and abundance, and other factors. In a recent review of these studies, Schueler (1994a) concludes that "this research, conducted in many geographic areas, concentrating on many different variables, and employing widely different methods, has yielded a surprisingly similar conclusion—stream degradation occurs at relatively low levels of imperviousness (10-20%)" (100). Recent studies also suggest that this threshold applies to wetlands health. Hicks (1995) found a well-defined inverse relationship between freshwater wetland habitat quality and impervious surface area, with wetlands suffering impairment once the imperviousness of their local drainage basin exceeded 10%. Impervious coverage, then, is both a reliable and integrative indicator of the impact of development on water resources.

The second factor in favor of the use of imperviousness is that it is measurable. This enhances its utility both in planning and regulatory applications. (Examples follow in a later section.) Depending on the size of the area being considered and the particular application being applied, a wide range of techniques—with a wide range of price tags—exists for the measurement of impervious coverage.

For site level applications, on-site measurement

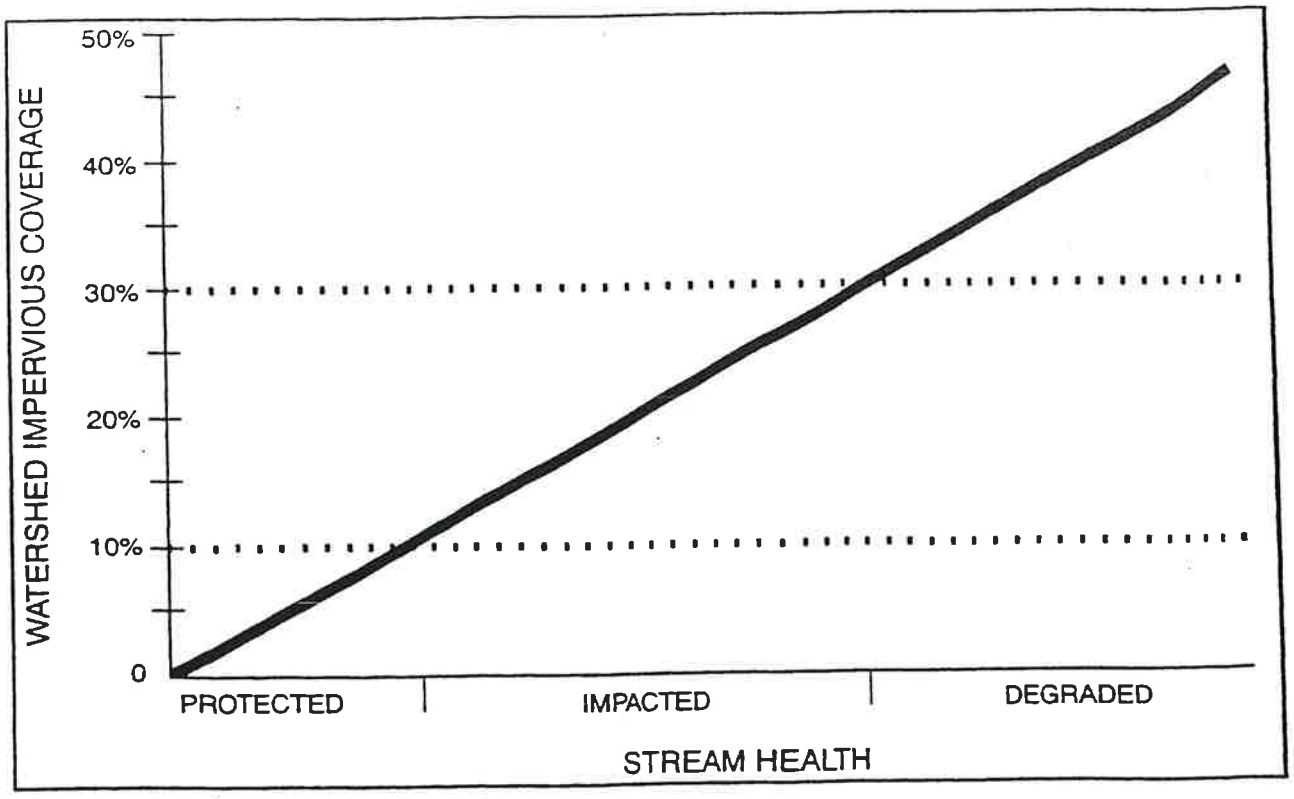


FIGURE 2. Stylized relationship of imperviousness to stream health
Modified from Schueler 1992

using surveying equipment (sometimes as basic as a tape measure) is the most accurate and appropriate method. On the neighborhood level, "windshield" surveys may be appropriate where it is less important to have exact numbers. For community- or regional-scale areas, land cover derived from aerial photographs provides perhaps the best compromise between accuracy and cost. Finally, for applications encompassing even larger areas, remotely-sensed satellite-based land cover can be a viable option. At present, impervious estimates based on satellite data must be calculated by applying literature values of imperviousness to satellite land cover categories. We are currently involved with a remote sensing research project at the University of Connecticut that is attempting to devise a method for directly estimating imperviousness from satellite images (Civco and Arnold 1994).

It is important to note that all of these methods of measurement are increasingly being digitized and presented in the form of computerized maps in a geographic information system, or GIS. This trend eventually will make the information easier to acquire, often at lower expense. Many communities have been unable to afford GIS, and others have been disillusioned at its cost and complexity once they invested in it. Evolution of the technology, however, is making GIS more accessible to local officials every day.

The Components of Imperviousness

To measure and use impervious coverage as a tool for protecting water resources, it is necessary to know how imperviousness is distributed about the landscape. On a scale of increasing refinement, impervious coverage can be broken down by land use, by function within each land use, and by its relative impact on runoff. Each of these pieces of the puzzle can help to target planning and/or regulatory approaches to reducing impervious coverage. As with measurement techniques, the extent to which planners need detailed information on these components depends on the particular application.

The percentage of land covered by impervious surfaces varies significantly with land use. The most frequently cited estimates come from a report by the Soil Conservation Service (1975) (figure 3). "Strip" type

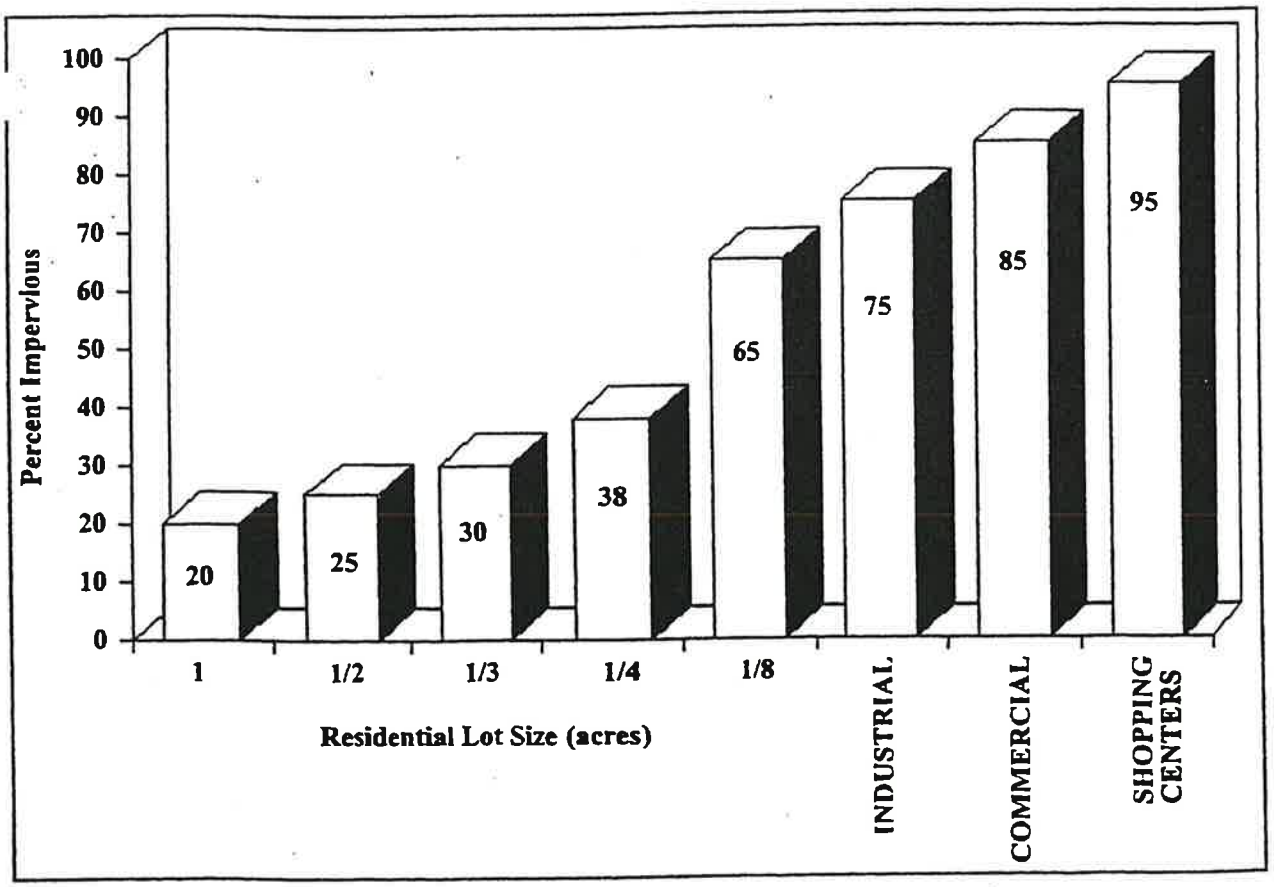


FIGURE 3. Average percentage of impervious coverage by land use
Source: Soil Conservation Service 1975

commercial development tops the chart at around 95% coverage, with other business areas and industrial development lagging slightly behind. In residential areas, there is a wide range of imperviousness that varies predictably with lot size, going from about 20% in one-acre zoning to as high as 65% in one-eighth-acre zoning.

The City of Olympia, Washington, recently conducted a thorough study of impervious coverage in their area. For 11 sites measured, they found coverage values similar to the SCS values, finding four high-density residential developments (3–7 units/acre) to average 40% impervious, four multifamily developments (7–30 units/acre) to average 48% impervious, and three commercial/industrial sites to average 86% impervious coverage (City of Olympia 1995) (table 1).

In addition to the relationship between land use and the total amount of impervious coverage, studies show that all land uses are not equal with regard to the levels of contaminants present in the runoff. As noted, pollutant or land-use-specific studies are relatively new to the scientific community, but existing information supports the common-sense assumption that some land uses are more contaminating than others; for instance, runoff from gasoline stations contains extremely high levels of hydrocarbons and heavy metals (Schueler 1994b).

Recent research from Wisconsin goes one major step further, actually determining the pollutant concentrations from specific categories of impervious surfaces. Using micro-monitoring samplers that collected the runoff from 12 different types of surfaces (e.g., roofs, streets, parking lots, lawns, driveways) in residential, commercial, and industrial areas, Bannerman et al. (1993) were able to show distinct differences in the types and amounts of certain pollutants, depending on the source of the runoff. The study clearly identified streets as the impervious surfaces having the highest pollutant loads for most land-use categories (table 2). Roofs, with the exception of the zinc from industrial roofs, were generally low in pollutant loads, while parking lots had surprisingly moderate

TABLE 1. Site coverage for three land uses in Olympia, Washington

Surface Coverage Type	Average Approximate Site Coverage, % High Density Residential (3–7 units/acre)	Multifamily (7–30 units/acre)	Commercial
1. Streets	16	11	03
2. Sidewalks	03	05	04
3. Parking/driveways	06	15	53
4. Roofs	15	17	26
5. Lawns/landscaping	54	19	13
6. Open space	n/a	34	n/a
Total impervious surface (1–4)	40	48	86
Road-related impervious surface (1–3)	25	31	60
(Road-related as a percentage of total impervious coverage)	(63%)	(65%)	(70%)

Adapted from City of Olympia 1995

TABLE 2. Surfaces exhibiting highest levels of runoff-borne pollutants, out of twelve surface types sampled in selected urban areas in Wisconsin

POLLUTANT	SURFACE Highest levels	Second highest levels	Third highest levels
e. coli (pathogens)	residential feeder streets	residential collector streets	residential lawns
solids (sediment)	industrial collector streets	industrial arterial streets	residential feeder streets
total phosphorous	residential lawns	industrial collector streets	residential feeder streets
zinc	industrial roofs	industrial arterial streets	commercial arterial streets
cadmium	industrial collector streets	industrial arterial streets	commercial arterial streets
copper	industrial collector streets	industrial arterial streets	residential collector streets

Adapted from Schueler 1994d

vels of pollutants. The one unpaved surface monitored, residential lawns, showed high levels of phosphorous, presumably from lawn and garden fertilizers. As this study is augmented by others over time, reliable relationships between pollutant loads and specific landscape components will undoubtedly emerge.

Impervious cover can be further broken down into its functional components. Schueler (1994a) and others point out the two major categories of impervious surface: rooftops, and the transport system (roads, parking lots, driveways, sidewalks). In general, the transport system is the dominant component, reinforcing the concept of an automobile-centric society. In the Olympia study, for instance, the transportation component ranged from 63% for single-family residential development to 70% for commercial development (City of Olympia 1995) (table 1).

One last refinement of the impervious component is its relationship in the landscape to surrounding areas, in the sense of how much of the rainfall onto a given surface is actually conveyed to a stream or stormwater collection system. In general, the rooftop component, which often drains to a lawn or other permeable areas, has less impact than roadways, which typically channel runoff directly to the stormwater system. The Olympia study (1994b) calls this factor the *effectiveness* at producing runoff, and estimates impervious areas in low-density residential developments to be about 40% effective, while those in commercial/industrial areas are close to 100% effective. In theory this concept could be applied to all surfaces—lawns themselves, for instance, can have a significant coefficient of runoff—but to our knowledge this level of refinement has not been researched, nor is it generally needed for most applications.

Imperviousness in Planning: A Framework, Some Examples

By considering the distribution of impervious cover by land use, function, and contribution to runoff, strategies begin to emerge for the reduction of both current and future levels of imperviousness. We suggest that these strategies can be grouped into three basic categories: community or regional planning; neighborhood and site planning, and regulation. Each category presents opportunities to revisit the *status quo* with an eye to water resource protection. Following are some general concepts and specific examples of such opportunities.

Planning at the Community or Regional Level

Land-use planning, even at the town level, need not be based on traditional political boundaries. Increasingly, environmental and natural resource professionals recommend planning based on the organization of natural systems (Environmental Protection Agency 1993c). Ecosystems as an organizational unit have been suggested, but the functional definition of an ecosystem remains elusive.

A more promising trend has been toward using watersheds as planning units (Environmental Protection Agency 1993b). A watershed, or drainage basin, is an area that drains to a common body of water, be it a lake, river, stream, aquifer, or bay. Watersheds have an advantage in that they can be clearly defined as geographic units. In addition, the watershed can be used as a system of organization at any number of scales, from a major basin encompassing several states, to a regional basin involving several municipalities, to a local sub-basin on the neighborhood level.

Thinking in terms of watersheds is particularly appropriate for stormwater management, which, after all, is all about drainage. At the University of Connecticut, we have developed a regional/community-level planning approach that provides an example of the use of both watersheds and impervious coverage. The Nonpoint Education for Municipal Officials (NEMO) project was initiated in 1991 to assist communities in dealing with the complexities of polluted runoff management (Arnold et al. 1993). The project, funded by the United States Department of Agriculture's Cooperative State Research, Education and Extension Service, is run by an interdisciplinary team that includes water quality, natural resource planning, and computer technology expertise. NEMO uses geographic information system (GIS) technology as a tool to educate local land-use decision-makers about the links between their town's land use and its water quality. Natural resource information on waterways and watersheds is combined with satellite-derived, land-cover information, and then displayed on colorful maps created with the GIS.

At the heart of NEMO is an analysis of impervious cover. Literature values for the percentage of impervious cover are applied to satellite land-cover categories to come up with rough estimates for the current level of imperviousness within a town or watershed. These values are averaged and displayed by local drainage basin (average area about one square mile) and categorized according to the protected/impacted/degraded scale of increasing impervious cover previously described and shown in figure 2. The current values are then contrasted with a zoning-based, build-out analysis of imperviousness, again displayed by local subbasin (figure 4). The build-out allows town officials a look into the possible future of their town, not in conventional terms of population or lot coverage, but in

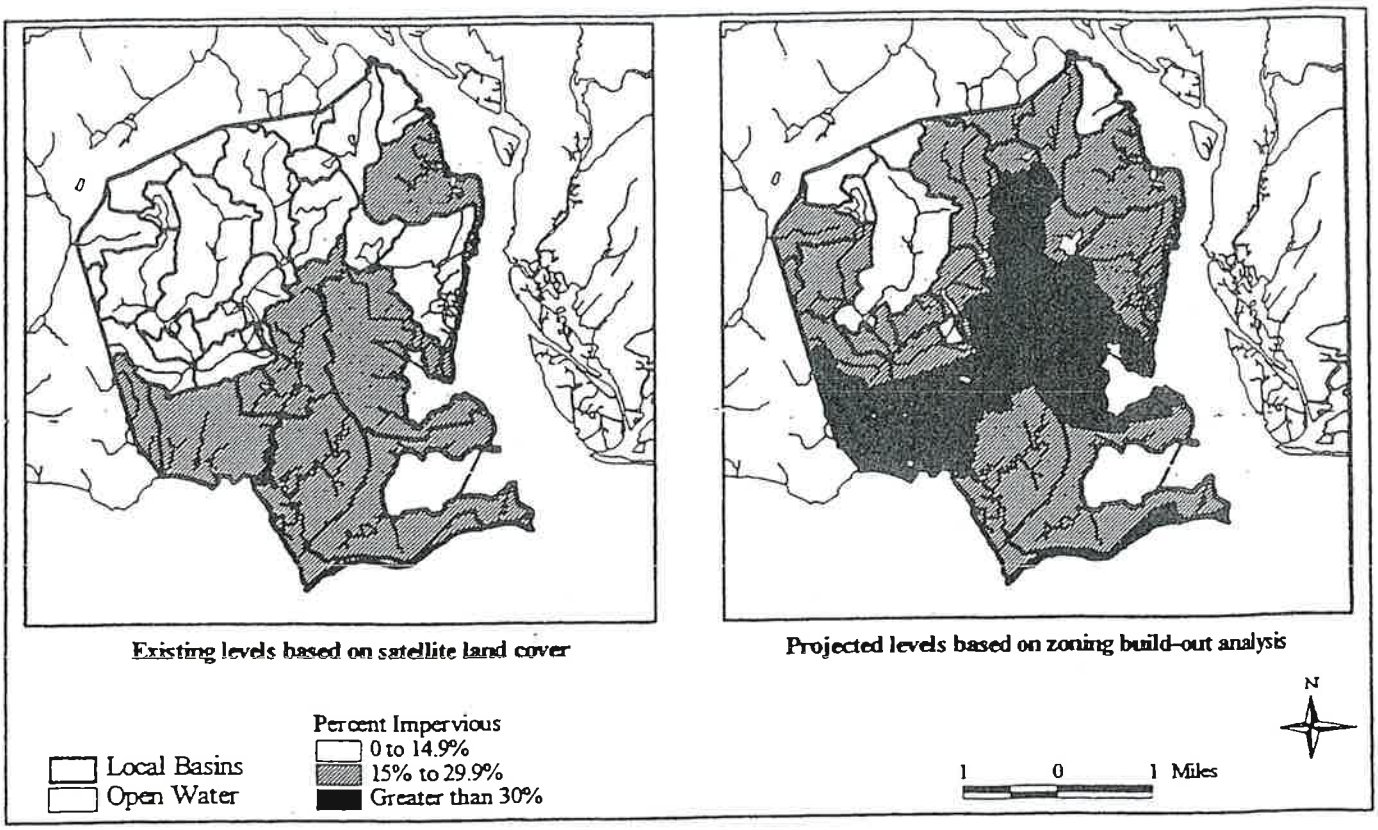


FIGURE 4. Impervious coverage analysis for Old Saybrook, CT

terms of impervious cover—and by inference, the health of their local water resources.

The results of the impervious surface analysis can be used to help guide planning emphasis within each local basin area. For areas in the lower impervious zone, emphasis should be placed on preventive measures that retain existing natural systems, using techniques like open space planning and stream buffers. For areas that are in, or will be in, the "impacted" (10–30%) zone, preventive planning should be accompanied by a focus on site design considerations that reduce runoff and imperviousness. Finally, for areas at (or climbing into) the "degraded" (over 30%) zone, the focus shifts to remediation through pollutant mitigation and resource restoration.

NEMO is one example of the use of imperviousness for broad-based community or regional water resource planning. Similar approaches are beginning to spring up around the country. Schueler (1994a) recommends watershed-based zoning that "is based on the premise that impervious cover is a superior measure to gauge the impacts of growth, compared to population density, dwelling units or other factors." In Alpine Township, Michigan, concern about the effects of urbanization on a formerly productive cold-water trout fishery has prompted researchers from Grand Valley State University to design a watershed-based GIS decision support system for local land-use authorities (Frye and Denning 1995). The system makes use of a number of hydrologic and land-use factors, including impervious surface estimates and zoning-based build-out analyses. In Montgomery County, Maryland, a detailed planning study was done to formulate a land-use strategy to protect the water resources of the Paint Branch stream (Montgomery County MD 1995). The study both measures and projects future impervious surface coverage by subwatershed basin, and uses this information to help guide its recommendations for protective actions.

Each of these efforts contains the elements of impervious cover, subbasin-level analysis, and build-out projections. An even more comprehensive treatment is that undertaken by the City of Olympia, Washington. During 1993 and 1994, Olympia conducted their Impervious Surface Reduction Study (ISRS), from which information is cited repeatedly in this paper. The ISRS Final Report (City of Olympia 1995) contains an impressive and comprehensive body of research, policy analysis, and build-out scenarios, culminating in 19 specific action recommendations. The study concludes

that "a 20% reduction [in future impervious cover] is a feasible and practical goal for Olympia and will not require exceptional changes in the Olympia community." The recommended reduction is equal to approximately 600 fewer acres of impervious coverage by the year 2012. Planners wishing to see an example of a comprehensive approach to reducing imperviousness would do well to read the Olympia ISRS report.

As with other natural resource protection efforts, community and watershed-level planning approaches like these are often the most effective way of achieving results. Addressing the issue at this scale provides an overall perspective and rationale for the design and regulatory tools described in the following sections. Site-level considerations are then based not only on the immediate impacts of a given development on the local stream or pond, but also on the site's incremental contribution to the pollution (or protection) of a larger-scale water body or aquifer. Review of site design and stormwater management plans, for instance, can be checked for consistency with goals for the appropriate watershed.

Providing this broad context has the added benefit of allowing for greater flexibility at the site level. Planners can evaluate individual factors like a site's location within the watershed, its land use, and the relative priority of the receiving stream as they relate to the overall plan, rather than applying a rigid and uniform set of requirements to all parcels.

Site-Level Planning

Site planning is perhaps the least-explored approach to reducing water pollution. Kendig (1980) states that "good design begins with an analysis of the natural and environmental assets and liabilities of a site," and that these factors should be the determinants of development patterns. Applying this principle to water resource protection translates to maintaining the natural hydrologic function of a site, through retaining natural contours and vegetation to the maximum extent possible. Consideration of impervious surface is a key element of this overall strategy, extending to all site-level considerations. These include construction practices, design that reduces imperviousness, and design that includes measures to mitigate the effects of the runoff from impervious areas.

Construction activity itself usually creates impervious surface, severely compacting earth with heavy machinery. Although erosion control practices may require procedures for limiting the area of exposed soil and how long it remains exposed, that requirement does not necessarily minimize the amount of compacted soil. Construction should be sequenced with this goal in mind, and it may be necessary later to loosen compacted areas and/or cover them with additional pervious materials (Craul 1995).

From construction, we move to reduction. For virtually all land uses, one of the best design-related opportunities for reducing imperviousness is through the reduction of road widths. As has been seen, roads both constitute a major fraction of a community's impervious coverage, and tend to produce the most pollutant-laden runoff.

The long-established concept of road hierarchies, which relates road size to the intensity of use, has many positive aspects beyond water-quality, among them cost reductions and aesthetic benefits. Yet Southworth and Ben-Joseph (1995), in a recent article on the history of residential street design, found that, for a variety of historical and institutional reasons, road hierarchies are often overlooked by local planners and commissions. The authors conclude that an overemphasis on traffic control has resulted in a "rigid, over-engineered approach ... deeply embedded in engineering and design practice." Simple math dictates that for a given length of subdivision road, reduction from a typical 32-foot to a 20-foot width results in a 37.5% reduction in pavement, or over 63,000 square feet (about one and one-half acres) per linear mile. The Olympia study estimated that changing the width of local access roads from 32 to 20 feet would result in an overall 6% reduction in imperviousness for a given development site in their region, that is, six acres less street pavement for a typical 100-acre subdivision (City of Olympia 1994b).

Road surface reduction is a primary reason why clustering is the most pavement-stingy residential design. Large-lot subdivisions, which have long been recognized as being antithetical to most conservation goals (Arendt 1994a, 1994b) generally create more impervious surface and greater water resource impacts than cluster-style housing. does. This is true even though the large lots may have less impervious coverage per lot, because the attenuated design requires longer roads, driveways, and sidewalks, which make the overall subdivision parcel more impervious (figure 5). Schueler (1994c) states that cluster development can reduce site imperviousness by 10-50%, depending on lot size and the road network.

In commercial and industrial zones, the focus of design-related reductions in imperviousness shifts to parking areas, the largest component of impervious cover (table 1). Research has shown oversupply of parking to be the rule. Willson (1995), citing his research and that of many others, found that the "golden rule" of 4.0 parking spaces per 1,000 square

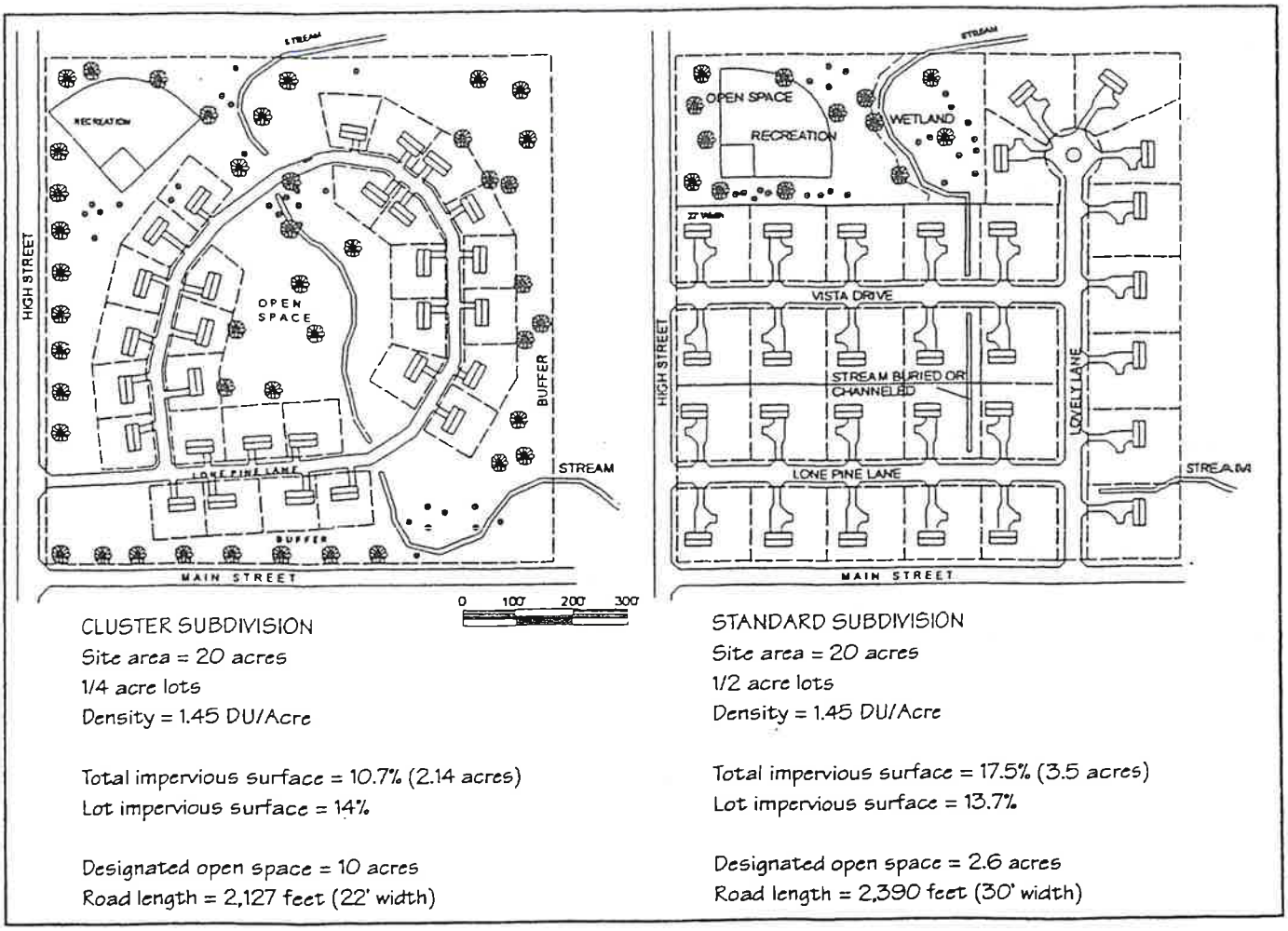


FIGURE 5. Clustering reduces overall site imperviousness.
Source: John Alexopoulos, University of Connecticut

feet of office floor space is often almost twice what is actually needed. Using a generic, medium-sized office building as a hypothetical example, he shows that a typical parking supply ratio of 3.8 results in an extra 55,000 square feet of parking lot, compared to using a more factually-based ratio of 2.5.

The City of Olympia found not only parking oversupply, with vacancy rates of 60–70%, but also developers consistently building parking above minimum ratios, with 51% more parking spaces at their 15 survey sites than were required by zoning (City of Olympia 1994c). This agrees with our observation that, at least in Connecticut, overbuilding of parking appears to be a recent trend with "big box" retail store developers, who typically require at least 5 spaces per 1,000 square feet, principally to meet peak demands on weekends and during the busy period from Thanksgiving to Christmas.

Reductions in parking-related impervious coverage can be attained in ways other than adjusting parking supply ratios. Shoup (1995) suggests that parking can be reduced through economic incentives that effectively end the subsidy provided by employer-paid parking. Employee commuter option programs, mandated by the Clean Air Act Amendments of 1990 in areas of "severe nonattainment" for ozone standards, hold some promise for reducing parking demand. The Olympia study (City of Olympia 1994d) concluded that sharing, joining, or coordinating parking facilities can reduce parking significantly. Finally, vertical garages (above or below ground) can be encouraged, although this alternative can be expensive. Many of these strategies were recently combined in an innovative office park design in Lacey, Washington, where the new 360,000-square-foot headquarters of the state Department of Ecology was designed around a "parking diet" that slashed parking spaces from 1500 to 730 (Untermann 1995).

Imperviousness also has a role in design related mitigation of polluted runoff. "Best management practices" (BMPs) is the most commonly-used term to describe the wide range of on-site options available to manage stormwater runoff. BMPs are often divided into two major types: those involving structures such as stormwater detention ponds or infiltration trenches, and "nonstructural" practices that usually involve use of vegetated areas to buffer, direct, and otherwise break up the sea of asphalt. Maintenance measures like road sand sweeping and storm drain cleaning are also included.

It is not within the scope of this article to give a thorough discussion of these practices; choosing the correct assemblage is a combination of art and science, and involves many considerations. From the standpoint of imperviousness, however, BMPs can be viewed in terms of how well they replicate the natural hydrological functioning of the site. This perspective puts a premium on restoring infiltration, which has been suggested by Ferguson (1994) and others to be highly preferable to surface detention.

Emphasizing infiltration and nonstructural solutions often comes into conflict with established development practices. Curbing is a good example. Just as Southworth and Ben-Joseph (1995) found the overengineering of road widths to be ingrained in local practice, our experience has been that to many town engineers, the necessity of curbing is a given. Safety and structural integrity of the road are often given as reasons for curbing, above and beyond its drainage function. Highway engineers in our state, however, have told us that the sole purpose of curbing is to direct stormwater, and even then, it is only truly needed during the unstable construction phase (Connecticut Department of Transportation 1995). In many cases, more pervious alternatives to directing runoff should be investigated. Grassy swales, for instance, might be constructed in the margin created when existing right-of-way widths are retained while road widths are reduced.

Mitigating the impacts of polluted runoff in the "ultra-urban" inner city environment is a particularly thorny issue. Regional approaches like the Olympia ISRS may target these areas for increased impervious cover (City of Olympia 1994a). Growth policies that encourage urban "infilling" may result in higher inner-city imperviousness in order to reduce sprawl and overall imperviousness, region-wide. In effect, this is "clustering" on a regional scale.

Nonetheless, even for these seemingly intractable areas, using imperviousness as a planning framework can be useful. Usually, this involves linking the reduction of impervious surfaces to complementary urban initiatives. Parking is one example. Excess parking can be attacked from many angles other than water quality, including air quality, traffic congestion, promotion of sprawl, and inefficient use of building lots. A parking reduction initiative could be combined with a plan to use the recouped paved area either for active stormwater treatment (infiltration basins, detention ponds) or for more modest stormwater management (vegetated strips). Such a strategy could be combined with the creation of "vest pocket" parks and other green spaces, shown by urban forestry research as having positive sociological and psychological effects on city dwellers (Gobster 1992; Schroeder and Lewis 1992).

Research on the pollutant-processing capability of various types of vegetation suggests a slight twist on parking lot design that may reap large benefits in water quality for urban areas. Parking lots often incorporate landscaped areas, usually in raised beds surrounded by asphalt curbing. However, these vegetated areas can be planted *below* the level of the parking surface, serving as infiltration and treatment areas for runoff (Bitter and Bowers 1994) (figure 6). This idea can be extended to other areas where vegetated "islands" are traditionally used, such as in the middle of cul-de-sac circles.

Another consideration for urbanized areas is pervious alternatives to pavement. This includes various mixes of asphalt with larger pore spaces (e.g., "popcorn" mix), and alternative systems such as open-framework concrete pavers filled with sand or gravel, or turf reinforced with plastic rings. These systems can become clogged with sediment, particularly during construction, but are often a suitable alternative in low traffic areas like emergency roads, driveways, and overflow parking areas. Cahill (1994) asserts that, contrary to common belief, pervious pavement can be used successfully in many places if certain siting, construction, and maintenance practices are followed; for instance, he recommends vacuum cleaning at least twice per year. Granular surfacings are being promoted by some landscape architects as attractive, inexpensive, and more aesthetically-pleasing alternatives to paved pathways and trails (Sorvig 1995).

One last important note about reducing imperviousness through planning and design–it can save money. Savings to both the private and public sectors in reduced construction and infrastructure costs can be considerable. For instance, a recent study done for the Delaware Estuary Program compared the impacts on twelve communities in the watershed, over a 25-year horizon, of a continuation of current "sprawl" development patterns versus the Program-recommended pattern of promoting mixed uses, open space, and

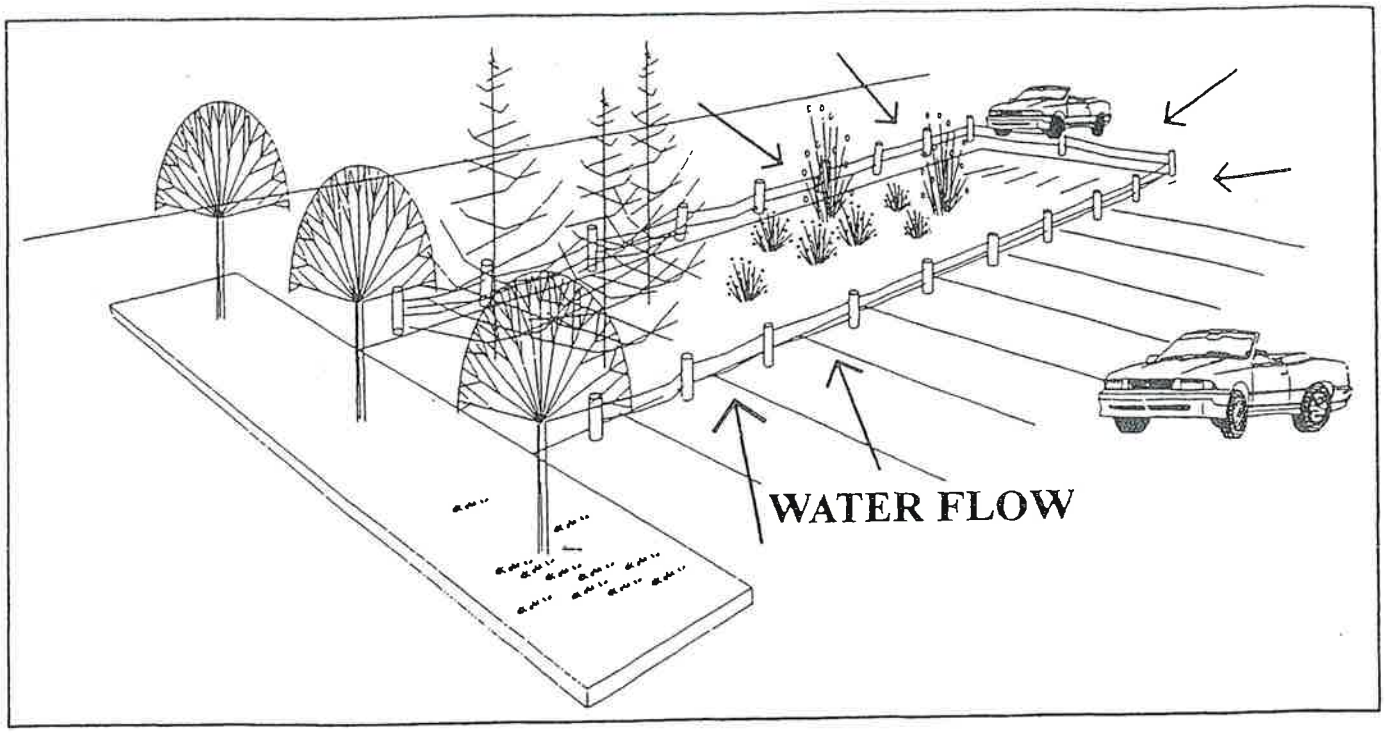


FIGURE 6. **Sunken vegetated parking lot "islands" intercept and treat runoff.**
Source: John Alexopoulos, University of Connecticut

growth around existing centers. They concluded that for these communities, the less consumptive pattern resulted in savings of $28.8 million in local road costs, $9.1 million in annual water treatment costs, $8.3 million in annual sewer treatment costs, as well as an 8.4% reduction in overall housing costs, and a 6.9% savings in annual costs of local public-sector services (Burchell, Dolphin, and Moskowitz 1995).

The Use of Imperviousness for Regulation

Planning approaches at the community and site level can be complemented with specific applications that give regulatory teeth to planning objectives. To begin with, planners can revisit their current zoning and subdivision requirements with an eye to imperviousness. For instance, many lot coverage limits, particularly for residential uses, refer to rooftops but do not include parking space, sidewalks, and driveway coverage.

Impervious cover lends itself well to zoning that uses performance standards. In fact, Kendig (1980) defines performance zoning as that which regulates development on the basis of four fundamental measures of land-use intensity, one of which is the impervious surface ratio. Jaffe (1993), in a critical assessment of performance-based zoning, concludes that "Kendig's recreational and impervious surface ratios are especially effective in achieving local environmental objectives for stormwater management and groundwater recharge." Performance zoning has the added effect of encouraging mixed uses, which generally result in less impervious coverage and less pollution, by reducing roads and vehicle traffic.

Community-wide applications encompassing large areas with varied land use will require sliding scales of impervious coverage limits that depend on the location, size, and type of use. Such standards have been in place in some Florida communities for almost a decade (American Planning Association Zoning News 1989). More recently, ordinances limiting impervious cover have been enacted in Austin and San Antonio, Texas, driven by concern about pollution of the area's major drinking water aquifer (City of Austin 1992; City of San Antonio 1995).

In instances where protection of a particularly important resource is desired, strict limits on impervious coverage may be imposed. Such is the case in Brunswick, Maine, where a "coastal protection" zone was created for areas draining to Maquoit Bay, site of shellfish beds critically important to the town. The special zone has certain stringent performance standards, among them a maximum impervious-surface lot coverage of 5%. This coverage includes ". . . buildings, roads, driveways, parking areas, patios, and other simi-

lar surfaces" (Town of Brunswick 1991). In this case, the very low impervious limit was feasible because the total area affected was fairly small, the use was largely residential, and the specific pollutant of concern was nitrogen emanating from septic systems, resulting in zoning that called for a minimum lot size of one unit per five acres. This "down-zoning" approach, which has also been used in the Buttermilk Bay area in Massachusetts (Horsley and Witten 1991), is practicable for small areas with septic-related concerns, but if applied over large areas, can lead in the long run to promotion of sprawl.

Strict limits may be appropriate, yet in practice they can result in the need for complicated exemption provisions, or even raise the specter of private property rights takings (Land Use Law and Zoning Digest 1995; Ross 1995; Settle,Washburn, and Wolfe 1995). One method for "softening" the concept of limits is to allow for flexibility on the site level. In this scenario, an ordinance setting a limit (or goal) for a site's impervious coverage would require more stringent on-site stormwater treatment when the limit is exceeded. This type of approach will undoubtedly become more common as the information base on removal efficiencies of various treatment measures expands. Another type of flexibility comes from applying performance standards to specific elements of imperviousness within the landscape. In their discussion of next steps, the Olympia study (City Of Olympia 1995) cites the development of performance-based standards for sidewalks, parking, and landscaping "to encourage innovation and provide flexibility in meeting impervious surface reduction goals."

One practical regulatory application of impervious coverage is for stormwater utility assessment, an "impact fee" that is growing in use in urban areas of the country as a way of paying for the treatment and control of polluted runoff. Impervious surface has long been a key determinant in mathematical models that predict the volume of runoff from a given piece of land. Stormwater utility assessments have taken the lead from these models in using imperviousness as a basis for a utility rate structure that fairly distributes the cost of treatment according to a property's contribution to runoff.

Such systems are now in place in many areas, including Kansas City, Missouri; Kitsap County, Washington; and throughout the state of Florida. This type of application requires a community-wide assessment of impervious coverage, and a wide range of techniques is being used. In Kansas City, rate structures are based on digitized high-resolution orthorectified aerial photos (Murphy 1995), while in Florida they are based on statistical surveys of area lots (Livingston 1995). The Kitsap County, Washington, Comprehensive Surface and Stormwater Management Program, established in 1994, creates a rate structure based on an "equivalent service unit" equal to the average estimated amount of impervious surface area on a single-family residential parcel (Kitsap County 1994).

Such programs not only raise funds for mitigation of adverse impacts, but also, by attaching a cost to imperviousness, provide an economic incentive to reduce it. Apparently, this effect is beginning to be seen in Florida, where the cost savings associated with lower stormwater utility fees have provided the impetus for reduction of impervious cover during site redevelopment (Livingston 1995).

Integrating Stormwater Control into Community Planning

The strategies described above demonstrate that for the planner, imperviousness can provide a useful framework for addressing the impacts of urbanization on water resources. But the advantage of this approach goes beyond any specific application. We have found that working with a town on water resource protection often leads to related natural resource issues like open space preservation and forest management. Our recent experience with NEMO has taught us that framing water issues largely in terms of imperviousness serves to expand the range of these connections.

Once water pollution is linked to impervious coverage and its various components, it has a way of insinuating itself into issues currently "on the table" in town. Road widths and curbing may be subjects of town debate about cost or neighborhood character. Parking and landscaping requirements for commercial zones may be undergoing reexamination for aesthetic reasons. The appropriateness of "big box" retailers may be a hot topic, with arguments centered around traffic congestion and the impact on local merchants. An open space plan may be in the formative stages, or the use of stream buffers being questioned. Citizens may be interested in naturalistic landscaping, water conservation, or volunteer monitoring of local waterways. These typical local debates, drawn from towns working with the NEMO Project, now have elements of water quality and impervious surface reduction as part of the mix. And through these debates, the subject of water quality in the community is extended beyond land-use-related staff and boards to include engineering and public works departments, land trusts and other nonprofits, and citizens.

Cross connections of this type are an important key to ensuring the implementation of any planning initiative. For the professional planner, they create

opportunities to reinforce complementary planning concepts from several different angles. Beyond the well-established concept of planning and designing with nature (McHarg 1969), there are many relatively recent themes in transportation, subdivision design, and landscape architecture that go hand-in-glove with the reduction of impervious surfaces. Performance zoning is one example. Another is neotraditional residential design, which champions styles of development patterned after the traditional New England village in order to foster a sense of community (Duany and Plater-Zyberk 1991). The open space subdivision designs promoted by Arendt (1994b) for land conservation are also a good fit. On another front, residential street layouts promoting "traffic calming" for a variety of safety, aesthetic, and sociological benefits (Hoyle 1995; Ben-Joseph 1995) could easily incorporate pavement reduction. Landscape architects are calling for more naturalistic schemes that follow the natural contours and make use of low-maintenance, drought-resistant plants (Ash 1995). Planners should seize the opportunity to "piggy-back" water quality with these complementary initiatives, making sure to explicitly incorporate the reduction of paved surfaces and their impacts into official policy, plans, and procedures.

The other advantage of the cross-cutting nature of water resource protection in general, and imperviousness specifically, is that it seems to make sense to the average citizen. Reduction of paved areas is one of relatively few planning initiatives that "plays" at all levels, from the suburban driveway to the big box parking lot, and even to the Chief Justice of the Supreme Court, who recognized the link between the growth of paved surfaces and increased runoff (in *Dolan v. City of Tigard*) (Merriam 1995).

From our standpoint as educators, this feature is critical to the success of any local planning initiative. Education of citizens and local officials on the issues is a necessary and integral part of the process of changing land-use procedures. Volunteer commissioners on local land-use boards are particularly important. In our experience, almost any narrowly-framed issue or problem (environmental or otherwise) brought before busy city, town, or county boards is already operating with two strikes against it. Few issues are isolated, yet they are frequently presented to communities as such, reflecting not the nature of community planning but that of regulatory agencies. A regional planner we work with has called this the "environmental flavor of the month" syndrome.

The result is that even legally mandated initiatives may be doomed to failure by the sheer inertia involved in integrating new and complex information into the busy world of local land-use decision-making. Framing the issue of nonpoint source pollution in terms of imperviousness, although it may be a bit simplistic, appears to be an effective way of enabling local decision-makers to grasp the issue sufficiently to take action.

Conclusion

Water pollution is getting more complex, while at the same time the responsibility for water resource protection is shifting toward local authorities. The use of impervious surface coverage as an environmental indicator can assist planners to construct a game plan to protect their community's natural resources.

Imperviousness integrates the impacts of development on water resources, so it can help to cut through much of the complexity. It is measurable, and so appropriate for a wide range of planning and regulatory applications. It is a cross-cutting feature that is a frequently hidden, but nonetheless substantial, component of many current trends in road, neighborhood, and landscape design, so it can be used as a reinforcing connection between seemingly unrelated planning initiatives. Finally, the basic tenets of reducing imperviousness—retaining the natural landscape, minimizing pavement, promoting infiltration to the soil—are simple concepts that can be understood by a community and its residents.

Impervious cover is rarely specifically identified or addressed in community goals, policies, or regulations. It should be. In this article, we have tried to facilitate the use of this indicator by (1) reviewing the scientific literature to provide a comfort level with its appropriateness; (2) creating a framework for its use in overall planning, site-level planning, and regulation; and (3) providing real-world examples of such applications. With imperviousness as a foundation, planning that begins with water resources often leads to character, design, and aesthetic issues that, taken together, define much of the overall quality of life in a community.

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End

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URBANIZATION OF AQUATIC SYSTEMS: DEGRADATION THRESHOLDS, STORMWATER DETECTION, AND THE LIMITS OF MITIGATION[1]

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ABSTRACT: Urbanization of a watershed degrades both the form and the function of the downstream aquatic system, causing changes that can occur rapidly and are very difficult to avoid or correct. A variety of physical data from lowland streams in western Washington displays the onset of readily observable aquatic-system degradation at a remarkably consistent level of development, typically about ten percent effective impervious area in a watershed. Even lower levels of urban development cause significant degradation in sensitive water bodies and a reduced, but less well quantified, level of function throughout the system as a whole. Unfortunately, established methods of mitigating the downstream impacts of urban development may have only limited effectiveness. Using continuous hydrologic modeling we have evaluated detention ponds designed by conventional event methodologies, and our findings demonstrate serious deficiencies in actual pond performance when compared to their design goals. Even with best efforts at mitigation, the sheer magnitude of development activities falling below a level of regulatory concern suggests that increased resource loss will invariably accompany development of a watershed. Without a better understanding of the critical processes that lead to degradation, some downstream aquatic-system damage is probably inevitable without limiting the extent of watershed development itself.

(KEY TERMS: stormwater management; urban hydrology; hydrograph analysis and modeling.)

INTRODUCTION

Urban development imposes a variety of watershed changes that profoundly affect runoff processes and the downstream surface-water aquatic system. Attention is generally given to channel changes: the stream channel itself is the object of interest and also, typically, the focus of any subsequent restoration or rehabilitation efforts. Yet that stream channel, commonly draining up to many square kilometers, is largely a product of its upland watershed. The net effect of upland changes, occurring across the land surface of the contributing headwater catchments, is at least as important in determining overall stream function, degradation, and rehabilitation potential (National Research Council, 1992). To understand the potentially degrading effects of urban development and the potential for mitigation, both areas – upland and riparian – must be considered in turn.

Our approach to this problem draws on both field data and hydrologic simulation results from a variety of lowland watersheds in King County, Washington (Figure 1, Table 1). We have relied on field data to display overall trends in stream-channel changes; hydrologic simulations have been no less invaluable to improve our understanding of the likely physical processes that underlie those observed changes. Although an analysis of urban-induced channel changes would be complete without any discussion of mitigation, we have elected to include here an investigation into the most common of mitigation efforts, stormwater detention. Stormwater detention is a particularly widespread application that promises substantive improvements, but all-too-often it fails to achieve even the most limited of objectives.

Development-Induced Upland Changes – Runoff and Sediment Processes

Modifications of the land surface during urbanization produce changes in both the type and the magnitude of runoff processes. These changes result from vegetation clearing, soil compaction, ditching and

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draining, and finally covering the land surface with impervious roofs and roads. The infiltration capacity of these covered areas is lowered to zero, and much of the remaining soil-covered area is trampled to a near-impervious state. Compacted, stripped, or paved-over soil also has lower storage volumes, and so even if precipitation can infiltrate, the soil reaches surface saturation more rapidly and more frequently. Thus *Horton overland flow* or *saturation overland flow* (Dunne and Leopold, 1978) is introduced into areas that formerly may have generated runoff only by subsurface flow processes, particularly in humid areas of generally low-intensity rainfall such as the Pacific Northwest.

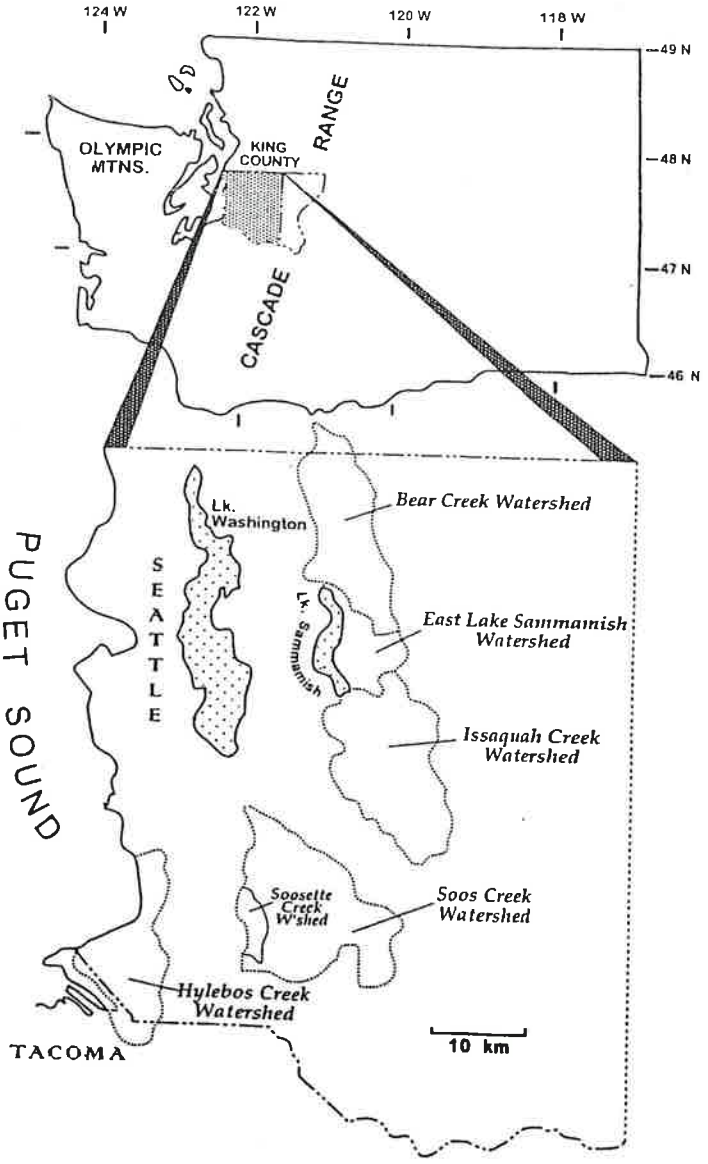


Figure 1. Map of watersheds used as sources of field data and in analyses. Physical and simulation characteristics are summarized in Table 1.

Besides changing the hydrologic flow regime, urbanization affects other elements of the drainage system. Gutters, drains, and storm sewers are laid in the urbanized area to convey runoff rapidly to stream channels. Natural channels are often straightened, deepened, or lined with concrete to make them hydraulically smoother. Each of these changes increases the efficiency of the channel, transmitting the flood wave downstream faster and with less retardation by the channel. In total, direct measurements and hydrologic simulation models demonstrate several related consequences: for any given intensity and duration of rainfall the peak discharge is greater (by factors of 2 to 5; Hollis, 1975), the duration of any given flow magnitude is longer (by factors of 5 to 10; Barker *et al.*, 1991), and the frequency with which sediment-transporting and habitat-disturbing flows move down the channel network is increased dramatically (by factors of 10 or more; Booth, 1991; Booth and Fuerstenberg, 1994) (Figure 2).

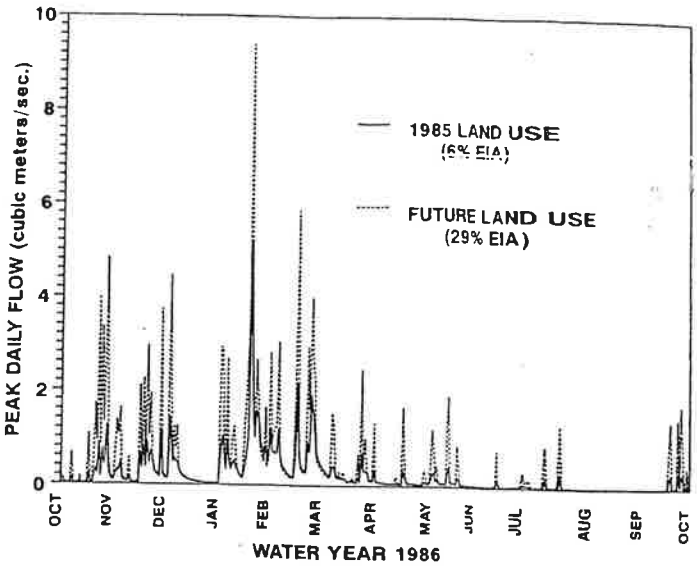


Figure 2. One year of simulated streamflow from a 14.2-km^2 watershed (Soosette Creek), under identical rainfall but differing land uses, using the continuous numerical model HSPF (USEPA, 1984). Parameters characterize the present-day (1985) land cover [6 percent effective impervious area (EIA), the impervious surfaces with direct hydraulic connection to the stream system] and projected future land cover (29 percent EIA).

Changes in upland runoff processes, particularly from a predominantly *subsurface* flow regime to a predominantly *surface* flow regime, alter not only the magnitude of discharges but also the delivery of sediment to the stream network. With overland flow, fine sediment is moved into channels throughout the year; when coupled with land-cover changes, the sediment

TABLE 1. Physical Characteristics of Watersheds Used as Data Sources and in Analyses.

Watershed Name	Soos	Bear	Hylebos	East Lake Sammamish	Issaquah
Reference	King County, 1990a	King County, 1989	King County, 1990b	King County, 1990c	King County, 1991
Size	181 km^2	132 km^2	93 km^2	38 km^2	158 km^2
Range of Watershed Elevations	305 m - 25 m	185 m - 9 m	158 m - 0 m	168 m - 10 m	905 m - 10 m
Average Annual Rainfall	1190 mm	1100 mm	1040 mm	1220 mm	1450 mm
Number of HSPF-Modeled Subcatchments	57	66	61	22	65
Subcatchment Size – Average and Range	3.18 km^2 (avg.) 1.53-10.62 km^2 (range)	2.00 km^2 (avg.) 0.56-8.65 km^2 (range)	1.52 km^2 (avg.) 0.21-2.36 km^2 (range)	1.73 km^2 (avg.) 0.33-4.86 km^2 (range)	2.43 km^2 (avg.) 0.31-6.97 km^2 (range)
Watershed Impervious Area (EIA)	49%	3.0%	20.0% (median of 8 independent subwatersheds)	5.0% (median of 3 independent subwatersheds)	1.4%
Impervious Areas (EIA) – Range by Subcatchments	0.7-23.1%	0.0-12%	0.2-54%	0.0-13.1%	0.0-18.3%
Forest Cover	69%	76%	27% (median of 8 subwatersheds	60% (median of 3 subwatersheds	78%
Forest Cover – Range by Subcatchments	35.3-88.8%	41-100%	0.1-100%	29.0-68.4%	25.6-100%
Unit-Area Discharges (2-year) – at Watershed Outlet, and Range Within Subcatchments	0.13 $m^3/sec/km^2$ (at outlet; = 12.1 cfs/mi^2) 0.08-0.41 $m^3/sec/km^2$ (range)	0.14 $m^3/sec/km^2$ (at outlet; = 12.4 cfs/mi^2) 0.09-0.42 $m^3/sec/km^2$ (range)	0.60 $m^3/sec/km^2$ (median of 8 independent subwatersheds at outlets; = 55.0 cfs/mi^2) 0.01-0.98 $m^3/sec/km^2$ (range)	0.19 $m^3/sec/km^2$ (median of 3 independent subwatersheds at outlets; = 51.2 cfs/mi^2) 0.02-0.56 $m^3/sec/km^2$ (range)	0.32 $m^3/sec/km^2$ (at outlet; = 28.9 cfs/mi^2) 0.10-0.66 $m^3/sec/km^2$ (range)
Unit-Area Discharges (100-year) – Outlet, and Range	0.28 $m^3/sec/km^2$ (at outlet; = 25.9 cfs/mi^2) 0.13-0.97 $m^3/sec/km^2$ (range)	0.31 $m^3/sec/km^2$ (at outlet; = 15.2 cfs/mi^2) 0.17-0.80 $m^3/sec/km^2$ (range)	1.20 $m^3/sec/km^2$ (median, at outlets; = 110 cfs/mi^2) 0.03-1.94 $m^3/sec/km^2$ (range)	0.41 $m^3/sec/km^2$ (median, at outlets; =37.2 cfs/mi^2 0.06-1.20 $m^3/sec/km^2$ (range)	0.79 $m^3/sec/km^2$ (at outlet; = 72.5 cfs/mi^2) [range data not available]

load can increase by many orders of magnitude (Wolman and Schick, 1967) and the predominant grain-size distribution can shift to much finer fractions. Such increases in the delivery of fine sediments significantly alters the sediment size distribution of gravel bed streams (e.g., Carling, 1984; Jobson and Carey, 1989), with attendant changes in stream ecology (recognized as early as Ellis, 1936; also Hawkins *et al.*, 1982; Culp *et al.*, 1986; Chapman, 1988; Naiman *et al.*, 1992; Weaver and Garman, 1994).

Development-Induced Riparian Changes

Urban development not only increases rates of water and sediment delivery but also encroaches on the riparian corridor. From clearing of streamside vegetation, less wood enters the channel, depriving the stream of stabilizing elements that help dissipate flow energy and usually (although not always) help protect the bed and banks from erosion (Booth *et al.*, 1996). Deep-rooted bank vegetation is replaced, if at all, by shallow-rooted grasses or ornamental plants that provide little resistance to channel widening (Booth and Jackson, 1994). Furthermore, the overhead canopy of a stream is lost, eliminating the shade that controls temperature and supplies leaf litter that enters the aquatic food chain.

Channel Response to Development-Induced Watershed Changes

As a result of these factors, channel widths and depths increase throughout urban areas (Hammer, 1972; Leopold, 1973) and heterogeneous channel morphology becomes more simplified and uniform. Most commonly, channels expand gradually in response to progressive increases in the flow regime (Figure 3). However, they can also experience rapid and nearly uncontrolled incision of the stream bed, usually in response to an increase in the flow rate combined with specific combinations of gradient, substrate, and reduced in-channel vegetation (Heede, 1985; Booth, 1990).

At the end of this causal chain of upland, riparian, and channel changes lies the degradation of in-stream biological function that so often motivates rehabilitation efforts (Karr, 1996). In the Pacific Northwest, many of these efforts are focused on enhancing populations of anadromous salmon in lowland streams. These fish depend on a particular combination of water and sediment fluxes to maintain favorable channel conditions. Because land-use change in a watershed alters those fluxes, the resulting flow regime and channel configuration no longer tend to favor salmonids (Booth and Fuerstenberg, 1994), and thus most rehabilitation efforts that address only the in-stream symptoms of these watershed changes are unlikely to succeed (Roper *et al.*, 1997). This study addresses only the flow-related consequences of upland watershed changes, and so it does not offer a comprehensive analysis of, or solution to, the loss of salmonids in urban streams of the Pacific Northwest. However, the work has been motivated in large measure by these concerns, and it demonstrates the tremendous ecological significance of those upland changes occurring in the urban environment.

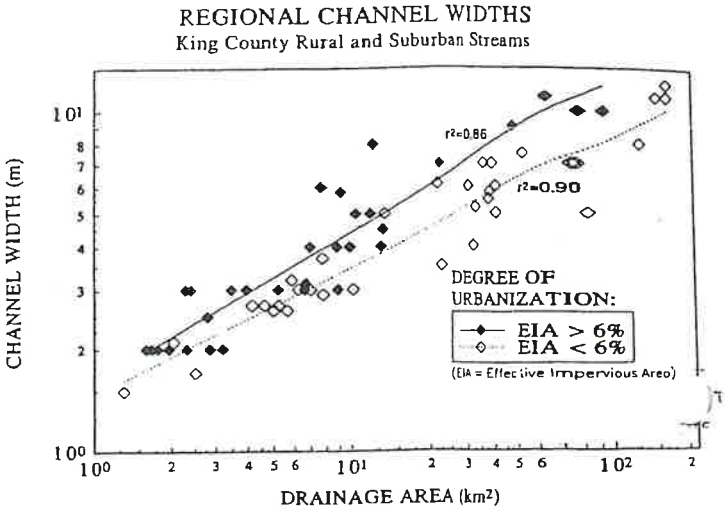


Figure 3. Channel widths as a function of contributing drainage area, measured by the senior author using the methods for bankfull channel identification in Williams (1978). Regression lines plotted for each data set independently.

THE RELATIONSHIP BETWEEN URBANIZATION AND AQUATIC-SYSTEM DEGRADATION

Study Approach

With this conceptual model of altered watershed processes as our context, we wish to better characterize the magnitude of urban development and to identify any consistent trends or thresholds of aquatic-system degradation associated with that development. Our approach has been to collect data rapidly from a large number and wide variety of urbanizing watersheds, acknowledging the extreme variability in our sample population but anticipating that the overriding influence of urban development will impose consistent trends in our measurements. Two types of

data are required: those that characterize the *magnitude* of urban development, and those that characterize the *effects* of urban development.

Characterizing the Magnitude of Urban Development

Rationale. There is great appeal to identifying a single "index" variable that characterizes the magnitude of urban development in a watershed. Patterns can be readily displayed, correlations are simplified, and communication between scientists and planners is enhanced. Yet urban development comes in many styles, occurs on many different types of landscapes, and is accompanied by a variety of mitigation measures designed to reduce its negative consequences on downstream watercourses. So any simple correlation between urbanization and aquatic-system condition appears unlikely, and it is with this expectation that many of the data reported below were first collected.

TIA and EIA. Past efforts to quantify the degree of urban development have not been consistent. Recent and historical use of the most widely accepted parameter, percent impervious area in the contributing watershed, has been carefully documented in a recent review article (Schueler, 1995) but several issues remain ambiguous. Most significant of these is the distinction between ***total*** impervious area (TIA) and ***effective*** impervious area (EIA). TIA is the "intuitive" definition of imperviousness: that fraction of the watershed covered by constructed, non-infiltrating surfaces such as concrete, asphalt, and buildings. Hydrologically this definition is incomplete for two reasons. First, it ignores nominally "pervious" surfaces that are sufficiently compacted or otherwise so low in permeability that the rate of runoff from them are similar or indistinguishable from pavement. For example, Wigmosta *et al.* (1994) found that the impervious unit-area runoff was only 20 percent greater than that from pervious areas, primarily thin sodded lawns over glacial till, in a western Washington residential subdivision. Clearly, this hydrologic contribution cannot be ignored entirely.

The second limitation of TIA is that it includes some paved surfaces that may contribute nothing to the storm-runoff response of the downstream channel. A gazebo in the middle of parkland, for example, probably will impose no hydrologic changes into the catchment except a very localized elevation of soil moisture at the edge of its roof. Less obvious, but still relevant, will be the different downstream consequences of rooftops that drain alternatively into a piped storm-drain system with direct discharge into a natural stream or onto splashblocks that disperse the runoff onto the garden or lawn at each corner of the building.

The first of these TIA limitations, the production of significant runoff from nominally pervious surfaces, is typically ignored in the characterization of urban development. The reason for such an approach lies in the difficulty in identifying such areas and estimating their contribution, although site-specific studies demonstrate that these tasks can be accomplished with simple field methods and the resulting hydrologic insights are often valuable (Burges *et al.*, 1989). Furthermore, the degree to which pervious areas shed water as overland flow should be related, albeit imperfectly, with the amount of *impervious* area: where construction and development is more intense and covers progressively greater fractions of the watershed, the more likely that the intervening green spaces have been stripped and compacted during construction and only imperfectly rehabilitated for their hydrologic functions during subsequent "landscaping."

The second of these TIA limitations, inclusion of non-contributing impervious areas, is formally addressed through the concept of *effective impervious areas* (EIA), defined as the impervious surfaces with direct hydraulic connection to the downstream drainage (or stream) system. Thus any part of the TIA that drains onto pervious (i.e., "green") ground is excluded from the measurement of EIA. This parameter, at least conceptually, captures the hydrologic significance of imperviousness. EIA is the parameter normally used to characterize urban development in hydrologic models.

Yet the direct measurement of EIA is complicated. Studies designed specifically to quantify this parameter must make direct, independent measurements of both TIA and EIA (Alley and Veenhuis, 1983; Laenen, 1983; Prysch and Ebbert, 1986). The results can then be generalized either as either a correlation between the two parameters or as a "typical" value for a given land use. For example, Alley and Veenhuis (1983) found that $[EIA] = 0.15\ [TIA]^{1.41}$ in their highly urbanized watersheds in Denver, Colorado ($r^2 = 0.98$). Using the alternative approach, Dinicola (1989) compiled the findings of these earlier studies to recommend a single set of impervious-area values based on five land-use categories for use in studies of western Washington watersheds (Table 2). These values are the basis for the impervious-area assignments for our present study as well.

Characterizing the Effects of Urban Development

Previous Studies. Correlations between development and aquatic-system conditions have been

TABLE 2. Presumed Relationship Between Imperviousness and Land Use (from Dinicola, 1989).

Land Use	TIA (percent)	EIA (percent)
Low Density Residential (1 unit per 2-5 acres)	10	4
Medium Density Residential (1 unit per acre)	20	10
"Suburban" Density (4 units per acre)	35	24
High Density (multi-family or 8+ units per acre)	60	48
Commercial and Industrial	90	86

investigated for nearly two decades with remarkably consistent results. Klein (1979) published the first such study, where he reported a rapid decline in biotic diversity where watershed imperviousness much exceeded 10 percent. A variety of more recent studies, mainly unpublished but covering a large number of study methods and researchers, has been compiled by Schueler (1995). Two aspects of his exhaustive compendium, however, limit the ability to draw overly precise conclusions:

1. The geographic scope of this body of work is largely restricted to streams of the mid-Atlantic seaboard and Pacific Northwest. A few reports from other humid regions are included, and they do not suggest radical differences. However, arid and semi-arid regions are entirely unrepresented by this set of studies

2. The definition and determination of "imperviousness," by far the most common characterization of urban development in use, is not well described in most of the studies (including the preliminary report of this study – Booth and Jackson, 1994). Commonly, not even the use of TIA or EIA is specified, nor is the measurement method used (e.g., direct measurement from aerial photographs, interpretation of LANDSAT imagery, or characteristic values assigned to different land uses). In the typical range of imperviousness for which "degradation thresholds" have been investigated, this uncertainty in the choice of imperviousness measure introduces a potential factor-of-two error (Table 2) in comparing the results of one study with another.

Flow Increases. The data sets in our current investigation focus on measures of flow quantity, channel size, and condition of the riparian corridor. They were collected during a series of watershed assessments in the east-central Puget Lowland and are compiled in a series of associated planning documents (see Table 1). The absence of chemical measurements reflects our judgment of the voluminous, but inconclusive, body of water-quality data that shows only poor correlation between development intensity and water quality across the range of (mainly suburban) land uses that we are investigating (Horner *et al.*, 1996). In contrast, the dramatic evidence of physical degradation that is so readily seen in these watersheds (Booth, 1991) suggests the overriding significance of urban-induced flow increases, characterized by both peak discharges and the aggregate duration of sediment-transporting events.

To identify rapidly the potential effects of flow increases in field observations, we discriminate between ***stable*** channels, with little or no erosion of their bed and banks, and ***unstable*** channels, which display long continuous reaches with bare and destabilized banks indicative of severe downcutting and widening (Galli, 1996). To quantify the increase in flows imposed by urbanization, we have used the output of a continuous hydrologic model (Hydrologic Simulation Program-FORTRAN [HSPF]; USEPA, 1984) to simulate discharges in a variety of local watersheds under identical rainfall regimes but differing land uses. We have indexed the magnitude of modeled flow changes in terms of the *post*development frequency of the discharge that had a *pre*development (i.e., forested) recurrence of 10 years ($Q_{10\text{-}for}$). Note, however, that other measures of hydrologic change would produce a similar result; there is nothing unique about this particular index discharge.

Model simulations on the watersheds of Figure 1, matched with corresponding field observations, are summarized by Figure 4. This plot discriminates the degree of observed channel stability at each station (indicated by the "X"s and "O"s of Figure 4), and it positions each observation with respect to the contributing watershed's EIA (horizontal axis) and the now-increased frequency of $Q_{10\text{-}for}$ under current urbanized conditions (vertical axis). The simulations assumed no on-site detention of stormwater runoff under current conditions, because almost no development in this region had yet been constructed with hydrologically significant detention volumes when these observations were made (1988-1992). The forested land-use simulations assumed a [illegible] regime and channel network identical to the present, focusing solely on the land-use changes from pre- to post-development conditions.

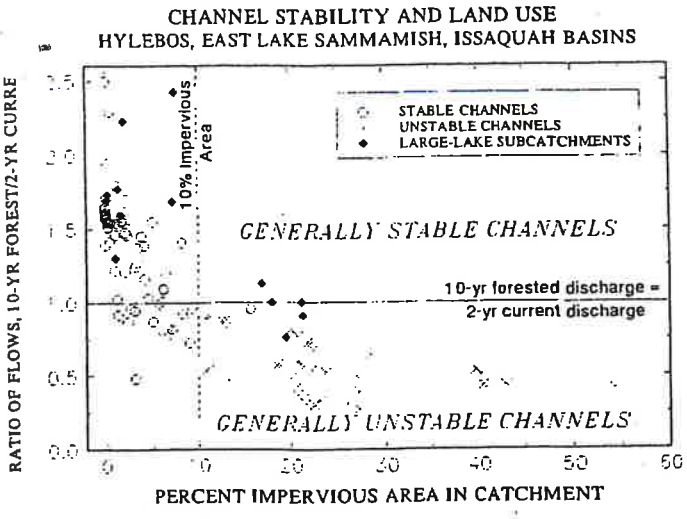


Figure 4. Observed stable ("O") and unstable ("X") channels, plotted by percent effective impervious area (EIA) in the upstream watershed (horizontal scale) and ratio of modeled 10-year forested and two-year current (i.e. urbanized) discharges (vertical scale). Apparent thresholds relating channel stability with either 10 percent EIA or $Q_{2\text{-cur}} = Q_{10\text{-for}}$ are consistently met except for the few catchments containing large lakes.

A surprisingly good correlation emerges between observed channel stability and watershed urbanization, be it characterized by percent effective impervious area or by the magnitude of simulated flow increases. The observations here show that observed instability is all-but ubiquitous where the contributing effective impervious area percentage exceeds a rather low level: a value of about 10 percent (dashed vertical line in Figure 4) discriminates between observed stable and unstable reaches almost perfectly. The magnitude of simulated hydrologic change also discriminates between these observations: in any basin where the discharge equal to $Q_{10\text{-for}}$ now has a recurrence of two years or less (shown by the solid horizontal line in Figure 4), instability is assured. We see anomalously low flow increases with increasing EIA only where large lakes (surface area equals or exceeds 10 percent of the watershed area) are present upstream of the observation point. We emphasize that the good relationship between "instability" and "imperviousness" is not a simple causal relationship, because we recognize that EIA is but an *index* of the variety of hydrologic changes imposed by urban development. However, it is clearly a robust and easily estimated relationship.

Integrated Effects of Urban Development. Urbanization yields not only measurable changes in specific elements of aquatic systems but also a decline in the overall function of those systems. This fact is evident to any resident of such a watershed; similarly intuitive is the observation that degradation increases as development progresses. To understand the range of such effects we have made more complete surveys of the physical habitat along 140 km of stream channel in two of the King County watersheds (Figure 1), classifying each reach as excellent, fair, or poor, defined on the basis of not only channel stability but also pool:riffle ratio, channel roughness and diversity, and observed fish use. The effective impervious-area percentage of the watershed above each channel reach was measured, with EIAs ranging from 2 to 50 percent in watersheds ranging from 2 to 110 km^2. As with all of our data, significant on-site detention is absent in these watersheds. The level of degradation changes markedly at about 8-10 percent EIA (Figure 5), except a few sites with areas of significant upstream impoundments. A similar relations between habitat quality and effective impervious area has also been seen in wetlands of this region (Booth and Reinelt, 1993).

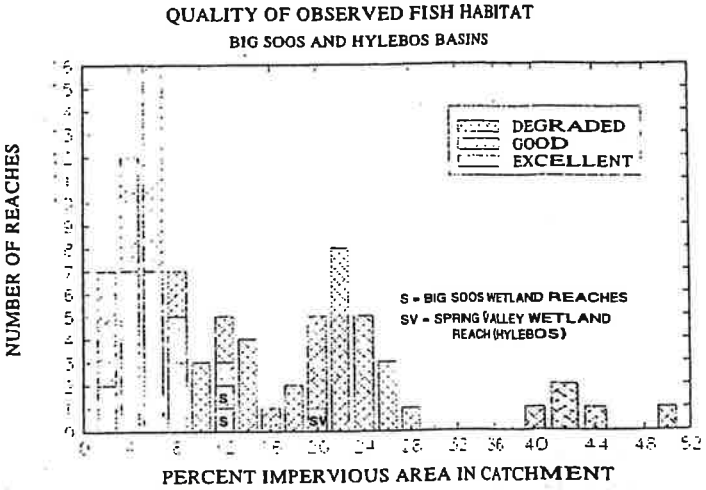


Figure 5. Observed fish-habitat quality as a function of effective impervious area in the contributing watershed, based on more than 80 individually inventoried channel segments in south King County (Figure 1). "EXCELLENT" reaches show little or no habitat degradation; "GOOD" reaches show some damage to habitat but still maintain good biological function; and "DEGRADED" reaches contain aquatic habitat that has been clearly and extensively damaged, typically from bank erosion, channel incision, and sedimentation. Three identified reaches with large wetland-to-watershed-area ratios disturb an otherwise consistent pattern of degradation across the gradient of urban development.

At very low levels of watershed urbanization, individual differences between watersheds produce greater variability in relative habitat quality. Patterns become evident only through more detailed evaluations of stream reaches, using not only physical but also biological criteria, which have been

conducted through the watershed plans that now cover over 750 km^2 in the lightly (but rapidly) urbanizing areas of the region (Figure 1; e.g., King County, 1990a, 1992, 1993). Each such plan has identified "Regionally Significant Resource Areas" (RSRAs), where the aquatic system is observed to function at a very high level "by virtue of exceptional species and habitat diversity and abundance, when compared to aquatic and terrestrial systems of similar size and structure elsewhere in the region" (King County, 1993). Across the region, 12 such RSRA stream reaches or subbasins have been identified out of a potential population of several hundred. With one exception, located in a uniquely infiltrative subbasin with extremely permeable soils, none are found where the contributing EIA exceeds 3.6 percent. Indeed, the three RSRAs with the greatest contributing impervious area are in basins with unusually widespread and rapid infiltration. *Every other* RSRA has 3 percent or less EIA in its watershed.

Conclusions: Urbanization and Aquatic-System Degradation

These results show remarkably clear and consistent trends in aquatic-system degradation. In western Washington, and likely in other humid regions as well, approximately 10 percent effective impervious area in a watershed typically yields demonstrable, and probably irreversible, loss of aquatic-system function. Even lower levels of urban development cause significant degradation in sensitive water bodies and a reduced, but less well quantified, degree of loss throughout the system as a whole. These results do not indicate a "threshold" per se: degradation begins at very low levels of urban development and continues well beyond the range of imperviousness emphasized in this study. But we find a noteworthy accumulation of physical and biological effects, particularly those that can be consistently observed and measured by even rather crude (but also rapid and so inexpensive) methods, once EIAs reach about 10 percent. The *changes* imposed on the natural system are a continuum, and so defining a strict "threshold" in this context would be naive; but our *perception of* and our *tolerance for* those changes appears to undergo a far more abrupt transition, one which suggests a basis for discrete levels of both impact evaluation and management response.

ON-SITE DETENTION AS MITIGATION FOR URBAN DEVELOPMENT

Design Issues

The value of storing stormwater runoff in large water bodies has been recognized for decades (Dunne and Leopold, 1978; Whipple, 1979) and is in widespread practice nationwide. In general, all such impoundments function similarly: water is collected from developed areas and is released by infiltration (retention facilities) or surface discharge (detention facilities) at a slower rate than it enters; the excess of inflow over outflow is temporarily stored in a pond or vault. In principle, adequate performance of these "R/D ponds" might change the level of or even eliminate the impervious-area thresholds that produce recognizable aquatic-system degradation.

The *actual* performance of R/D ponds, however, depends on the answer to two questions. The first is one of design ***policy***: how completely do we want the facility to mimic predevelopment runoff conditions? The second is one of design ***analysis***: how accurately does our hydrologic model predict true performance, so that the constructed facility actually achieves the intended management policy?

Policy: Design Performance. R/D ponds can achieve either of two levels of design performance, depending on the desired balance between achieving downstream protection and the cost of that protection. A ***peak standard***, the classic (and least costly) goal of R/D facilities, seeks to maintain postdevelopment *peak* discharges at their predevelopment levels. Even if this goal is achieved successfully, however, the aggregate duration that such flows occupy the channel must increase because the overall volume of runoff is greater.

In contrast, a ***duration standard*** seeks to maintain the postdevelopment duration of all sediment-transporting discharges at predevelopment levels. Duration standards are motivated by a desire to avoid potential disruption to the conveying channel itself by not allowing increased sediment transport. Without infiltration of runoff, however, the total volume of runoff increases in the postdevelopment condition, and so durations cannot be matched for all dischargesóat some level the "excess" water must be released. This is accomplished by determining a threshold discharge below which sediment transport in the receiving channel does not occur. This determination can be made by site-specific, but rather expensive, analysis based on stream hydraulics and sediment size (Buffington and Montgomery, 1997) or can be applied as a "generic" standard based on pre-

development discharges. Differences between stream nels ensure that no single threshold can possibly work equally well on all channels; nevertheless, a single criterion has substantial advantages in ease of analysis and implementation. A presumed threshold discharge of about one-half of the 2-year flow ($Q_{pre-2}/2$), at least for gravel-bed streams, appears to have reasonable substantiation in the scientific literature (e.g., Pickup and Warner, 1976; Andrews, 1984; Carling, 1988; Sidle, 1988).

Faced with determining the threshold discharge for sediment transport by using either (1) a site-specific method that will likely prove somewhat ambiguous and cumbersome to use; or (2) a rapid, universally applicable method that almost certainly generates incorrect results in a fraction of circumstances, the choice of method may not appear obvious. However, public regulations are replete with examples of uniform (and predictable) standards that may be inappropriate in a minority of cases, because the benefits of such a uniform approach are judged to outweigh the disadvantages. That approach is recommended for this issue as well.

Analysis: Choice of Model. Having determined a design standard, a particular hydrologic model must be used during the design analysis. The choice is critical, because model predictions of pre- and post-development runoff determine the size and configuration of the detention facility. Use of a 24-hour Soil Conservation Service (SCS) Curve-Number method, typically the Santa Barbara Urban Hydrograph method, or SBUH, has been standard practice across much of the Pacific Northwest since 1990 despite its poor correlation between assigned and calibrated curve numbers (Hawkins, 1984) and the inability of any event-based model to predict accurately a continuous process such as runoff (Barker *et al.*, 1991). Alternatives to the SCS method have produced promising results, particularly the King County Runoff Time Series program (KCRTS; King County, 1995). It is a relatively simple hydrologic analysis tool with nearly all of the accuracy and versatility of the continuous rainfall/runoff model, Hydrologic Simulation Program-FORTRAN (HSPF), on which it is based. KCRTS provides the user with a database (the runoff files) of unit-area runoff rates pre-simulated using HSPF for a range of land cover and soil conditions, and for different precipitation regions. Hydrograph analysis and design of detention facilities is then accomplished by directly manipulating the runoff-file and land-cover data with the supporting interface software.

Characterizing Pond Volumes. The volume of a detention pond is its single most important design characteristic. From a hydrologic perspective, that volume determines the time-integrated difference between inflow and outflow and so imposes an absolute limit on net hydrologic performance. It is also the single most expensive element of pond design and construction, because pond volume is directly related to pond area and thus cost, incurred in both construction and lost developable land. Once a development is complete, pond volume is also the most inflexible parameter. Orifices may be resized with only trivial effort, but the total pond area or the maximum depth of live storage generally cannot be changed without tremendous expense.

To facilitate comparisons, all detention-pond designs here are expressed in terms of a live-storage volume per unit area of developed land draining to the facility. This normalized measure of volume is thus, paradoxically, in units of *depth* and is equal to the volume of the pond as though it were evenly spread out over the area of the development. Typical unit-area volumes are expressed in cm-hectares per hectare (metric) or inch-acres per acre (English), and so the simplified units are simply "centimeters" or "inches" of net pond volume.

Performance of Ponds

Peak Standards. HSPF simulation of runoff originating from an SCS-designed detention pond was analyzed by Barker *et al.* (1991). Ponds were initially designed using SBUH to match pre- and post-development two- and ten-year peak discharges (a "2-10 standard"). Where the simulated land-use conversion was from forest land cover to urban land use, performance within the design range (i.e., up to the ten-year event) was near-perfect: in other words, pre- and post-development peak discharges for any given recurrence within this frequency range were equivalent. The volume of these ponds, a rough surrogate for facility cost, can be as much as 4 cm (i.e., 4 cm-hectares of volume per hectare of developed land). Where the land-use conversion was from *grassland* to urban uses, however, even ten-year flows discharged from the SCS ponds increased up to three-fold. Beyond the design range of discharges both land-cover conversions result in more extreme postdevelopment flooding; in particular, the predevelopment $Q_{100\text{-yr}}$ discharge for a grass-to-urban conversion recurs about 10 times as often. Even this relatively poor performance is an historic improvement; ponds constructed prior to 1990 using a design based on the rational method (Yrjanainen and Warren, 1973) typically provided one-quarter or less of this volume.

Using KCRTS for pond design, performance is uniform and successful across all types of land conversion following development. Indeed, because of a 20

percent safety factor added to the volume of all pond designs by this program, KCRTS ponds designed under the "2-10 standard" actually match postdevelopment and predevelopment peak discharges up to the *100*-year events. To achieve this performance, however, requires pond volumes as much as 50 percent greater than under the SCS design.

Duration Standards. Matching pre- and postdevelopment flow durations is a far more challenging task than simply matching flow peaks, because the total *volume* of runoff arising from a given storm is greater and so must be released or disposed of in some fashion. We have considered two modeling approaches for attaining this enhanced performance in the absence of infiltration: using an apparent "overperformance" of the SCS 24-hour method (Table 3), or using KCRTS with this performance as an explicit goal. In either case, any R/D design that meets a flow-duration standard will easily meet a peak standard as well.

TABLE 3. Design Standard for Use with SCS Curve Number Method to Control Postdevelopment Runoff Durations ("Overperformance").

Postdevelopment Recurrence	Target Postdevelopment Discharge
2 year	0.5 x $Q_{predevelopment\ 2\text{-}yr}$
10 year	$Q_{predevelopment\ 2\text{-}year}$
100 year	$Q_{predevelopment\ 10\text{-}year}$

A detailed comparison of duration-control ponds designed with these two models is instructive, using the 14.2-km^2 Soosette Creek watershed (Figure 1). The watershed's land use, currently 25 percent suburban, 25 percent grassland, and 50 percent forest, is typical of conditions across the region. About 6 percent of the basin is covered by effective impervious area. HSPF simulations, which provide the "truest" picture of detention-pond performance, were generated by a model calibrated to this basin using two years of gauged rainfall-runoff data (King County, 1990a; see Figure 2 for sample simulation outputs from this watershed).

Pond performance depends strongly on the predevelopment vegetation cover. Conversion of the 50 percent forested land in the watershed results in little dependence on modeling method; ponds associated with such development meet their stated goals (i.e., matching of flow durations) regardless of which model is used for design. Pond volumes may be as much as 14 cm, depending on the details of the local soil and topography. Conversion of the 25 percent grassed areas, however, results in substantial difference between design methods. The "overperformance" SCS ponds result in extended postdevelopment flow durations, with discharges greater than $Q_{pre\text{-}2}$ occurring 15 to 40 percent more often than they did prior to this (limited) development. In contrast, the KCRTS ponds achieve durations that are less than or equal to the predevelopment durations for all discharges above one-half of the 2 year flow ($Q_{pre\text{-}2}/2$).

Describing the physical *consequences* of flow-duration changes is a vexing, but critical, task. Management decisions involving high-cost facilities will not be made on the basis of fractional flow-duration increases but on anticipated, tangible changes in downstream channels. We have estimated these consequences by comparison to other actual basins in the region where stream-channel conditions can be readily observed. The magnitude of flow-duration increase seen in the SCS-pond grassland simulation, i.e., 25 percent of the watershed area converted with a resultant 15-40 percent increase in flow durations, is of a magnitude seen once development achieves 1.7 to 4.6 percent effective impervious area in a watershed, based on calibrated HSPF simulation of such land-use conversions region-wide. Thus for a watershed that began as half forested and half grassland, for example, total urban development under an SCS-ba. "duration-control" standard would *in fact* allow duration increases about double to those seen in the Soosette example, and so similar to those already experienced by a watershed that now has approximately three to nine percent *undetained* EIA. Referring to our previous discussion, this level of equivalent watershed imperviousness is associated, at minimum, with loss of the highest degree of resource value and aquatic-system function in virtually any catchment in which it is applied. If yet more than 50 percent of the watershed is in grass cover prior to development the equivalent impervious-area increase will likely exceed 10 percent, ensuring substantial channel instability and the near-complete loss of significant aquatic resources despite a highly restrictive detention design.

CONCLUSION: MITIGATION USING ON-SITE DETENTION

These results demonstrate fundamental elements of urban runoff mitigation. From the standpoint of *peak discharge*, even relatively modest detention umes can achieve notable (though commonly imper fect) flow reductions, reducing the consequences of a given impervious-area increase on flow maxima by

two-thirds or more. Reducing *flow durations*, in contrast, not only reduces or entirely solves downstream conveyance problems but also helps control development-induced channel erosion (Figure 6). This improved performance, however, comes with a cost, because the necessary detention volumes are dramatically larger. It also requires the use of an adequate hydrologic model, or the anticipated performance may never be achieved.

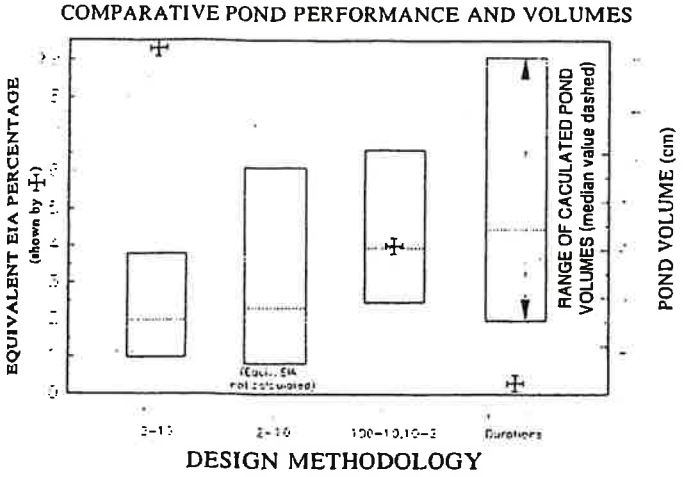


Figure 6. Comparative pond performance using different design methodologies – SCS and KCRTS hydrologic models, each under peak (labeled "2-10") and duration (labeled "100-10,10-2" or "Durations") standards. Evaluations are based on HSPF simulations of different developments within the fully built-out Soosette Creek watershed (29 percent impervious; see Figure 1). Overall performance (crosses) is represented by the equivalent flow increases allowed by a watershed having the indicated impervious-area percentage (as EIA) *without* detention; only KCRTS with a duration standard achieves "full" mitigation. The range of pond sizes (boxes) is expressed in cm-ha of volume per developed ha, with the range imposed by variability of soils and pre-development vegetation and the median value for all simulations shown by the dotted line.

The Limits of Mitigation

Despite the promise of successfully mitigating the effects of urban development through detention ponds, hydrologic modeling and empirical data suggest the elusivity of this goal. Along with the use of imperfect hydrologic models, several additional factors, both social and physical, are responsible for this shortcoming.

Regulatory Thresholds. There are practical limits to applying drainage regulations to individual small-scale land developments. Jurisdictions typically set a minimum "threshold of concern" to nearly all development activities: above this threshold the drainage regulations apply, but below this level regulations are minimal or absent [e.g., local King County regulations stipulate a minimum 0.50-cfs (0.014-m^3/sec) increase in runoff, equivalent to about 0.5 acre (0.2 ha) impervious surface, before mitigation is required]. Based on six years of King County permit activity (1987-1992), about one quarter of the impervious area added to the local watersheds there fell below this threshold and so are constructed without any detention facilities at all. Thus at full build-out (25-50 percent EIA, depending on zoning), a watershed will contain six to more than ten percent EIA that lacks any drainage control whatever. So under current regulatory thresholds, debates over the relative merits of alternative R/D design standards are largely moot – even the most restrictive design standard is unlikely to maintain future aquatic-system function at any but a recognizably degraded level.

Cost of Mitigation. Effective runoff mitigation in the Pacific Northwest appears to require pond volumes from 3 to as much as 14 centimeters (Figure 6). With associated berms, control structures, and maintenance access roads such a facility may occupy more than 10 percent of the gross area of a development (Figure 7). These are "lakes," not stormwater ponds, and although fully justifiable from a hydrologic standpoint they are unlikely to be built except in the most unusual of economic and social climates.

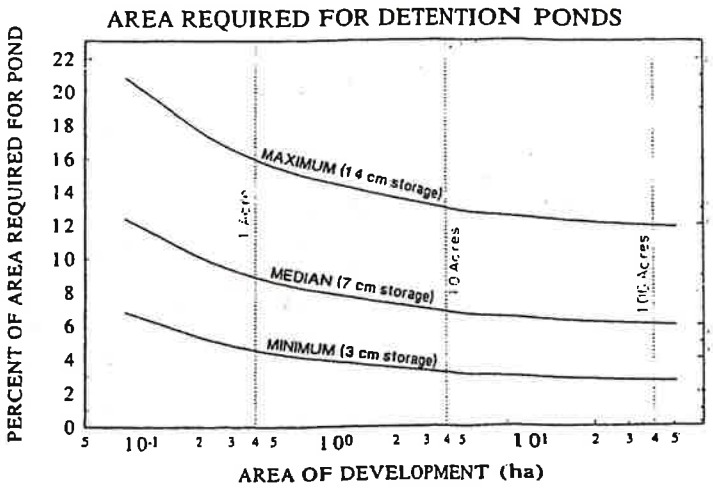


Figure 7. Relative gross area required for detention ponds, depending on the development area and the desired volume of stored runoff (expressed as cm-ha per ha of developed land). Pond layout and design is in accord with local regulations and assumes a 1.3-m (4-ft) maximum water depth and 3:1 sideslopes on all confining berms. Range of pond volumes correspond to the likely values determined with a "KCRTS duration" standard (Figure 6).

Thresholds of Sediment Movement. The concept of a "duration standard" implies the existence of a discharge below which no sediment transport occurs, allowing non-erosive release of urban-increased runoff volumes. For gravel-bed stream channels, this threshold discharge is real and can be determined on a site-specific or generic basis. In sand-bedded channels, however, the threshold of sediment motion occurs at impracticably low discharges, and so increases in the net transport of bed material is virtually unavoidable is such systems. We have not investigated the consequences of such a condition in small sand-bedded urban streams but speculate that they may be locally severe.

Point Discharges. Hydrologic models make the near-universal presumption that surface water exits a watershed at a point discharge. In the postdevelopment case this is invariably true: a constructed channel or a culvert outfall is generally quite identifiable. In the predeveloped case, however, watersheds up to several tens of hectares in size may have no discrete surface-water discharge point at all. Even if flow durations are matched precisely in pre- and post-developed cases, the change from a subsurface to a surface flow regime renders the entire design analysis irrelevant and can lead to severe, but entirely unanticipated, channel incision (Booth, 1990).

CONCLUSIONS: URBANIZATION, DEGRADATION, AND THE LIMITS OF MITIGATION

In western Washington, and likely in other humid regions as well, approximately 10 percent effective impervious area in a watershed typically yields demonstrable, and probably irreversible, loss of aquatic-system function. The data do not require a discrete "threshold" of effects, but they do display a noteworthy accumulation of physical and biological effects once this fraction of a watershed is covered by EIA. On-site detention is an appealing and widespread strategy for mitigating these effects, but very restrictive and so costly standards may need to be met to protect aquatic systems in urbanizing areas. Even though this study has considered only this one mitigation strategy, substantial difficulties are revealed. The common hydrologic methods used to size detention facilities give a false sense of accomplishment, and regulatory thresholds designed to avoid economic hardship for small projects may nevertheless allow substantial cumulative impacts to accrue. Many of the changes to the landscape imposed by urbanization are probably beyond our best efforts to fully correct them, and so some downstream loss of aquatic-system function is probably inevitable at present level of understanding. Unless we can develop a more precise, process-based understanding of how altered landscapes produced degraded stream channels we probably will not achieve genuine protection without limiting the extent of development itself, a strategy that is being used with increasing frequency in this region's remaining resource-rich watersheds.

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Impacts of Urbanization on Stream Habitat and Fish Across Multiple Spatial Scales

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ABSTRACT / We analyzed the relation of the amount and spatial pattern of land cover with stream fish communities, in-stream habitat, and baseflow in 47 small southeastern Wisconsin, USA, watersheds encompassing a gradient of predominantly agricultural to predominantly urban land uses. The amount of connected impervious surface in the watershed was the best measure of urbanization for predicting fish density, species richness, diversity, and index of biotic integrity (IBI) score; bank erosion; and base flow. However, connected imperviousness was not significantly correlated with overall habitat quality for fish. Nonlinear models were developed using quantile regression to predict the maximum possible number of fish species, IBI score, and base flow for a given level of imperviousness. At watershed connected imperviousness levels less than about 8%, all three variables could have high values, whereas at connected imperviousness levels greater than 12% their values were inevitably low. Connected imperviousness levels between 8 and 12% represented a threshold region where minor changes in urbanization could result in major changes in stream condition. In a spatial analysis, connected imperviousness within a 50-m buffer along the stream or within a 1.6-km radius upstream of the sampling site had more influence on stream fish and base flow than did comparable amounts of imperviousness further away. Our results suggest that urban development that minimizes amount of connected impervious surface and establishes undeveloped buffer areas along streams should have less impact than conventional types of development.

Recent studies indicate that stream hydrology, geomorphology, water chemistry, and biota are largely determined by a combination of regional factors, such as geology and climate, and local land cover and land use (Richards and others 1996, Seelbach and others 1997, Wehrly and others 1998, Zorn and others 1998). There is increasing interest in understanding the mechanisms by which watershed land uses influence stream ecosystems so that appropriate land management can be undertaken to improve or maintain stream quality (Booth and Jackson 1997, Lammert and Allan 1999).

Urban land use can severely degrade stream ecosystems (Wang and others 1997, 2000). A growing body of literature documents substantial alterations in flow patterns, channel morphology, water quality, and biotic communities associated with watershed urbanization (e.g., Ferguson and Suckling 1990, Lenat and Crawford 1994, Masterson and Bannerman 1994, Crunkilton and others 1996, Booth and Jackson 1997, May and others 1997). As the amount of urban land grows, precipitation runoff volume and rate increase, causing the frequency and magnitude of floods to rise and base flows to fall. Greater flooding makes the channel less stable, leading to excessive bank erosion, loss of pool habitat and instream cover, and excessive streambed scour and deposition. Urban runoff typically also contains a variety of pollutants that degrade water quality. All of these physical and chemical alterations restructure biotic communities and cause declines in the diversity and productivity of invertebrates and fishes. Relatively small amounts of urban land use in a watershed can lead to major changes in biota, and there appear to be threshold values of urbanization beyond which degradation of biotic communities is rapid and dramatic (May and others 1997, Wang and others 2000).

Efforts to conserve stream biological communities in urbanizing watersheds require quantitative and predictive models that describe the relation between urbanization and the biological integrity of the community (Wang and others 1997, 2000). One challenge in constructing such models is the identification of appropriate indicators of the amount and extent of urbanization

KEY WORDS: Urbanization; Spatial land cover; Imperviousness; Habitat; Fish community: Base flow

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to use in statistical analysis and model building. Urban land use encompasses a wide range of interrelated human activities that can be difficult to summarize numerically. Moreover, not only the type, but also the intensity and the location of the land use within the watershed are likely to determine its impact on the biological community of the stream (Booth and Jackson 1997, May and others 1997).

In previous studies, several different measures have been used to characterize the degree of urbanization and its relation to stream biota and their habitat. Biological diversity and integrity have been shown to be negatively correlated with percentage urban land cover (Klein 1979, Steedman 1988, Limburg and Schmidt 1990, Lenat and Crawford 1994, Weaver and Garman 1994, Wang and others 1997, Klauda and others 1998), human population density (Jones and Clark 1987, Schueler 1997), and house density (Benke and others 1981). However, Wang and others (1997) did not find a strong correlation between stream habitat for fish and the percentage of urban land cover within either the entire watershed or the riparian corridor.

Recently, the amount of impervious surface within the watershed, which strongly influences the pattern and magnitude of precipitation infiltration and surface runoff, has been proposed as a key environmental indicator of urban land-use effects (Schueler 1994, Arnold and Gibbons 1996). The extent of imperviousness has an obvious direct effect on stream hydrology and water quality and an indirect but strong effect on stream habitat and biota (Booth and Jackson 1997). An impervious surface is also one of the few urban land-use attributes that can be explicitly quantified and managed at each stage of land development. However, only a few studies have examined relations between watershed imperviousness and stream fish communities (Klein 1979, Booth and Jackson 1997, May and others 1997, Wang and others 2000).

Proximity to the stream also appears to be an important consideration in estimating the impact of urban land uses on stream biological communities. A positive relation has been reported between the width of forested riparian corridors and fish and invertebrate biotic integrity in urbanizing watersheds of forested regions of southern Ontario and western Washington state (Steedman 1988, May and others 1997). In analyzing 45 agriculture- or forest-dominated catchments of a river basin in central Michigan, Richards and others (1996) found that stream riparian areas (buffers) were more important than whole-catchment data for predicting sediment-related habitat variables, but that channel morphology was more strongly related to attributes of entire catchments. For three first-order tributaries of the River Raisin in southeastern Michigan with mixed agriculture and forest land cover, Lammert and Allan (1999) reported that land use immediately adjacent to the tributaries predicted biotic condition better than regional land use but was less important than local in-stream habitat variables.

In this study, we compared a variety of measures of urbanization to identify which one(s) had the strongest relation with fish habitat quality, fish community structure, and biotic integrity. Once we had identified the best measure, we developed quantitative models to predict the characteristics of the fish habitat and fish community that could be attained at a given level of watershed urbanization. Finally we analyzed the amount of urbanization at different spatial scales to examine how the pattern and proximity of urban development influenced stream ecosystems.

Methods

Study Area

We analyzed land use, fish habitat, and fish communities for 47 small watersheds in southeastern Wisconsin, USA, the same watersheds used in Wang and others (2000). All study watersheds were located within the Southeastern Wisconsin Till Plains Ecoregion (Omernik and Gallant 1988); 28 were in the Lake Michigan basin and 19 in the Mississippi River basin. Nearly all the soils in this region were formed, at least in part, from glacial materials. Nearly two thirds of the soils of the region are on glacial till, about a quarter on glacial outwash, and remainder on glaciolacustrine deposits (Hole 1976). Most of this area has low relief, and hill slopes are nearly level to rolling. Stream drainage systems are poorly developed and undrained depressions are common.

Owing to its rich soil and flat topography, southeastern Wisconsin has long been an important agricultural region. It has also been the most important urban area of the state, centered on the city of Milwaukee. In 1990 about 2 million people, 38% of Wisconsin's population, lived in this region. Over the last 70 years the urban population of southeastern Wisconsin has doubled, leading to a substantial increase in urban land and a major decrease in agricultural land.

A single stream site was sampled within each watershed in 1997, and the sites were chosen to minimize potential variation in natural biological attributes, such as watershed soil type, stream size and slope, and natural hydrological and temperature regimes, while maximizing variation in amount of urban and agricultural land use. At the sampling sites the streams were warm-

water (summer maximum daily mean temperature >25°C), second to third order in size, and had low to moderate gradients (<6 m/km). In the absence of differing watershed land uses, these sites would be expected to have similar habitat and fish communities (Lyons 1996).

Watershed Land Use

An existing digital land-use database for 1990, prepared and maintained by the Southeastern Wisconsin Regional Planning Commission, was used to abstract watershed land-cover data for the study sites. This database contained 63 urban and rural land-use categories, including residential (six categories), commercial (three categories), industrial (four categories), transportation (20 categories), communication and utilities (two categories), government and institutional (nine categories), recreation (seven categories), agriculture (six categories), and open or forested lands (six categories). The database had been developed from 1:4800 air photos and had resolutions of about 0.40 ha for rural areas and as small as 0.06 ha for urban areas. Watershed boundaries above each sampling site were delineated by hand on 1:24,000 topographic maps using ARC/INFO software (ESRI 1994). We quantified watershed land cover by overlaying watershed boundaries on top of the land-use database with ARC/INFO software. We analyzed land-use data for a 50-m-wide region along each side of the stream upstream from the site, a region between 50m and 100m from the stream, and a region beyond 100m. We also extracted land-use data within the watershed for an area within a 1.6-km radius upstream of the site, between a 1.6- and 3.2-km radius, and beyond a 3.2-km radius. We chose these buffer and radius distances based on results from previous studies of agriculture- and forest-dominated watersheds (Large and Petts 1994, Richards and others 1996, Wang and others 1997, Harding and others 1998, Lammert and Allan 1999).

Fish and Habitat Sampling

Habitat, fish communities, and baseflow were sampled at each stream site during 1997. The length of site was about 35 times mean stream width, or a minimum of 100 m, a length sufficient to characterize the fish assemblage and to encompass about three meander sequences (Lyons 1992a, Simonson and others 1994). As a result, stations ranged in length from 100 to 315 m.

Fish sampling occurred between late May and late August in 1997, when low stream flows facilitated sampling effectiveness and large-scale seasonal fish movements were unlikely to occur (Lyons and Kanehl 1993). The entire length of each site was electrofished with either two backpack units in tandem or a single towbarge unit with three anodes (Lyons and Kanehl 1993, Simonson and Lyons 1995). Efforts were made to collect all fish observed and all captured fish were identified and counted. Previous studies have shown that this sampling procedure yields an accurate and precise picture of the fish community, with a measurement error of about ±10%–20% (Simonson and Lyons 1995).

Habitat sampling occurred within a day of fish sampling. At each site, 28 habitat variables, encompassing channel morphology, bottom substrates, cover for fish, bank conditions, riparian vegetation, and land use, were measured or visually estimated along 13 transects using standardized procedures described in Simonson and others (1994). These procedures yield data with known levels of accuracy and precision, typically ±5%–10% (Wang and others 1996).

Stream base-flow was measured at a single transect near the downstream end of each site using a Flow-Mate model 2000 portable flowmeter. All measurements were made during a three-day period in October when flows were likely to have been at or near their annual minimum, based on an analysis of gauged sites in the region. No rainfall had occurred for at least 10 days before this sampling.

Data Analysis

We summarized the 63 watershed land-use types into 15 major categories and expressed each as a percentage of total watershed land use. We also determined the percentage of the watershed as connected impervious land cover, defined as those surfaces impervious to infiltration by precipitation (e.g., roads, sidewalks, parking lots, roofs) that had a direct hydraulic connection (e.g., surface drainage way, storm sewer) to the downstream drainage system (Booth and Jackson 1997). The connected impervious area was calculated based on a previous study that had estimated typical levels of connected imperviousness for different types of urban land uses in southern Wisconsin (Bannerman, WDNR unpublished data). The different land-cover types and the connected impervious area within the three buffer and three radius categories were also expressed as a percentage of total watershed area.

From the habitat data, we calculated in-stream fish habitat scores using a habitat rating system for low gradient streams (Wang and others 1998). This habitat rating system was specifically developed for Wisconsin stream fishes, was not species specific, and was designed to assess the suitability of a stream segment for an entire fish assemblage. It consists of differentially weighted measures of channelization, instream cover, bank ero-

sion, sinuosity, variation in thalweg depth, and riparian vegetation.

From the fish data, we determined the number of fish species, total fish density (number/100 m^2), and percentage of individuals that were tolerant of environmental degradation (Lyons 1992b). Fish data were also used to calculate the Shannon diversity index (Magurran 1988) and an index of biotic integrity (IBI) (Lyons 1992b). The IBI is a widely used measure of the quality of fish community, and an effective method to assess the overall condition or "health" of the stream ecosystem (Fausch and others 1990). The IBI used here was specifically developed for Wisconsin warmwater streams and could range from 0 to 100, with higher values indicating better fish communities.

For base flows, we calculated a value "adjusted" for differences among sites in the sizes of their watersheds. Our adjusted values were expressed as the quotient of the measured base flow divided by the area of the watershed in square kilometers, multiplied by 1000. Such an adjusted base flow is relatively consistent for streams with similar amounts of groundwater inputs and can be used to measure base flow changes resulting from watershed land modification (Seelbach and others 1997).

We analyzed the relation of each of the 16 land-use variables (i.e., 15 land cover types and connected imperviousness) with each of the fish, habitat, and baseflow ("stream") variables to identify the best measure of urban land use for predicting stream fish and habitat attributes. We first examined bivariate plots to determine if data transformations were required to stabilize variance and approximate normality. After any necessary transformations, we correlated land-use variables with stream variables using simple linear regression (SAS Institute 1990). The land-use variable with the highest significant ($P < 0.05$) r^2 value was considered to be the best estimator of urbanization.

We next developed predictive models that related selected stream attributes to the amount of urban land use in the watershed. Our goal in this analysis was to identify the best possible conditions that could be expected at a given level of urbanization. Consequently, we applied 90% quantile regression to estimate the upper bounds of each of the correlations between variables (BLOSSOM software; Slauson and others 1994).

Finally, we used simple linear regression to analyze the relation of agricultural, woodland, wetland, and urban land uses with selected stream variables at the differing spatial scales represented by our buffer and radius categories. For each combination of variables, we compared P and r^2 values among the buffer and radius categories to estimate the relative importance of the proximity of a given land use to the stream in influencing habitat, fish, and flow characteristics. When P and r^2 values were similar for different variables, we compared regression slopes, with higher slopes indicating stronger relations.

Results

Watershed and Land Cover

Our data set encompassed a wide range of watershed areas and land covers. Watershed areas upstream of the sampling sites ranged from less than 10 to 101 km^2 with a mean of 27.6 km^2. The watersheds were dominated by either urban (3%–97%) or agricultural (0–89%) land uses; woodland ranged from 0.2% to 18% with a mean of 6.1%; and water–wetland ranged from 0.2% to 25% with a mean of 8.7%. Details on the location, watershed size, and land use of each site are given in Wang and others (2000).

In general, the percentages of each land-use type were highly and significantly correlated among the three buffer and the three radius categories. Among the buffer categories, Pearson correlations for imperviousness and for urban, agriculture, and water–wetland land uses ranged from 0.70 to 0.99. Correlations for woodland land covers were more variable, ranging from 0.40 to 0.99. Among the radius categories, correlations were 0.80–0.99 for urban land uses and 0.35–0.92 for imperviousness and agriculture, woodland, and water–wetland land uses. However, correlations were not significant between the within-1.6-km and beyond-3.2-km categories for imperviousness, agriculture, woodland, and water–wetland land uses and between the 1.6-km-to-3.2-km and the beyond-3.2-km categories for imperviousness and agriculture land uses.

Best Land-Use Variables for Explaining Stream Attributes

Among the 16 land-use variables considered, connected imperviousness was the best at explaining variation in fish community attributes (Table 1). Percentage watershed connected imperviousness explained the most variance in the number of fish species (55%), Shannon diversity index (50%), fish density (39%), and the second-most variance for percent tolerant fish (19% vs 21% for the best variable) and third for IBI score (32% vs 34% and 33%). The next 10 best variables for explaining fish attributes were, from best to worst, highways–streets–parking lots, commercial land, total urban land, agricultural land, government land, residential land, environmental corridor (undisturbed land connected to the stream), woodland, vegetated

Table 1. Coefficients of determination (r^2) for regressions between land use variable (% of watershed) and fish and habitat variables[a]

Land cover Variables (%)	Species number (Ln)	IBI score (Ln)	Shannon index (Ln)	Individuals of tolerant fish (%)	Fish number/ 100 m^2 (Ln)	Habitat score	Erosion	Base flow (Ln)
Connected imperviousness	0.55* (−)	0.32* (−)	0.50* (−)	0.19* (+)	0.39* (−)	—	0.27* (+)	0.09 (−)
Highway, street, parking	0.48* (−)	0.23* (−)	0.48* (−)	0.17* (+)	0.28* (−)	—	0.25* (+)	0.10 (−)
Commercial land	0.41* (−)	0.33* (−)	0.30* (−)	0.21* (+)	0.31* (−)	—	0.21* (+)	0.14 (−)
Urban land	0.35* (−)	0.22* (−)	0.33* (−)	0.13 (+)	0.28* (−)	—	0.21* (+)	0.10 (−)
Agricultural land	0.33* (+)	0.13 (+)	0.31* (+)	—	0.22* (+)	—	0.13 (−)	—
Residential land	0.23* (−)	0.16* (−)	0.20* (−)	—	0.22* (−)	—	0.20* (+)	0.10 (−)
Government land	0.30* (−)	0.31* (−)	0.20* (−)	0.11 (+)	0.29* (−)	—	—	0.10 (−)
Environmental corridor (Ln)	0.17* (+)	0.34* (+)	0.10 (+)	0.11 (−)	0.26* (+)	0.09 (+)	0.14 (−)	0.24* (+)
Woodland (Ln)	0.15* (+)	0.27* (+)	0.13 (+)	0.11 (−)	0.28* (+)	0.13 (+)	—	0.16* (−)
Vegetated land (Ln)	0.10 (+)	0.23* (+)	—	0.09 (−)	0.23* (+)	0.11 (+)	—	0.15* (+)
Industry	0.08 (−)	—	0.14 (−)	—	—	—	—	—
Water/wetland	0.12 (+)	0.22* (+)	—	0.09 (−)	—	—	—	0.35* (+)
Other transportation	0.18* (−)	0.15* (−)	—	—	0.15* (−)	—	—	—
Recreational land	0.14 (−)	—	0.22* (−)	0.10 (+)	0.10 (−)	—	—	—
Pasture	0.10 (+)	0.15* (+)	0.10 (+)	—	0.21* (+)	—	—	—
Unused land	0.18* (−)	0.27* (−)	0.11 (−)	—	—	0.10 (−)	—	0.14 (−)

[a]Ln indicates natural log transformed variables; base flow = m^3/sec/1000 km^2 watershed area. Coefficients were listed only for regression slopes that were significant at $P < 0.05$; *indicates significant at $P < 0.01$. (+) indicates the relationship is positive and (−) is negative.

land, and water–wetland. Most of these variables explained the greatest variance for number of species and the least for percent tolerant fish.

Correlations were much weaker between land-use and habitat variables (Table 1). Environmental corridor, woodland, vegetative land, and unused land were the only variables that were significantly related to habitat score, but none explained more than 13% of the variation. Connected imperviousness and one of its major components—highways, streets, and parking lots—explained the most variation in streambank erosion (25%–27%). Water–wetland ($r^2 = 0.35$) and environmental corridor ($r^2 = 0.24$) had the best correlations with base flows. A plot suggested that connected imperviousness limited the maximum values for base flow, but the overall correlation was very weak ($r^2 = 0.09$).

Predictive Models Based on Connected Imperviousness

Percentage watershed connected imperviousness had similar relations with number of fish species, IBI scores, and adjusted base flows (Figure 1). For watersheds with connected imperviousness less than 8%, which corresponded to areas of relatively high agriculture (>40%), fish species number, IBI scores, and base flows were highly variable. Some sites had healthy fish communities (>15 species and IBI scores >50) and high base flows (>4 m^3/sec/1000 km^2), whereas others had poor-quality fish communities (<8 species and IBI scores <30) and very low base flows (<1 m^3/sec/1000 km^2). Watersheds with connected imperviousness greater than 12% had poor-quality fish communities and low base flows. Connected imperviousness levels from 8% to 12% appeared to represent a threshold zone, where there was a dramatic drop in the maximum possible value for species number, IBI score, and base flow with a small increase in connected imperviousness.

The 90% quantile regressions between connected imperviousness and numbers of species ($r^2 = 0.40$), IBI scores ($r^2 = 0.42$), and base flows ($r^2 = 0.26$) had similar forms and were best fit with a negative exponential model (Figure 1). The regression lines quantified the pattern of relatively high maximum values at connected imperviousness levels less than 8%, a sharp decline in maximum values between 8% and 12%, and consistently low maximum values above 12% connected imperviousness.

Influence of Spatial Distribution of Land Use

Analysis of the radius data emphasized the importance of urbanization and the effect of land-use proximity on in-stream conditions. Within the 1.6-km radius and between the 1.6- and 3.2-km radius, connected imperviousness tended to have stronger correlations with fish, habitat, and flow variables than did agricul-

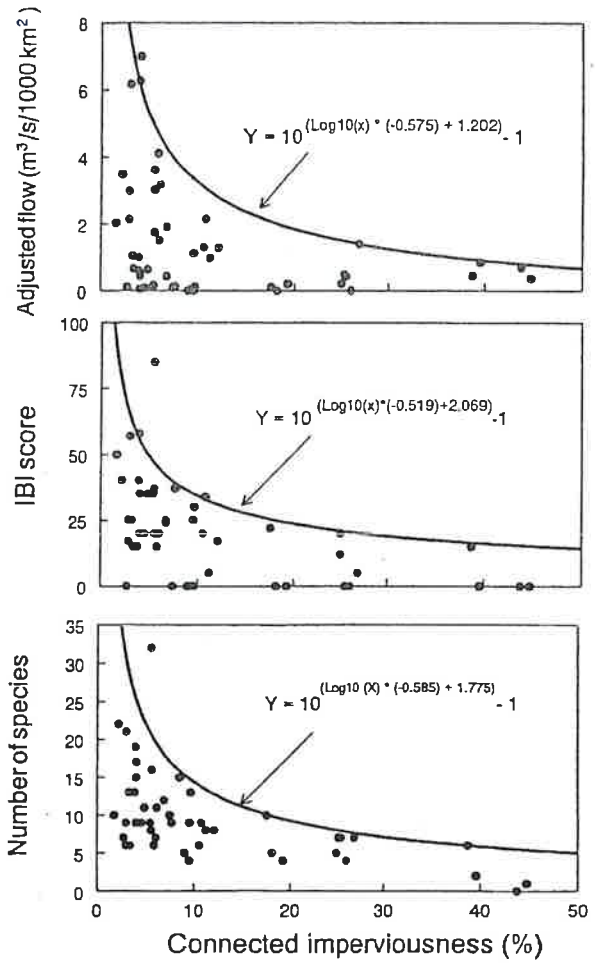


Figure 1. Plots between watershed percent connected imperviousness and number of fish species, IBI score, and base flow (m^3/sec/1000 km^2 of watershed area). The models were developed by first $\log_{10}$-transforming the dependent variables, then performing 90% quantile regression on these semitransformed data to develop linear models, and finally back-transforming the linear models into nonlinear models using antilogarithms. The coefficients of determination of the models, equivalent to r^2 in least square regression, are 0.40 for number of fish species, 0.42 for IBI score, and 0.26 for adjusted base flow.

tural, woodland, and water-wetland land-uses (Table 2). For connected imperviousness, the r^2 values were nearly identical for these two radius categories, but the slope was consistently steeper for the within-1.6-km class, suggesting that connected imperviousness immediately adjacent to the stream had the strongest influence on in-stream conditions. Beyond a 3.2-km radius, the correlation with imperviousness declined precipitously, and the other three land uses explained more of the variation in stream attributes. Interestingly, for these other land uses, the beyond-3.2-km category usually explained substantially more variation than the within-1.6-km or the 1.6-km-to-3.2-km categories. This result indicates that within 3.2 km of the study sites the effects of connected imperviousness were overwhelming, or at least obscuring, any influence of these other land uses.

Buffer analysis yielded a different pattern. For number of fish species, IBI scores, and Shannon index, the connected imperviousness had the highest r^2 values for all buffer categories, but woodland land cover had the steepest slopes (Table 3). With the exception of woodland beyond 100 m (r^2 = 0.14), none of the four land uses explained a significant amount of variation in habitat scores. Water–wetland land cover and connected imperviousness both were significantly related to baseflow for all three buffer categories. Water–wetland explained more variation but imperviousness tended to have steeper slopes.

Discussion

Imperviousness as an Indicator of Urbanization

Our results show that watershed connected imperviousness was the best single indicator of urbanization effects on stream fish communities in southeastern Wisconsin. This finding supports similar conclusions from previous studies of stream fish communities from Maryland (Klein 1979, Schueler 1994) and Washington state (Booth and Jackson 1997, May and others 1997). Our next-best indicator, land cover by highways, streets, and parking lots, was a major component of imperviousness. Overall urban land use, which has been widely used in previous studies (e.g, Steedman 1988, Wang and others 1997), was an adequate indicator, but it explained substantially less of the variation in fish community attributes than did imperviousness.

Surprisingly, we found little relation between connected imperviousness (or any other measure of urbanization) and our habitat quality index. This is consistent with an earlier statewide study of urbanization impacts on Wisconsin streams (Wang and other 1997), but appears to contradict findings from other parts of the United States. In other studies, researchers have documented increased erosion, channel destabilization and widening, loss of pool habitat, excessive sedimentation and scour, and reduction in large woody debris and other types of cover as a consequence of urbanization (Lenat and Crawford 1994, Schueler 1994, Arnold and Gibbons 1996, Booth and Jackson 1997, May and other 1997). We did find a significant negative correlation between connected imperviousness and ero-

Table 2. Coefficients of determination (r^2) and regression slopes for relations between selected fish and habitat variables and selected land-use variables[a]

Fish or habitat variable and distance from site	Land use (% of watershed area)							
	Agricultural		Woodland		Water–wetland		Connected imperviousness	
	r^2	Slope	r^2	Slope	r^2	Slope	r^2	Slope
Number of species (Ln)								
Within 1.6 km radius	0.01	+0.01	0.00	−0.01*	0.02	+0.05	**0.46**	**−0.12**
Between 1.6 and 3.2 km	0.08	+0.01	0.02	+0.16*	0.02	+0.03	**0.48**	**−0.07**
Beyond 3.2 km	**0.31**	**+0.02**	**0.18**	**+0.30***	**0.16**	**+0.05**	**0.16**	**−0.04**
Index of biotic integrity (Ln)								
Within 1.6 km radius	0.01	−0.02	0.00	+0.12*	0.06	+0.22	**0.34**	**−0.25**
Between 1.6 and 3.2 km	0.03	+0.02	**0.09**	**+0.74***	0.04	+0.10	**0.35**	**−0.14**
Beyond 3.2 km	**0.16**	**+0.03**	**0.38**	**+1.05***	**0.24**	**+0.14**	0.04	−0.05
Shannon index (Ln)								
Within 1.6 km radius	0.02	+0.01	0.00	+0.04*	0.00	+0.00	**0.43**	**−0.06**
Between 1.6 and 3.2 km	**0.09**	**+0.01**	0.02	+0.07*	0.02	+0.01	**0.45**	**−0.03**
Beyond 3.2 km	**0.27**	**+0.01**	**0.11**	**+0.11***	**0.27**	**+0.02**	**0.14**	**−0.02**
Habitat score								
Within 1.6 km radius	0.00	−0.17	0.01	+3.11*	0.00	+0.40	**0.14**	**−1.76**
Between 1.6 and 3.2 km	0.03	−0.23	0.05	+6.42*	0.01	+0.40	**0.15**	**−1.02**
Beyond 3.2 km	**0.10**	**+0.24**	**0.16**	**+7.39***	0.05	+0.70	0.02	−0.31
Adjusted base flow (m^3/sec/1000 km^2 watershed area) (Ln)								
Within 1.6 km radius	0.02	−0.01	0.01	−0.04	**0.12**	**+0.02**	**0.15**	**−0.30***
Between 1.6 and 3.2 km	0.01	+0.00	**0.11**	**+0.09**	**0.12**	**+0.08**	0.09	−0.18*
Beyond 3.2 km	0.03	+0.00	**0.10**	**+0.04**	**0.24**	**+0.05**	0.01	−0.08*

[a]Calculated as % watershed land use within a given radius upstream from the stream sampling site. Values significant at $P < 0.05$ are in bold type. Ln indicates natural log transformed; *indicates land-use variables were also natural log transformed.

sion, but the other habitat impacts (several of which are incorporated into the habitat quality index) were not correlated with urbanization. Many of our nonurban sites had degraded habitat from agricultural land uses in their watersheds, and this may have obscured the relation between increasing urbanization and decreasing habitat quality. Furthermore, our habitat scoring system seems to be most affected by local riparian conditions, as evidenced here by the significant correlations of habitat scores with stream corridor and vegetative land-cover variables (see Table 2). Some of our suburban and urban sites had well-vegetated riparian corridors, and these sites had at least fair-quality fish habitat.

The relation between connected imperviousness and baseflow was complex. Connected imperviousness appeared to limit the base flow in moderately to heavily urbanized watersheds but had little influence on base flow in rural watersheds. The low base flows we observed in urban watersheds agreed with findings from other studies, where impervious surfaces caused reduced infiltration of precipitation into the groundwater, a lowered water table, and a decrease in stream flow (Riggs 1965, Klein 1979, Simmons and Reynolds 1982, Ferguson and Suckling 1990, Schueler 1994). However, in nonurban areas other factors besides imperviousness controlled base flow. For these areas, the amount of surface water (i.e., lakes and impoundments) and wetlands in the watershed was a better predictor of base flow, suggesting that the surface water storage capacity of the watershed strongly influenced the volume of flow in the stream channel in the absence of runoff.

We expect that only a small increase in connected imperviousness occurred between 1990, when the land use data were captured, and 1997, when the stream fish and habitat data were collected. Between 1970 and 1990, the average annual increase in connected imperviousness for all 47 study watersheds was 0.09% (Wang and others 2000). For watersheds with less than 10% connected imperviousness, the increase was 0.03%. In addition, there is evidence to support a time lag between watershed land-use changes and responses of the biological community. In agricultural watersheds the time lag is typically two to three years (Wang, WDNR unpublished data). Therefore, we believe that the difference in collection dates for the watershed land use data and the stream fish and habitat data in this study

Table 3. Coefficients of determination (r^2) and regression slopes for relations between selected fish and habitat variables and selected land-use variables[a]

Fish or habitat variable and distance from stream	Land use (% of watershed area)							
	Agricultural		Woodland		Water-wetland		Connected Imperviousness	
	r^2	Slope	r^2	Slope	r^2	Slope	r^2	Slope
Number of species (Ln)								
Within 50 m buffer	**0.16**	**+0.09**	0.04	+0.42*	**0.10**	**+0.06**	**0.48**	**−0.33**
Between 50 and 100 m	**0.19**	**+0.09**	**0.09**	**+0.56***	**0.10**	**+0.14**	**0.45**	**−0.41**
Beyond 100 m	**0.34**	**+0.02**	**0.14**	**+0.28***	**0.11**	**+0.05**	**0.48**	**−0.04**
Index of biotic integrity (Ln)								
Within 50 m buffer	0.01	+0.06	**0.09**	**+1.59***	**0.19**	**+0.22**	**0.29**	**−0.51**
Between 50 and 100 m	0.04	+0.10	**0.23**	**+2.35***	0.04	+0.45	**0.26**	**−0.75**
Beyond 100 m	**0.16**	**+0.03**	**0.25**	**+0.92***	**0.18**	**+0.16**	**0.31**	**−0.08**
Shannon Index (Ln)								
Within 50 m buffer	**0.18**	**+0.05**	0.03	+0.02*	0.05	+0.17	**0.37**	**−0.14**
Between 50 and 100 m	**0.19**	**+0.04**	0.04	+0.20*	0.02	+0.03	**0.35**	**−0.17**
Beyond 100 m	**0.32**	**+0.07**	**0.12**	**+0.12***	0.05	+0.02	**0.48**	**−0.02**
Habitat score								
Within 50 m buffer	0.00	+0.07	0.01	+6.81*	0.04	+1.13	0.03	−2.19
Between 50 and 100 m	0.00	+0.39	0.05	+12.28*	0.02	+1.81	0.07	−4.21
Beyond 100 m	0.03	+0.13	**0.14**	**+7.46***	0.02	+0.62	0.06	−0.40
Adjusted base flow (m^3/sec/1000 km^2 watershed area) (Ln)								
Within 50 m buffer	0.01	−0.03	0.01	−0.11	**0.20**	**+0.08**	**0.16**	**−0.47***
Between 50 and 100 m	0.00	−0.04	0.02	+0.12	**0.31**	**+0.23**	**0.19**	**−0.57***
Beyond 100 m	0.03	+0.00	**0.14**	**+0.04**	**0.35**	**+0.08**	**0.12**	**−0.02***

[a]Calculated as % of watershed area at various distances from the stream upstream of the site. Values significant at $P < 0.05$ are in bold type. Ln indicates natural log transformed; * indicates land-use variables were also natural log transformed.

should not have a major effect on our results or conclusions.

Connected Imperviousness as a Limiting Factor and Values of Quantile Regression

Base flow and most of the fish community attributes that we measured had a wedge-shaped relation with connected imperviousness. High levels of imperviousness were always associated with low values of these attributes, but low levels had both high and low values. Traditional linear regression does not perform well with this sort of data structure. We analyzed relations with the recently developed technique of quantile regression, which is ideal for wedge-shaped relations (Terrell and others 1996, Thomson and others 1996, Scharf and others 1998, Cade and others 1999).

Quantile regression is superior to least-square linear regression in several regards. Least-square techniques are particularly sensitive to outlying values for dependent variables and irregularities in the distribution of observations, and they frequently produce inconsistent estimates of slope for upper and lower bounds (Scharf and others 1998). Estimates of means from least-square regressions are unbiased only for linear monotonic transformation (Bassett 1992). In contrast, quantile regression techniques based on least absolute value models are more robust to outlying values of the dependent variable and to sparseness within data sets, while providing consistent estimates of upper and lower bound slopes (Scharf and others 1998). In addition, quantile regression is proficient in dealing with curvilinear edges of scatter diagrams as nonlinear (e.g., logarithmic) transformations of data do not bias coefficient estimates (Bassett 1992). In previous biological applications, quantile regressions have been used to model stream fish habitat for standing stock estimation (Terrell and others 1996); estimate changes in glacier lily seedling numbers as a function of lily flower numbers, rockiness, and pocket gopher activity (Thomson and others 1996); examine patterns between prey size and predator size in animal populations and the relation between animal abundance and body size (Scharf and others 1998); and study changes in annual acorn biomass due to forest canopy cover of oak and oak species diversity (Cade and others 1999). All of these studies have demonstrated that quantile regression is an appropriate statistical technique for modeling relations with a wedge-shaped form.

Quantile regression has enhanced our understanding of how and when connected imperviousness acts as a limiting factor for stream fish communities. The 90% quantile estimates are calculated such that they are greater than 90% of the observations and less than the remaining 10%. The products of our models could be interpreted as predictions, with 90% probability, of the highest possible number of fish species, IBI score, and adjusted base flow that can be achieved for a given imperviousness level. Our model predicts that high values of these variables are possible, but not inevitable, at low levels of imperviousness, but that at high levels of imperviousness only low values of base flow and fish community characteristics can be achieved.

Previous studies of fish communities in urban watersheds have reported both wedge-shaped and linear relations. Wedge-shaped relations have been found mainly in areas where rural land-uses are dominated by agriculture, whereas linear relations are more typical of areas where the rural landscape has been less modified and remains mainly forest. Watershed agriculture can strongly impact stream fishes, but degradation of fish communities is not inevitable in predominantly agricultural watersheds (Wang and others 1997, 2000). For example, in a survey of 270 stream sites from watersheds with a mix of forest, agriculture, and urban land uses in Maryland, Klauda and others (1998) reported a wedge-shaped relation between urbanization and IBI score. Sites with greater than 50% total urban land use had IBI scores in the poor to very poor range, but among sites with less than 25% urban land use, a wide range of IBI scores was observed from good to very poor. However, when the analysis was restricted to 61 sites in the Patapsco basin, where agricultural land-use impacts were limited (Klauda and others 1998, Klauda, Maryland Department of Natural Resources unpublished data), a strong linear negative relation between IBI scores and urban land was observed. Similarly, in an early study of 27 small Maryland watersheds with limited agriculture, Klein (1979) reported a near-linear negative relation between watershed total imperviousness and a fish diversity index. Steedman (1988) also reported a negative linear correlation between watershed urban land use and IBI scores in largely forested watersheds in southern Ontario.

Regardless of the type of land use in rural areas, all studies to date comparing the relation between imperviousness and stream fishes, including this one, have noted a sharp decline in fish community attributes at 8%–12% imperviousness (Scheuler 1994, Booth and Jackson 1998, May and others 1997, Wang and others 2000). Below about 8% imperviousness, fish species richness, diversity, and IBI scores may be either high or low, but above 10%–12% they are consistently poor.

Impacts of Spatial Distribution of Urbanization on Stream Quality

The influence of the spatial distribution of land cover, especially in riparian areas, has long been recognized in watersheds with a mix of forest and agriculture or forest and urban lands. In otherwise predominantly agricultural or urban watersheds, riparian forests can stabilize streambanks and reduce erosion, provide woody debris that improves in-stream habitat, and filter sediment in nutrients from upland runoff (Castelle and others 1994). Establishment and maintenance of well-vegetated riparian buffer strips along streams has become one of the most visible and widely accepted applications of watershed management.

Buffer strips have a disproportionate influence on some aspects of stream biological communities and their habitats. In comparing the importance of buffer versus watershed land covers for mixed forest–agriculture watersheds, Richards and others (1996) reported that land cover from a 100-m-wide buffer explained more of the variance in the percent of fine substrate in the stream channel and in bank erosion than land cover in the entire catchment. However, catchment data explained more of the variance in channel morphological variables such as width, depth, and sinuosity. In a study attempting to distinguish the relative importance of local (riparian) versus regional (catchment) land uses on streams in a mixed forest–agriculture area, Allan and others (1997) concluded that the influence of land use on stream integrity was scale-dependent. Instream habitat structure and organic matter inputs were determined primarily by riparian conditions such as the vegetative cover adjacent to a stream site, whereas nutrient supply, sediment delivery, hydrology, and channel characteristics were influenced more by regional conditions, including landscape features and land cover upstream from and lateral to the site. In analyzing urbanization impacts on streams in primarily forested watersheds, Steedman (1988) and May and others (1997) have concluded that riparian buffers can offset some of the negative effects of urban land uses. They developed graphical models that predicted urbanization impacts on stream quality based on the amount of urban land use in the entire watershed and the amount of woodland in the riparian zone.

We can find no previous studies that have analyzed the spatial influence of different land uses in mixed agricultural–urban watersheds. Several factors make such an analysis difficult. Agricultural land uses appear to have more variable influences on stream attributes

than do forest land uses (Wang and others 1997, 2000). Land uses at different spatial scales are, at best, often highly intercorrelated and, at worst, not statistically independent, which has limited the application of multiple regression techniques. To avoid this problem, most previous investigators have compared regression coefficients of determination (i.e., r^2 values) from separate simple linear regressions for each land use and each spatial scale (Steedman 1988, Richards and others 1996, Roth and others 1996, Allan and others 1997, Harding and others 1998). However, such an approach can only indicate which spatial scale and land cover is a better predictor of stream quality, and it says little about how much of a change in stream quality will result from a change in the amount or spatial pattern of a land-use category.

Our study looked specifically at how the spatial pattern of different land-uses affected stream quality in an urbanizing agricultural region. We compared not only regression coefficients of determination but also regression slopes to assess the relative importance of location and type of land use. We found that urban land uses (i.e., connected imperviousness) in buffer areas along the stream (within 50 m and from 50 to 100 m) and in watershed areas immediately upstream (within a 1.6-km radius and between a 1.6- and 3.2-km radius) had much more influence on the fish community and on base flow than did urbanization further away from the site or stream. The closest buffer (within 50 m) and radius distances (within 1.6 km) had the steepest slopes, indicating that a given land use change in these areas would have a greater effect on the stream than a comparable change in a different part of the watershed. Weaver and Garman (1994) reported a significant correlation between fish community attributes and urbanization within a 1.4-km radius in a Virginia watershed.

We found relatively little influence of nonurban land uses near the stream or site on stream quality. We do not think that this finding means that the amount or location of these other land uses has no effect on the stream, but rather that the effects of connected imperviousness are so overwhelming that relations with other land uses are obscured (see also Wang and others 2000).

Summary and Management Implications

Our study has confirmed that the amount of connected impervious surface in the watershed is the best available indicator of urbanization impacts on stream fish communities and base flow. However, imperviousness may not be a good indicator of habitat quality, although it does accurately predict the amount of bank erosion present. Using connected imperviousness as our measure of urbanization, we developed quantile regressions that can be used to predict the maximum possible values for fish species richness, fish community biotic integrity, and base flow for a given level of urban development. High values for these three variables are possible (but not inevitable) if connected imperviousness is less than 8% of the watershed area, but low values are inevitable above 12% connected imperviousness. Levels of connected imperviousness between 8% and 12% represent a threshold zone where minor increases in urbanization are associated with sharp declines in fish community quality and baseflow. Connected imperviousness within a 100-m buffer along the length of the stream or within a 3.2-km radius upstream of the sampling site has substantially more influence on stream quality than comparable levels of imperviousness further away. Above about 12% connected imperviousness, the influence of urbanization on stream quality is so dominant that nonurban land uses showed little influence on stream fish communities or base flow.

Our results have several implications for watershed management. First, urban development schemes that minimize the amount of connected impervious surface (e.g., see Schueler 1994, Arnold and Gibbons 1996) should reduce the impact of urbanization on stream ecosystems. Urban watershed best management practices, such as detention ponds, should ease the dramatic increase in flooding caused by urbanization (e.g., Booth and Jackson 1997), although they will not reverse declines in base flow. Establishment of "green spaces" or other types of undeveloped buffer areas at least 50 m wide along streams should also be beneficial. However, even with more environmentally friendly urban development practices, urbanization probably will eventually degrade stream ecosystems once it exceeds a certain threshold level. All the urban best management practices can do is to raise such a threshold level. For the conventional types of urban development that are currently in widespread use, this threshold is between 8% and 12% connected impervious surface. Note that this level of imperviousness corresponds to a suburban rather than a downtown urban landscape. Studies from forested watersheds suggest that better development practices and the establishment of riparian buffers may increase the amount of watershed urbanization that a stream ecosystem can withstand before it becomes degraded (e.g., Steedman 1988, Booth and Jackson 1997). Whether this is the case in agricultural watersheds is as yet unknown. In any event, even under the best-case urban development scenarios, our results and those of previous studies indicate that stream fish communities will decline substantially in quality even while the wa-

tershed remains largely rural in character. Unlike in agricultural landscapes, where implementation of best-management land-use practices can allow for relatively healthy stream fish communities in watersheds that are almost completely farmed (Wang and others 1997, 2000), relatively low levels of watershed urbanization inevitably lead to serious degradation of the fish community.

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federal register

Wednesday
December 8, 1999

Part II

Environmental Protection Agency

40 CFR Parts 9, 122, 123, and 124
National Pollutant Discharge Elimination System—Regulations for Revision of the Water Pollution Control Program Addressing Storm Water Discharges; Final Rule

Report to Congress on the Phase II Storm Water Regulations; Notice

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Parts 9, 122, 123, and 124

[FRL—6470–8]

RIN 2040–AC82

National Pollutant Discharge Elimination System—Regulations for Revision of the Water Pollution Control Program Addressing Storm Water Discharges

AGENCY: Environmental Protection Agency (EPA).

ACTION: Final rule.

SUMMARY: Today's regulations (Phase II) expand the existing National Pollutant Discharge Elimination System (NPDES) storm water program (Phase I) to address storm water discharges from small municipal separate storm sewer systems (MS4s) (those serving less than 100,000 persons) and construction sites that disturb one to five acres. Although these sources are automatically designated by today's rule, the rule allows for the exclusion of certain sources from the national program based on a demonstration of the lack of impact on water quality, as well as the inclusion of others based on a higher likelihood of localized adverse impact on water quality. Today's regulations also exclude from the NPDES program storm water discharges from industrial facilities that have "no exposure" of industrial activities or materials to storm water. Finally, today's rule extends from August 7, 2001 until March 10, 2003 the deadline by which certain industrial facilities owned by small MS4s must obtain coverage under an NPDES permit. This rule establishes a cost-effective, flexible approach for reducing environmental harm by storm water discharges from many point sources of storm water that are currently unregulated.

EPA believes that the implementation of the six minimum measures identified for small MS4s should significantly reduce pollutants in urban storm water compared to existing levels in a cost-effective manner. Similarly, EPA believes that implementation of Best Management Practices (BMP) controls at small construction sites will also result in a significant reduction in pollutant discharges and an improvement in surface water quality. EPA believes this rule will result in monetized financial, recreational and health benefits, as well as benefits that EPA has been unable to monetize. Expected benefits include reduced scouring and erosion of streambeds, improved aesthetic quality of waters, reduced eutrophication of aquatic systems, benefit to wildlife and endangered and threatened species, tourism benefits, biodiversity benefits and reduced costs for siting reservoirs. In addition, the costs of industrial storm water controls will decrease due to the exclusion of storm water discharges from facilities where there is "no exposure" of storm water to industrial activities and materials.

DATES: This regulation is effective on February 7, 2000. The incorporation by reference of the rainfall erosivity factor publication listed in the rule is approved by the Director of the Federal Register as of February 7, 2000. For judicial review purposes, this final rule is promulgated as of 1:00 p.m. Eastern Standard Time, on December 22, 1999 as provided in 40 CFR 23.2.

ADDRESSES: The complete administrative record for the final rule and the ICR have been established under docket numbers W–97–12 (rule) and W–97–15 (ICR), and includes supporting documentation as well as printed, paper versions of electronic comments. Copies of information in the record are available upon request. A reasonable fee may be charged for copying. The record is available for inspection and copying from 9 a.m. to 4 p.m., Monday through Friday, excluding legal holidays, at the Water Docket, EPA, East Tower Basement, 401 M Street, SW, Washington, DC. For access to docket materials, please call 202/260–3027 to schedule an appointment.

FOR FURTHER INFORMATION CONTACT: George Utting, Office of Wastewater Management, Environmental Protection Agency, Mail Code 4203, 401 M Street, SW, Washington, DC 20460; (202) 260–5816; sw2@epa.gov.

SUPPLEMENTARY INFORMATION: Entities potentially regulated by this action include:

Category	Examples of regulated entities
Federal, State, Tribal, and Local Governments.	Operators of small separate storm sewer systems, industrial facilities that discharge storm water associated with industrial activity or construction activity disturbing 1 to 5 acres.
Industry	Operators of industrial facilities that discharge storm water associated with industrial activity.
Construction Activity.	Operators of construction activity disturbing 1 to 5 acres.

This table is not intended to be exhaustive, but rather provides a guide for readers regarding entities likely to be regulated by this action. This table lists the types of entities that EPA is now aware could potentially be regulated by this action. Other types of entities not listed in the table could also be regulated. To determine whether your facility or company is regulated by this action, you should carefully examine the applicability criteria in §§ 122.26(b), 122.31, 122.32, and 123.35 of the final rule. If you have questions regarding the applicability of this action to a particular entity, consult the person listed in the preceding FOR FURTHER INFORMATION CONTACT section.

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including heavy metals, toxics, oil and grease, solvents, nutrients, viruses and bacteria into receiving waterbodies. The NURP study, discussed earlier, found that pollutant levels from illicit discharges were high enough to significantly degrade receiving water quality and threaten aquatic, wildlife, and human health. The study noted particular problems with illicit discharges of sanitary wastes, which can be directly linked to high bacterial counts in receiving waters and can be dangerous to public health.

Because illicit discharges to MS4s can create severe widespread contamination and water quality problems, several municipalities and urban counties performed studies to identify and eliminate such discharges. In Michigan, the Ann Arbor and Ypsilanti water quality projects inspected 660 businesses, homes, and other buildings and identified 14 percent of the buildings as having improper storm sewer drain connections. The program assessment revealed that, on average, 60 percent of automobile-related businesses, including service stations, automobile dealerships, car washes, body shops, and light industrial facilities, had illicit connections to storm sewer drains. The program assessment also showed that a majority of the illicit discharges to the storm sewer system resulted from improper plumbing and connections, which had been approved by the municipality when installed (Washtenaw County Statutory Drainage Board. 1987. Huron River Pollution Abatement Program).

In addition, an inspection of urban storm water outfalls draining into Inner Grays, Washington, indicated that 32 percent of these outfalls had dry weather flows. Of these flows, 21 percent were determined to have pollutant levels higher than the pollutant levels expected in typical urban storm water runoff characterized in the NURP study (U.S. EPA. 1993. *Investigation of Inappropriate Pollutant Entries Into Storm Drainage Systems—A User's Guide.* EPA 600/R–92/238. Office of Research and Development. Washington, DC). That same document reports a study in Toronto, Canada, that found that 59 percent of outfalls from the MS4 had dry-weather flows. Chemical tests revealed that 14 percent of these dry-weather flows were determined to be grossly polluted.

Inflows from aging sanitary sewer collection systems are one of the most serious illicit discharge-related problems. Sanitary sewer systems frequently develop leaks and cracks, resulting in discharges of pollutants to receiving waters through separate storm sewers. These pollutants include sanitary waste and materials from sewer main construction (e.g., asbestos cement, brick, cast iron, vitrified clay). Municipalities have long recognized the reverse problem of storm water infiltration into sanitary sewer collection systems; this type of infiltration often disrupts the operation of the municipal sewage treatment plant.

The improper disposal of materials is another illicit discharge-related problem that can result in contaminated discharges from separate storm sewer systems in two ways. First, materials may be disposed of directly in a catch basin or other storm water conveyance. Second, materials disposed of on the ground may either drain directly to a storm sewer or be washed into a storm sewer during a storm event. Improper disposal of materials to street catch basins and other storm sewer inlets often occurs when people mistakenly believe that disposal to such areas is an environmentally sound practice. Part of the confusion may occur because some areas are served by combined sewer systems, which are part of the sanitary sewer collection system, and people assume that materials discharged to a catch basin will reach a municipal sewage treatment plant. Materials that are commonly disposed of improperly include used motor oil; household toxic materials; radiator fluids; and litter, such as disposable cups, cans, and fast-food packages. EPA believes that there has been increasing success in addressing these problems through initiatives such as storm drain stenciling and recycling programs, including household hazardous waste special collection days.

Programs that reduce illicit discharges to separate storm sewers have improved water quality in several municipalities. For example, Michigan's Huron River Pollution Abatement Program found the elimination of illicit connections caused a measurable improvement in the water quality of the Washtenaw County storm sewers and the Huron River (Washtenaw County Statutory Drainage Board, 1987). In addition, an illicit detection and remediation program in Houston, Texas, has significantly improved the water quality of Buffalo Bayou. Houston estimated that illicit flows from 132 sources had a flow rate as high as 500 gal/min. Sources of the illicit discharges included broken and plugged sanitary sewer lines, illicit connections from sanitary lines to storm sewer lines, and floor drain connections (Glanton, T., M.T. Garrett, and B. Goloby. 1992. The Illicit Connection: Is It the Problem? *Wat. Env. Tech.* 4(9):63–8).

3. Construction Site Runoff

Storm water discharges generated during construction activities can cause an array of physical, chemical, and biological water quality impacts. Specifically, the biological, chemical, and physical integrity of the waters may become severely compromised. Water quality impairment results, in part, because a number of pollutants are preferentially absorbed onto mineral or organic particles found in fine sediment. The interconnected process of erosion (detachment of the soil particles), sediment transport, and delivery is the primary pathway for introducing key pollutants, such as nutrients (particularly phosphorus), metals, and organic compounds into aquatic systems (Novotny, V. and G. Chesters. 1989. "Delivery of Sediment and Pollutants from Nonpoint Sources: A Water Quality Perspective." *Journal of Soil and Water Conservation*, 44(6):568–76). Estimates indicate that 80 percent of the phosphorus and 73 percent of the Kjeldahl nitrogen in streams is associated with eroded sediment (U.S. Department of Agriculture. 1989. "The Second RCA Appraisal, Soil, Water and Related Resources on Nonfederal Land in the United States, Analysis of Condition and Trends." Cited in Fennessey, L.A.J., and A.R. Jarrett. 1994. "The Dirt in a Hole: a Review of Sedimentation Basins for Urban Areas and Construction Sites." *Journal of Soil and Water Conservation*, 49(4):317–23).

In watersheds experiencing intensive construction activity, the localized impacts of water quality may be severe because of high pollutant loads, primarily sediments. Siltation is the largest cause of impaired water quality in rivers and the third largest cause of impaired water quality in lakes (U.S. EPA, 1998). The 1996 305(b) report also found that construction site discharges were a source of pollution in: 6 percent of impaired rivers; 11 percent of impaired lakes, ponds, and reservoirs; and 11 percent of impaired estuaries. Introduction of coarse sediment (coarse sand or larger) or a large amount of fine sediment is also a concern because of the potential of filling lakes and reservoirs (along with the associated remediation costs for dredging), as well as clogging stream channels (e.g., Paterson, R.G., M.I. Luger, E.J. Burby, E.J. Kaiser, H.R. Malcolm, and A.C. Beard. 1993. "Costs and Benefits of Urban Erosion and Sediment Control: North Carolina Experience." *Environmental Management* 17(2):167–78). Large inputs of coarse sediment into

stream channels initially will reduce stream depth and minimize habitat complexity by filling in pools (U.S. EPA. 1991. *Monitoring Guidelines to Evaluate Effects of Forestry Activities on Streams in the Pacific Northwest and Alaska.* EPA 910/9–91–001. Seattle, WA). In addition, studies have shown that stream reaches affected by construction activities often extend well downstream of the construction site. For example, between 4.8 and 5.6 kilometers of stream below construction sites in the Patuxent River watershed were observed to be impacted by sediment inputs (Fox, H.L. 1974. "Effects of Urbanization on the Patuxent River, with Special Emphasis on Sediment Transport, Storage, and Migration." Ph.D. dissertation. Johns Hopkins University, Baltimore, MD. As Cited in Klein, R.D. 1979. "Urbanization and Stream Quality Impairment." *Water Resources Bulletin* 15(4): 948–63).

A primary concern at most construction sites is the erosion and transport process related to fine sediment because rain splash, rills (i.e., a channel small enough to be removed by normal agricultural practices and typically less than 1-foot deep), and sheetwash encourage the detachment and transport of this material to waterbodies (Storm Water Quality Task Force. 1993. *California Storm Water Best Management Practice Handbooks—Construction Activity.* Oakland, CA: Blue Print Service). Construction sites also can generate other pollutants associated with onsite wastes, such as sanitary wastes or concrete truck washout.

Although streams and rivers naturally carry sediment loads, erosion from construction sites and runoff from developed areas can elevate these loads to levels well above those in undisturbed watersheds. It is generally acknowledged that erosion rates from construction sites are much greater than from almost any other land use (Novotny, V. and H. Olem. 1994. *Water Quality: Prevention, Identification, and Management of Diffuse Pollution.* New York: Van Nostrand Reinhold). Results from both field studies and erosion models indicate that erosion rates from construction sites are typically an order of magnitude larger than row crops and several orders of magnitude greater than rates from well-vegetated areas, such as forests or pastures (USDA. 1970. "Controlling Erosion on Construction Sites." *Agriculture Information Bulletin,* Washington, DC; Meyer, L.D., W.H. Wischmeier, and W.H. Daniel. 1971. "Erosion, Runoff and Revegetation of Denuded Construction Sites." *Transactions of the ASAE* 14(1):138–41; Owen, O.S. 1975. *Natural Resource Conservation.* New York: MacMillan. As cited in Paterson, et al., 1993).

A recent review of the efficiency of sediment basins indicated that inflows from 12 construction sites had a mean TSS concentration of about 4,500 mg/L (Brown, W.E. 1997. "The Limits of Settling." Technical Note No. 83. *Watershed Protection Techniques* 2(3)). In Virginia, suspended sediment concentrations from housing construction sites were measured at 500–3,000 mg/L, or about 40 times larger than the concentrations from already-developed urban areas (Kuo, C.Y. 1976. "Evaluation of Sediment Yields Due to Urban Development." Bulletin No. 98. Virginia Water Resources Research Center, Virginia Polytechnic Institute and State University, Blacksburg, VA).

Similar impacts from storm water runoff have been reported in a number of other studies. For example, Daniel, et al., monitored three residential construction sites in southeastern Wisconsin and determined that annual sediment yields were more than 19 times the yields from agricultural areas (Daniel, T.C., D. McGuire, D. Stoffel, and B. Miller. 1979. "Sediment and Nutrient Yield from Residential Construction Sites" *Journal of Environmental Quality* 8(3):304–08). Daniel, et al., identified total storm runoff, followed by peak storm runoff, as the most influential factors controlling the sediment loadings from residential construction sites. Daniel, et al., also found that suspended sediment concentrations were 15,000–20,000 mg/L in moderate events and up to 60,000 mg/L in larger events.

Wolman and Schick (Wolman, M.G. and A.P. Schick. 1967. "Effects of Construction on Fluvial Sediment, Urban and Suburban Areas of Maryland." *Water Resources Research* 3(2): 451–64) studied the impacts of development on fluvial systems in Maryland and determined that sediment yields in areas undergoing construction were 1.5 to 75 times greater than detected in natural or agricultural catchments. The authors summarize the potential impacts of construction on sediment yields by stating that "the equivalent of many decades of natural or even agricultural erosion may take place during a single year from areas cleared for construction" (Wolman and Schick, 1967).

A number of studies have examined the effects of road construction on erosion rates and sediment yields. A highway construction project in West Virginia disturbed only 4.2 percent of a 4.72-square-mile basin, but resulted in a three-fold increase in suspended sediment yields (Downs, S.C. and D.H. Appel. 1986. *Progress Report on the Effects of Highway Construction on Suspended-Sediment Discharge in the Coal River and Trace Fork, West Virginia,* 1975–81. USGS Water Resources Investigations Report 84–4275. Charlestown, WV). During the largest storm event, it was estimated that 80 percent of the sediment in the stream originated from the construction site. As is often the case, the increase in suspended sediment load could not be detected further downstream, where the drainage area was more than 50 times larger (269 square miles).

Another study evaluated the effect of 290 acres of highway construction on watersheds ranging in size from 5 to 38 square miles. Suspended sediment loads in the smallest watershed increased by 250 percent, and the estimated sediment yield from the construction area was 37 tons/acre during a 2-year period (Hainly, R.A. 1980. *The Effects of Highway Construction on Sediment Discharge into Blockhouse Creek and Stream Valley Run, Pennsylvania.* USGS Water Resources Investigations Report 80–68. Harrisburg, PA). A more recent study in Hawaii showed that highway construction increased suspended sediment loads by 56 to 76 percent in three small (1 to 4 square mile) basins (Hill, B.R. 1996. *Streamflow and Suspended-Sediment Loads Before and During Highway Construction, North Halawa, Haiku, and Kamooalii Drainage Basins, Oahu, Hawaii, 1983–91.* USGS Water Resources Investigations Report 96–4259. Honolulu, HI). A 1970 study determined that sediment yields from construction areas can be as much as 500 times the levels detected in rural areas (National Association of Counties Research Foundation. 1970. *Urban Soil Erosion and Sediment Control.* Water Pollution Control Research Series, Program #15030 DTL. Federal Water Quality Administration, U.S. Department of Interior. Washington, DC)

Yorke and Herb (Yorke, T.H., and W.J. Herb. 1978. *Effects of Urbanization on Streamflow and Sediment Transport in the Rock Creek and Anacostia River Basins, Montgomery County, Maryland, 1962–74.* USGS Professional Paper 1003, Washington, DC) evaluated nine subbasins in the Maryland portion of the Anacostia watershed for more than a decade in an effort to define the impacts of changing land use/land cover on sediment in runoff. Average annual suspended sediment yields for construction sites ranged from 7 to 100 tons/acre. Storm water discharges from construction sites that occur when the land area is disturbed (and prior to

surface stabilization) can significantly impact designated uses. Examples of designated uses include public water supply, recreation, and propagation of fish and wildlife. The siltation process described previously can threaten all three designated uses by (1) depositing high concentrations of pollutants in public water supplies; (2) decreasing the depth of a waterbody, which can reduce the volume of a reservoir or result in limited use of a water body by boaters, swimmers, and other recreational enthusiasts; and (3) directly impairing the habitat of fish and other aquatic species, which can limit their ability to reproduce.

Excess sediment can cause a number of other problems for waterbodies. It is associated with increased turbidity and reduced light penetration in the water column, as well as more long-term effects associated with habitat destruction and increased difficulty in filtering drinking water. Numerous studies have examined the effect that excess sediment has on aquatic ecosystems. For example, sediment from road construction activity in Northern Virginia reduced aquatic insect and fish communities by up to 85 percent and 40 percent, respectively (Reed, J.R. 1997. "Stream Community Responses to Road Construction Sediments." Bulletin No. 97. Virginia Water Resources Research Center, Virginia Polytechnic Institute, Blacksburg, VA. As cited in Klein, R.D. 1990. *A Survey of Quality of Erosion and Sediment Control and Storm Water Management in the Chesapeake Bay Watershed*. Annapolis, MD: Chesapeake Bay Foundation). Other studies have shown that fine sediment (fine sand or smaller) adversely affects aquatic ecosystems by reducing light penetration, impeding sight-feeding, smothering benthic organisms, abrading gills and other sensitive structures, reducing habitat by clogging interstitial spaces within a streambed, and reducing the intergravel dissolved oxygen by reducing the permeability of the bed material (Everest, F.H., J.C. Beschta, K.V. Scrivener, J.R. Koski, J.R. Sedell, and C.J. Cederholm. 1987. "Fine Sediment and Salmonid Production: A Paradox." *Streamside Management: Forestry and Fishery Interactions*, Contract No. 57, Institute of Forest Resources, University of Washington, Seattle, WA). For example, 4.8 and 5.6 kilometers of stream below construction sites in the Patuxent River watershed in Maryland were found to have fine sediment amounts 15 times greater than normal (Fox, 1974. As cited in Klein, 1979). Benthic organisms in the streambed can be smothered by sediment deposits, causing changes in aquatic flora and fauna, such as fish species composition (Wolman and Schick, 1967). In addition, the primary cause of coral reef degradation in coastal areas is attributed to land disturbances and dredging activities due to urban development (Rogers, C.S. 1990. "Responses of Coral Reefs and Reef Organizations to Sedimentation." *Marine Ecology Progress Series*, 62:185–202).

EPA believes that the water quality impact from small construction sites is as high as or higher than the impact from larger sites on a per acre basis. The concentration of pollutants in the runoff from smaller sites is similar to the concentrations in the runoff from larger sites. The proportion of sediment that makes it from the construction site to surface waters is likely the same for larger and smaller construction sites in urban areas because the runoff from either site is usually delivered directly to the storm drain network where there is no opportunity for the sediment to be filtered out.

The expected contribution of total sediment yields from small sites depends, in part, on the extent to which erosion and sedimentation controls are being applied. Because current storm water regulations are more likely to require erosion and sedimentation controls on larger sites in urban areas, smaller construction sites that lack such programs are likely to contribute a disproportionate amount of the total sediment from construction activities (MacDonald, L.H. 1997. *Technical Justification for Regulating Construction Sites 1–5 Acres in Size*. Unpublished report submitted to U.S. EPA, Washington, DC). Smaller construction sites are less likely to have an effective plan to control erosion and sedimentation, are less likely to properly implement and maintain their plans, and are less likely to be inspected (Brown, W. and D. Caraco. 1997. *Controlling Storm Water Runoff Discharges from Small Construction Sites: A National Review*. Submitted to Office of Wastewater Management, U.S. EPA, Washington, DC., by the Center for Watershed Protection, Silver Spring, MD). The proportion of sediment that makes it from the construction site to surface waters is likely the same for larger and smaller construction sites in urban areas because the runoff from either site is usually delivered directly to the storm drain network, where there is no opportunity for the sediment to be filtered out.

To confirm its belief that sediment yields from small sites are as high as or higher than the 20 to 150 tons/acre/year measured from larger sites, EPA gave a grant to the Dane County, Wisconsin Land Conservation Department, in cooperation with the USGS, to evaluate sediment runoff from two small construction sites. The first was a 0.34 acre residential lot and the second was a 1.72 acre commercial office development. Runoff from the sites was channeled to a single discharge point for monitoring. Each site was monitored before, during, and after construction.

The Dane County study found that total solids concentrations from these small sites are similar to total solids concentrations from larger construction sites. Results show that for both of the study sites, total solids and suspended solids concentrations were significantly higher during construction than either before or after construction. For example, preconstruction total solids concentrations averaged 642 mg/L during the period when ryegrass was established, active construction total solids concentrations averaged 2,788 mg/L, and post-construction total solids concentrations averaged 132 mg/L (on a pollutant load basis, this equaled 7.4 lbs preconstruction, 35 lbs during construction, and 0.6 lbs post-construction for total solids). While this site was not properly stabilized before construction, after construction was complete and the site was stabilized, post-construction concentrations were more than 20 times less than during construction. The results were even more dramatic for the commercial site. The commercial site had one preconstruction event, which resulted in total solids concentrations of 138 mg/L, while active construction averaged more than 15,000 mg/L and post-construction averaged only 200 mg/L (on a pollutant load basis, this equaled 0.3 lbs preconstruction, 490 lbs during construction, and 13.4 lbs post-construction for total solids). The active construction period resulted in more than 75 times more sediment than either before or after construction (Owens, D.W., P. Jopke, D.W. Hall, J. Balousek and A. Roa. 1999. "Soil Erosion from Small Construction Sites." Draft USGS Fact Sheet. USGS and Dane County Land Conservation Department, WI). The total solids concentrations from these small sites in Wisconsin are similar to total solids concentrations from larger construction sites. For example, a study evaluating the effects of highway construction in West Virginia found that a small storm produced a sediment concentration of 7,520 mg/L (Downs and Appel, 1986).

One important aspect of small construction sites is the number of small sites relative to larger construction sites

and total land area within the watershed. Brown and Caraco surveyed 219 local jurisdictions to assess erosion and sediment control (ESC) programs. Seventy respondents provided data on the number of ESC permits for construction sites smaller than 5 acres. In 27 cases (38 percent of the respondents), more than three-quarters of the permits were for sites smaller than 5 acres; in another 18 cases (26 percent), more than half of the permits were for sites smaller than 5 acres.

In addition, data on the total acreage disturbed by smaller construction sites have been collected recently in two States (MacDonald, 1997). The most recent and complete data set is the listing of the disturbed area for each of the 3,831 construction sites permitted in North Carolina for 1994–1995 and 1995–1996. Nearly 61 percent of the sites that were 1 acre or larger were between 1.0 and 4.9 acres in size. This proportion was consistent between years. Data showed that this range of sites accounted for 18 percent of the total area disturbed by construction. The values showed very little variation between the 2 years of data. The total disturbed area for all sites over this 2-year period was nearly 33,000 acres, or about 0.1 percent of the total area of North Carolina.

EPA estimates that construction sites disturbing greater than 5 acres disturb 2.1-million acres of land (78.1 percent of the total) while sites disturbing between 1 and 5 acres of land disturb 0.5-million acres of land (19.4 percent). The remaining sites on less than 1 acres of land disturb 0.07-million acres of land (only 2.5 percent of the total). Given the high erosion rates associated with most construction sites, small construction sites can be a significant source of water quality impairment, particularly in small watersheds that are undergoing rapid development. Exempting sites under 1 acre will exclude only about 2.5 percent of acreage from program coverage, but will exclude a far higher number of sites, approximately 25 percent.

Several studies have determined that the most effective construction runoff control programs rely on local plan review and field enforcement (Paterson, R. G. 1994. "Construction Practices: the Good, the Bad, and the Ugly." *Watershed Protection Techniques* 1(3)). In his review, Paterson suggests that, given the critical importance of field implementation of erosion and sediment control programs and the apparent shortcomings that exist, much more focus should be given to plan implementation.

Several commenters disputed the data presented in the proposed rule for storm water discharges from smaller construction sites. One commenter stated that EPA has not adequately explained the basis for permitting construction activity down to 1 disturbed acre. Another commenter stated that EPA did not present sufficient data on water quality impacts from construction sites disturbing less than 5 acres.

EPA believes that the data presented above sufficiently support nationwide designation of storm water discharges from construction activity disturbing more than 1 acre. Based on total disturbed land area within a watershed, the cumulative effects of numerous small construction sites can have impacts similar to those of larger sites in a particular area. In addition, waivers for storm water discharges from smaller construction activity will exclude sites not expected to impair water quality. EPA will continue to collect water quality data on construction site storm water runoff.

C. Statutory Background

In 1972, Congress enacted the CWA to prohibit the discharge of any pollutant to waters of the United States from a point source unless the discharge is authorized by an NPDES permit. Congress added CWA section 402(p) in 1987 to require implementation of a comprehensive program for addressing storm water discharges. Section 402(p)(1) required EPA or NPDES-authorized States or Tribes to issue NPDES permits for the following five classes of storm water discharges composed entirely of storm water ("storm water discharges") specifically listed under section 402(p)(2):

(A) a discharge subject to an NPDES permit before February 4, 1987

(B) a discharge associated with industrial activity

(C) a discharge from a municipal separate storm sewer system serving a population of 250,000 or more

(D) a discharge from a municipal separate storm sewer system serving a population of 100,000 or more but less than 250,000

(E) a discharge that an NPDES permitting authority determines to be contributing to a violation of a water quality standard or a significant contributor of pollutants to the waters of the United States.

Section 402(p)(3)(A) requires storm water discharges associated with industrial activity to meet all applicable provisions of section 402 and section 301 of the CWA, including technology-based requirements and any more stringent requirements necessary to meet water quality standards. Section 402(p)(3)(B) establishes NPDES permit standards for discharges from municipal separate storm sewer systems, or MS4s. NPDES permits for discharges from MS4s (1) may be issued on a system or jurisdiction-wide basis, (2) must include a requirement to effectively prohibit non-storm water discharges into the storm sewers, and (3) must require controls to reduce pollutant discharges to the maximum extent practicable, including best management practices, and other provisions as the Administrator or the States determine to be appropriate for the control of such pollutants. At this time, EPA determines that water quality-based controls, implemented through the iterative processes described today are appropriate for the control of such pollutants and will result in reasonable further progress towards attainment of water quality standards. See sections II.L and II.H.3 of the preamble.

In CWA section 402(p)(4), Congress established statutory deadlines for the initial steps in implementing the NPDES program for storm water discharges. This section required development of NPDES permit application regulations, submission of NPDES permit applications, issuance of NPDES permits for sources identified in section 402(p)(2), and compliance with NPDES permit conditions. In addition, this section required industrial facilities and large MS4s to submit NPDES permit applications for storm water discharges by February 4, 1990. Medium MS4s were to submit NPDES permit applications by February 4, 1992. EPA and authorized NPDES States were prohibited from requiring an NPDES permit for any other storm water discharges until October 1, 1994.

Section 402(p)(5) required EPA to conduct certain studies and submit a report to Congress. This requirement is discussed in the following section.

Section 402(p)(6) requires EPA, in consultation with States and local officials, to issue regulations for the designation of additional storm water discharges to be regulated to protect water quality. It also requires EPA to extend the existing storm water program to regulate newly designated sources. At a minimum, the extension must establish (1) priorities, (2) requirements for State storm water management programs, and (3) expeditious deadlines. Section 402(p)(6) specifies that the program may include performance standards, guidelines, guidance, and management practices and treatment requirements, as

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Table 1: Big Indian (Eastern) Surface Soil Characteristics

							----- Construction & Maintenance Risk ------		
DEIS Soils Code	Delaware County Soils Code	% of Eastern Site (& Acres)	Slope (%)	Hydro-logic Group	Erosion Factor (Kf)	Runoff Class	Dwellings with (w/) or without (w/o) Basements	Local Roads & Streets	Lawns, Fairways, & Land-scaping
EkD	EdD	4.2 (52)	15-25	C	.32	H	Severe	Severe	Severe
HrF	HcF	26.8 (327)	35-70	C or C/D	.32	HV	Severe	Severe	Severe
HvD	HcE	1.4 (17)	15-35	C/D	.32	HV - H	Severe	Severe	Severe
LeB	LhB or LkC	1.6 (20)	3-8	C	.28-.32	M	w/ Severe, w/o Moderate	Moderate	Moderate
LeC	LhC or LkC	5.2 (64)	8-15	C	.28-.32	H	w/ Severe, w/o Moderate	Moderate	Moderate
LeD	LhD or LkE	2.8 (35)	15-25	C	.28-.32	HV	Severe	Severe	Severe
LeF	LhE or LkF	5.4 (66)	>25	C	.28-.32	HV	Severe	Severe	Severe
VeF	ElF	2.0 (24)	35-70	C or C/D	.32	H	Severe	Severe	Severe
VhD	HcE	5.5 (68)	15-35	C/D	.32	HV - H	Severe	Severe	Severe
VhF	HcF	10.3 (126)	35-70	C or C/D	.32	HV - H	Severe	Severe	Severe
VyB	VlB	15.0 (183)	2-8	C	.28-.32	M	w/ Severe, w/o Moderate	Moderate	Moderate
VyC	VlC	11.7 (142)	8-15	C	.28-.32	M	w/ Severe, w/o Moderate	Moderate	Moderate
VyD	VlD	7.0 (85)	15-25	C	.28-.32	H	w/ Severe, w/o Moderate	Severe	Severe
Total		98.9 (1,209)							

Table 2: Wildacres (Western) Surface Soil Characteristics

DEIS Soils Code	Delaware County Soils Code	% of Western Project Site (& Acres)	Slope (%)	Hydro-logic Group	Erosion Factor (Kf)	Runoff Class	Dwellings with (w/) or without (w/o) Basements	Local Roads & Streets	Lawns, Fairways, & Land-scaping
							------ Construction & Maintenance Risk ------		
EkB	None	1.0 (7)							
EkC	EdC	3.5 (26)	8-15	C	.32	M	Moderate	Moderate	Moderate
EkD	EdD	3.4 (25)	15-25	C	.32	H	Severe	Severe	Severe
HrF	HcF	22.3 (160)	35-70	C or C/D	.32	HV	Severe	Severe	Severe
HvF	HcF	3.9 (28)	35-70	C or C/D	.32	HV-H	Severe	Severe	Severe
LeC	LhC or LkC	2.8 (20)	8-15	C	.28-.32	H	w/ Severe, w/o Moderate	Moderate	Moderate
LeD	LhD or LkE	3.7 (27)	15-25	C	.28-.32	HV	Severe	Severe	Severe
LeF	LhE or LkF	2.2 (16)	>25	C	.28-.32	HV	Severe	Severe	Severe
OsB	OeB and No	1.4 (10)	0-8	C	.24-.32	HV	Severe	Severe	Severe
VeD	ElE	1.7 (12)	15-35	C	.28-.32	H	Severe	Severe	Severe
VeF	EIF	2.4 (17)	35-70	C or C/D	.28-.32	H	Severe	Severe	Severe
VhC	HcC	5.1 (37)	2-15	C or C/D	.32	H-L	Severe/Moderate	Sev/Mod	Sev/Mod
VhD	HcE	17.3 (125)	15-35	C/D	.32	HV-H	Severe	Severe	Severe
VhF	HcF	10.4 (75)	35-70	C or C/D	.32	HV-H	Severe	Severe	Severe
VyB	VlB	2.4 (17)	2-8	C	.28-.32	M	w/ Severe, w/o Moderate	Moderate	Moderate
VyC	VlC	5.9 (43)	8-15	C	.28-.32	M	w/ Severe, w/o Moderate	Moderate	Moderate
VyD	VlD	2.5 (18)	15-25	C	.28-.32	H	w/ Severe, w/o Moderate	Severe	Severe
WlB	WmB or WnC	3.9 (28)	3-8	C	.28-.32	M	Severe	Severe	Severe
WlC	WmC or WnC	2.2 (15)	8-15	C	.28-.32	M	Severe	Severe	Severe
Total		98.0 (707)							

Table 3: Big Indian (Eastern) Surface Soils - Characteristics of Areas Disturbed for Structures

					---- Construction & Maintenance Risk ----		
DEIS Soils Code	Delaware County Soils Code	Acres of Eastern Project Site	Slope (%)	Rating Class With (w/) or Without (w/o) Basement	Slope	Depth to Hard Rock	Depth to Saturated Zone
EkD	EdD	0.3	15-25	Severe	Yes		
HrF	HcF	2.0	35-70	Severe	Yes	Yes	
HvD	HcE	0.4	15-35	Severe	Yes	Yes	
LeB	LhB or LkC	1.1	3-8	w/ Severe, w/o Moderate			Yes
LeC	LhC or LkC	0.3	8-15	w/ Severe, w/o Moderate	Yes		Yes
LeD	LhD or LkE	2.2	15-25	Severe	Yes		Yes
VhD	HcE	3.9	15-35	Severe	Yes	Yes	
VhF	HcF	1.0	35-70	Severe	Yes	Yes	
VyB	VlB	0.2	2-8	w/ Severe, w/o Moderate		Yes	
VyC	VlC	1.6	8-15	w/ Severe, w/o Moderate	Yes	Yes	
VyD	VlD	0.8	15-25	Severe	Yes	Yes	
Total		14.0					

Table 4: Wildacres (Western) Surface Soils - Characteristics of Areas Disturbed for Structures

					--- Construction & Maintenance Risk ---		
DEIS Soils Code	Delaware County Soils Code	Acres of Western Project Site	Slope (%)	Rating Class With (w/) or Without (w/o) Basement	Slope	Depth to Hard Rock	Depth to Saturated Zone
EkB	None	0.1					
EkC	EdC	0.2	8-15	Moderate	Yes		
HrF	HcF	1.7	35-70	Severe	Yes	Yes	
LeB	LhB or LkC	0.5	3-8	w/Severe, w/o Moderate			Yes
LeC	LhC or LkC	0.6	8-15	w/ Severe, w/o Moderate	Yes		Yes
VeF	ElF	0.1	35-70	Severe	Yes	Yes	
VhC	HcC	0.7	2-15	w/ Severe, w/o Moderate	Yes	Yes	
VhD	HcE	2.0	15-35	Severe	Yes	Yes	
VhF	HcF	0.2	35-70	Severe	Yes	Yes	
VyB	VlB	2.2	2-8	w/ Severe, w/o Moderate		Yes	
VyC	VlC	0.4	8-15	w/ Severe, w/o Moderate	Yes	Yes	
VyD	VlD	0.8	15-25	Severe	Yes	Yes	
WlB	WmB or WnC	0.7	3-8	Severe			Yes
WlC	WmC or WnC	0.3	8-15	Severe	Yes		Yes
Total		10.5					

Table 5: Big Indian (Eastern) Surface Soils - Characteristics of Areas Disturbed for Roads and Parking Lots

					---------- Construction & Maintenance Risk ----------			
DEIS Soils Code	Delaware County Soils Code	Acres of Western Project Site	Slope (%)	Rating Class Roads and Parking Lots	Slope	Depth to Saturated Zone	Frost Action	Depth to Hard Rock
EkD	EdD	2.9	15-25	Severe	Yes		Yes	
HrF	HcF	13.4	35-70	Severe	Yes		Yes	Yes
LeB	LhB or LkC	0.6	3-8	Moderate		Yes	Yes	
LeC	LhC or LkC	2.0	8-15	Moderate	Yes	Yes	Yes	
LeD	LhD or LkE	1.1	15-25	Severe or Moderate	Yes	Yes	Yes	
LeF	LhE or LkF	0.6	>25	Severe	Yes	Yes	Yes	
VhD	HcE	3.1	15-35	Severe	Yes		Yes	Yes
VhF	HcF	4.4	35-70	Severe	Yes		Yes	Yes
VyB	VlB	2.2	3-8	Moderate			Yes	Yes
VyC	VlC	5.9	8-15	Moderate	Yes		Yes	Yes
VyD	VlD	0.5	15-25	Severe	Yes		Yes	Yes
Total		36.7						

Table 6: Wildacres (Western) Surface Soils - Characteristics of Areas Disturbed for Roads and Parking Lots

					---------- Construction & Maintenance Risk ----------			
DEIS Soils Code	Delaware County Soils Code	Acres of Western Project Site	Slope (%)	Rating Class Roads and Parking Lots	Slope	Depth to Saturated Zone	Frost Action	Depth to Hard Rock
EkB	None	0.3						
EkC	EdC	0.6	8-15	Moderate	Yes		Yes	
EkD	EdD	0.2	15-25	Severe	Yes		Yes	
HrF	HcF	2.2	35-70	Severe	Yes		Yes	Yes
HvF	HcF	0.9	35-70	Severe	Yes		Yes	Yes
LeB	LhB or LkC	0.9	3-8	Moderate		Yes	Yes	
LeC	LhC or LkC	1.2	8-15	Moderate	Yes	Yes	Yes	
LeD	LhD or LkE	0.2	15-25	Severe or Moderate	Yes	Yes	Yes	
OsB	OeB and No	1.6	0-8	Severe		Yes	Yes	
OsC	OeC and No	0.4	8-15	Severe		Yes	Yes	
VhC	HcC	1.8	2-15	Severe/Moderate	Yes		Yes	Yes
VhD	HcE	3.6	15-35	Severe	Yes		Yes	Yes
VhF	HcF	0.4	35-70	Severe	Yes		Yes	Yes
VyB	VlB	1.7	2-8	Moderate			Yes	Yes
VyC	VlC	3.0	8-15	Moderate	Yes		Yes	Yes
VyD	VlD	1.3	15-25	Severe	Yes		Yes	Yes
WlB	WmB or WnC	3.5	3-8	Severe/Severe-Mod		Yes	Yes	
WlC	WmC or WnC	0.8	8-15	Severe/Severe-Mod	Yes	Yes	Yes	
Total		24.6						

Table 7: Big Indian (Eastern) Surface Soils - Characteristics of Areas Disturbed for Golf Fairways, Lawns, and Landscaping

					Construction & Maintenance Risk					
DEIS Soils Code	Delaware County Soils Code	Acres of Eastern Project Site	Slope (%)	Rating Class Fairways and Lawns	Slope	Droughty	Depth to Saturated Zone	Depth to Bedrock	Gravel Content	Content of Large Stones
EkC	EdC	0.2	8-15	Moderate	Yes					
EkD	EdD	20.4	15-25	Severe	Yes					
HrF	HcF	64.3	35-70	Severe	Yes	Yes		Yes	Yes	Yes
HvD	HcE	1.8	15-35	Severe	Yes	Yes		Yes	Yes	Yes
LeB	LhB or LkC	9.1	3-8	Moderate		Yes	Yes		Yes	
LeC	LhC or LkC	14.0	8-15	Moderate	Yes	Yes	Yes		Yes	
LeD	LhD or LkE	4.0	15-25	Severe	Yes	Yes	Yes		Yes	
LeF	LhE or LkF	5.5	>25	Severe	Yes	Yes	Yes		Yes	
TkC	TkC	0.3	8-15	Moderate	Yes	Yes			Yes	
VeD	ElE	0.7	15-35	Severe	Yes					
VeF	ElF	5.8	35-70	Severe	Yes	Yes		Yes	Yes	Yes
VhD	HcE	12.7	15-35	Severe	Yes	Yes		Yes	Yes	Yes
VhF	HcF	30.1	35-70	Severe	Yes	Yes		Yes	Yes	Yes
VyB	VlB	19.5	2-8	Moderate		Yes		Yes	Yes	
VyC	VlC	42.8	8-15	Moderate	Yes	Yes		Yes	Yes	
VyD	VlD	4.0	15-25	Severe	Yes	Yes		Yes	Yes	
Total		235.2								

Table 8: Wildacres (Western) Surface Soils - Characteristics of Areas Disturbed for Golf Fairways, Lawns, and Landscaping

					---------- Construction & Maintenance Risk ----------					
DEIS Soils Code	Delaware County Soils Code	Acres of Western Project Site	Slope (%)	Rating Class Fairways and Lawns	Slope	Droughty	Depth to Saturated Zone	Depth to Bedrock	Gravel Content	Content of Large Stones
EkB	None	5.4								
EkC	EdC	8.9	8-15	Moderate	Yes					
EkD	EdD	3.6	15-25	Severe	Yes					
HrF	HcF	16.3	35-70	Severe	Yes	Yes		Yes	Yes	Yes
HvF	HcF	12.9	35-70	Severe	Yes	Yes		Yes	Yes	Yes
LeB	LhB or LkC	3.4	3-8	Moderate			Yes			
LeC	LhC or LkC	3.1	8-15	Moderate	Yes	Yes	Yes		Yes	
LeD	LhD or LkE	4.9	15-35	Severe	Yes	Yes	Yes		Yes	
OsB	OeB and No	6.0	0-8	Severe		Yes	Yes		Yes	
OsC	OeC and No	0.3	8-15	Severe		Yes	Yes			
VhC	HcC	18.0	2-15	Severe/Moderate	Yes	Yes		Yes	Yes	Yes
VhD	HcE	30.9	15-35	Severe	Yes	Yes		Yes	Yes	Yes
VhF	HcF	1.3	35-70	Severe	Yes	Yes		Yes	Yes	Yes
VyB	VlB	2.8	2-8	Moderate		Yes		Yes	Yes	
VyC	VlC	13.6	8-15	Moderate	Yes	Yes		Yes	Yes	
VyD	VlD	3.8	15-25	Severe	Yes	Yes		Yes	Yes	
WlB	WmB or WnC	19.4	3-8	Moderate		Yes	Yes		Yes	Yes
WlC	WmC or WnC	6.6	8-15	Moderate	Yes	Yes	Yes		Yes	Yes
Total		161.2								

Table 9: Catskill Watershed Surface Soil Characteristics

Soil Types are Listed Alphabetically based on the NYC Watershed Soil Key

DEIS Soils Code	NYC Water-shed Soils Code	Delaware Co. Map Units	% of Catskill Portion of the NYC Watershed	Hydro-logic Group	Erosion Factor (Kf)	Slope (%)	Runoff Class*	----------Construction & Maintenance Risk -------- Dwellings with (w/) or without (w/o) Basements	Local Roads & Streets	Golf Fairways, Lawns & Land-scaping
EkD	EgD	EdD	4.0	C	.32	15-25	H	Severe	Severe	Severe
None	Ff	Ff	1.5	D and B	.15-.32	0-3	HV	Severe	NR	Severe
HrF	HbF	HcF	2.4	C or C/D	.32	35-70	HV	Severe	Severe	Severe
VhC	HcC	HcC	4.8	C or C/D	.32	2-15	H-L	Severe/Moderate	Sev/Mod	Sev/Mod
HvD	HcE	HcE	12.1	C/D	.32	15-35	HV-H	Severe	Severe	Severe
HvF	HcF	HcF	17.4	C or C/D	.32	35-70	HV-H	Severe	Severe	Severe
LeD	LdhD	LhD or LkE	1.8	C	.28-.32	15-25	HV	Severe	Severe	Severe
LeC	LhC	LhC or LkC	1.1	C	.28-.32	8-15	H	w/ Sev, w/o Md	Moderate	Moderate
LeD	LkE	LhD or LkE	7.5	C	.28-.32	15-25	HV	Severe	Severe	Severe
OsB	OfB	OeB and No	2.8	C	.24-.32	2-10	HV	Severe	Severe	Severe
VhC	OrC	HcC	1.5	C/D	.24-.37	2-15	H-L	w/ Sev, w/o S/M	Sev/Mod	Sev/Mod
VhD	OrE	HcE	2.5	C/D	.24-.37	15-35	HV-H	Severe	Sevee	Severe
VhF	OrF	HcF	4.5	C or C/D	.32	35-70	HV-H	Severe	Severe	Severe
W	W	W (water)	2.9							
WlC	WffB	WfC	1.5	C	.28-.43	2-15	M	Severe	Sev/Mod	Moderate
WlB	WmB	WmB or WnC	1.2	C	.28-.32	3-8	M	Severe	Severe	Moderate
WlC	WmC	WmC or WnC	1.2	C	.28-.32	8-15	M	Severe	Severe	Moderate
WlB/ WlC	WnC	WmB or WmC or WnC	5.7	C	.28-.32	3-15	M	Severe	Severe	Moderate
Total			76.4							

Belleayre Soil Key

DEIS Soils Code or MapUnits	Delaware County Soils Code or Map Units	Delaware County Soil Descriptions
EkB	None	
EkC	EdC	Elka Channery Silt Loam, 8 to 15% Slopes
EkD	EdD	Elka Channery Silt Loam, 15 to 25% Slopes
None	Ff	Fluvaquents-Udifluvents Complex, frequently drained
HrF	HcF	Halcott, Mongaup, and Vly Soils, 35 to 70% Slopes
HvF	HcF	Halcott, Mongaup, and Vly Soils, 35 to 70% Slopes
LeB	LhB or	Lewbeach Channery Loam, 3 to 8% Slopes
	LkC	Lewbeach and Lewbath Soils, 3 to 15% Slopes
LeC	LhC or	Lewbeach Channery Loam,8 to 15% Slopes
	LkC	Lewbeach and Lewbath Soils, 3 to 15% Slopes
LeD	LhD or	Lewbeach Channery Loam,15 to 25% Slopes
	LkE	Lewbeach and Lewbath Soils, 15 to 35% Slopes
LeF	LhE or	Lewbeach Channery Loam,25 to 40% Slopes
	LkF	Lewbeach and Lewbath Soils, 35 to 55% Slopes
OsB	OeB and	Onteora Channery Silt Loam, 3 to 8% Slopes
	No	Norchip Silt Loam
OsC	OeC and	Onteora Channery Silt Loam, 8 to 15% Slopes
	No	Norchip Silt Loam
TkB	TkB	Tunkhannock Gravelly Loam, 3 to 8% Slopes
VeD	ElE	Elka-Vly Channery Silt Loams, 15 to 35% Slopes
VeF	ElF	Elka-Vly Channery Silt Loams, 35 to 70% Slopes
VhC	HcC	Halcott, Mongaup, and Vly Soils, 2 to 15% Slopes
VhD	HcE	Halcott, Mongaup, and Vly Soils, 15 to 35% Slopes
VhF	HcF	Halcott, Mongaup, and Vly Soils, 35 to 70% Slopes
VyB	VlB	Vly Channery Silt Loam, 2 to 8% Slopes
VyC	VlC	Vly Channery Silt Loam, 8 to 15% Slopes
VyD	VlD	Vly Channery Silt Loam, 15 to 25% Slopes
W	W	Water
WlB	WmB or	Willowemoc Channery Silt Loam, 3 to 8% Slopes
	WnC	Willowemoc and Willden Soils, 2 to 15% Slopes
WlC	WmC or	Willowemoc Channery Silt Loam, 8 to 15% Slopes
	WnC	Willowemoc and Willden Soils, 2 to 15% Slopes

4

Proposed Belleayre Resort: Economic Impacts and Their Contribution to Impervious Surfaces

Prepared for

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by



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Executive Summary

Staff at the Office of the Watershed Inspector General within the New York State Attorney General's Office is concerned about the potential impacts on water quality of a proposed resort (Belleayre Resort) in Greene, Ulster, and Delaware Counties. In December 2003 the Office asked Dr. Gerrit Knaap of the National Center for Smart Growth Education and Research at the University of Maryland (with the assistance of Terry Moore and others at the consulting firm of ECONorthwest) to review a Draft Environmental Impact Statement (DEIS) for that proposed development. As it relates to the analysis in this report, the concern was that the amount of development that could accompany or follow the resort development could be larger than estimated, and that the additional impervious surface and disturbed land such development would create would have a significant negative impact on water quality in the watershed that serves New York City.

Note also that though impervious surface certainly has a negative impact on water quality, it is not the only way that development can have a negative impact on water quality. Consider the following:

- Development impacts water quality not only by the impervious surface it presents when fully developed, but by the disruption and impaction of soil that occurs during construction, when erosion can be substantial.
- Development means waste water from kitchens and bathrooms gets created and goes somewhere, presumably to be treated at a sewage treatment plant or to be filtered through septic systems. Such treatment may end up discharging into streamwater with some level of contamination.
- Golf courses or other landscaped or crop areas have no impervious surface, but may get treated with fertilizers and pesticides, some of which run off and find their way into streams, lowering water quality. Moreover, the conversion of pristine natural areas to developed open space can cause changes to the ability of the pervious land to rapidly absorb rain, thus increasing runoff.

To address that concern we reviewed and evaluated the estimated economic impacts as reported in the DEIS, adjusted them if we thought adjustment was necessary, looked at the relationship between economic impacts and land development impacts, and estimated how land development would increase the amount of impervious surface and disturbed land. Our analysis has four geographic areas of focus: the state of New York, the *three-county area* of Greene, Ulster, and Delaware counties (whose boundaries meet near the resort area), the *study area*, which is a subset of those three counties (defined by 15 zip codes that cover the Route 28 corridor within the watershed), and an Expanded Study Area employed for an evaluation of cumulative impacts. We divide our estimates into two categories:

- Category 1: Impervious surface and disturbed land that can be linked through standard economic models to the development proposed at the Belleayre Resort.
- Category 2: Impervious surface and disturbed land that might occur in the watershed Enhanced Study Area over the long run. The key point here is that the Belleayre Resort may be at the leading edge of an amount of development that could cause water quality problems.

CATEGORY 1: DIRECT AND INDIRECT ECONOMIC AND DEVELOPMENT IMPACTS

Most of the estimates of economic / employment impacts—whether from the DEIS or from our independent analysis—are generated for an area composed of three counties: Greene, Ulster, and Delaware. Thus, the primary challenge for the analysis is to find credible ways to allocate the three-county employment and development impacts to the Study Area. The Study Area has an estimated population of 13,827. We developed an integrated spreadsheet model with various parameters regarding the percentages of economic impacts that get allocated from the three-county area to the Study Area, and how those employment impacts become land use impacts (total area developed and impervious surface).

Table S-1 presents estimates of new households, employment, acres of development and impervious surfaces (both on and off the resort) for the three counties and the Study Area using parameter values that yield high estimates, low estimates, and our best estimate. High estimates result from parameter values based on assumptions that: (1) a large percentage of newly created employment will occur in the three county and Study Areas, (2) low numbers of employees reside in each household, (3) large numbers of new households need newly constructed housing, (4) newly constructed housing occurs at low densities, and (5) construction of all types yield high levels of impervious surfaces and disturbed land. Low estimates reflect parameter values based on opposite assumptions, and the expected estimates are based on what we considered the most likely parameter values.

Table S-1. Impacts of the direct and indirect economic effects of Belleayre resort on several variables, for land in the three-county area and Study Area, at full operation

Area	Households	Employment	Total Developed Acres	Total Impervious Acres
Three Counties				
Low	648	438	718	130
Expected	900	548	820	205
High	1,042	548	915	266
Study Area				
Low	128	31	598	62
Expected	332	102	657	100
High	479	150	723	142

Source: Calculated by NCSGRE and ECONorthwest.

The DEIS states that the resort will directly create 85 acres of impervious surface, and estimates that all other indirect economic effects may create about another 5 to 10 acres of impervious surface in the *three-county* area. Our estimates of off-site (not on the resort properties) impervious surface caused by the proposed development are greater than those in the DEIS, even under the low estimate.

For our discussion, Category 1 is divided into four types of impacts:

- Direct *economic* impacts,
- Indirect *economic* impacts,
- Direct *development* impacts and
- Secondary *development* impacts.

DIRECT ECONOMIC IMPACTS

CONSTRUCTION

The DEIS estimates that construction activities will generate 264 person-years of employment each year of construction and annual average wages and salaries of $10.14 million. The DEIS further states that construction activity will have a positive, but marginal, effect on the local economy because most of the construction workers will come from outside the local area. In our analysis, we estimate approximately 1,747 jobs and $70.99 million in wages and salaries are directly attributed to spending on building the resort. If we average this economic activity over the eight-year construction period, each year there will be 218 jobs and $8.9 million in wages and salaries. However, for purposes of estimating growth in this report, we accept the developer's projections for jobs and wages.

OPERATIONS

Our analysis calculated that jobs and wages generated by the projected $43.4 million in gross annual revenues was lower than the jobs and wages

reported in the DEIS. We calculated that resort revenues would yield 525 jobs, 42% fewer than the DEIS projects. We calculated that resort revenues would yield $7.75 million dollars in wages, less than half of the wages projected by the DEIS. Our experience suggests that workers in the hotel, food service, and retail industries typically earn less than the DEIS expects them to earn at the Belleayre Resort. However, for purposes of estimating growth in this report, we accept the developer's projections for jobs and wages.

The DEIS considers direct economic impacts of operating the resort as the impacts of gross revenues spent at the resort, that is, jobs and income earned by those employed by the resort. The DEIS fails to include the direct economic impacts stemming from the money that resort visitors spend off-site. The DEIS estimates the visitors will spend $11.8 million off-site during stays at the resort, and uses that information to estimate demand for new buildings. The $11.8 million that visitors are expected to spend each year off-site would create jobs and income, and those effects should have been included in the DEIS. The DEIS does not estimate the number of jobs and wages that spending will generate. The DEIS simply ignores the direct economic impacts of off-site spending. Without such an analysis, the DEIS implicitly assumes that off-site spending by resort visitors will generate no jobs or income.

Our model calculated that the $11.8 million in off-site spending would generate 152 direct jobs, such as people working at restaurants, grocery stores, gas stations, and souvenir shops. The spending would generate $2.12 million in direct wage impacts each year. Most of the direct wage impacts would be located in the service and retail sectors, such as eating and drinking establishments, miscellaneous retail, amusement, and food stores. These are typically lower paying jobs. For instance, the average annual wage for direct hires is approximately $14,000. Because some of these jobs are part-time, that figure cannot be directly translated to an hourly wage.

INDIRECT ECONOMIC IMPACTS

CONSTRUCTION

The DEIS estimates that construction expenditures will generate indirect employment and income of an annual average of 221 person-years of employment each year of construction and annual average wages and salaries of $8.05 million. Our analysis estimated 44% more jobs than the DEIS, or an annual average of 319 jobs and $12.58 million in wages and salaries. In our model, we used a multiplier that accounts for direct, indirect, and induced spending, which may have captured more impacts than the DEIS model.

OPERATIONS

The DEIS estimates the indirect impacts of on-site operations with direct impacts that were later revised upward. The DEIS reports the initial direct

job estimate was 665 full-time equivalents, but the figure was subsequently increased to 747 full-time equivalents, an increase of approximately 12%. The initial direct wage estimate was $18.81 million, but the figure was increased to $20.5 million, or by about 9%. The DEIS did not revise the indirect impact analysis. On that basis alone, even if one accepts all the rest of the analysis, the indirect impacts reported in the DEIS would be underestimated by 9%: indirect jobs would increase from 211 to 237; wages would increase from $7.4 to $8.1 million.

We estimated 309 indirect and induced jobs and $8.2 million in wages. Comparing our job estimates to the adjusted DEIS estimates of 237 indirect jobs and $8.1 million in wages, our indirect job impacts are about 30% greater than those estimated by the DEIS.

The DEIS provides detailed estimates of spending by various visitor groups (hotel visitors, golf county club visitors, etc.), and the amount of spending that occurs off-site. The DEIS does not estimate the indirect economic impacts from such spending. The $11.8 million dollars that visitors are expected to spend off-site will indeed have ripple effects throughout the economy, and those effects should have been included in the DEIS. The DEIS simply ignores the indirect economic impacts of off-site spending. We estimated that off-site spending would indirectly generate 87 jobs.

DIRECT DEVELOPMENT IMPACTS

We accept the DEIS estimates of 573 acres of disturbed area on the project site and 85 acres of impervious surfaces. Our understanding is that the estimate is for the resort at full build out, which occurs in Year 8. Thus, those are the total onsite direct development impacts.

SECONDARY DEVELOPMENT IMPACTS

There are direct economic impacts offsite during operation: people using the resort spend money directly offsite. Arguably that new spending requires new development. The DEIS treats these impacts as secondary development impacts. For this discussion, secondary development impacts include commercial development, seasonal residential development and year-round residential development.

Commercial

The DEIS argues that most new demand will most likely be absorbed by existing businesses or by redevelopment of abandoned or underused sites. We believe that this is unlikely, for several reasons:

- Even in the absence of increased expenditures in a local economy, we have observed that new development occurs to take market share from existing businesses and to meet increasing demand by consumers for selection, convenience, and value.

- Increased traffic and expenditures generated by the proposed resort development will be a strong attractor for entrepreneurs and corporations seeking a place to locate or expand their business.
- The DEIS argues that existing restaurants are likely to meet new demand by increasing table turnover, staying open later, and staying open an additional night. Existing restaurants will meet what demand they can, but the substantial growth in vacationers and demand will encourage entrepreneurs to develop new restaurants in the Study Area.
- The DEIS estimates additional expenditures at eating and drinking places would be more than sufficient to support development of several new restaurants in the impact area.
- The DEIS estimates a level of expenditure on gasoline, oil, and automotive service, that will be sufficient to justify construction of a new gas station.
- New development in response to increased expenditures generated by the resort will want to locate in locations that are visible and conveniently accessible to traffic traveling to and from the resort. This will create strong demand for locations on Highway 28.

The DEIS states that most of the new development will take place within the hamlets and villages. However, new businesses in the impact area will have a strong economic incentive to locate on sites visible and accessible from Highway 28 with the capacity to accommodate the larger stores typical of new commercial development. The local communities will likely face the choice of approving development on Highway 28 outside of the town center or not getting the development at all. Local communities will have incentives to approve such development for the tax revenue such development will provide.

The DEIS fails to include secondary impacts stemming from anything other than the retail sector. However, resort employee and resort visitor spending will affect more than the retail sector.

Seasonal residential demand

Because the resort is adding to the non-wintertime amenities in the Study Area, the resort is expected to increase the attractiveness of the region. The area will become an increasingly attractive option for second homebuyers. However, the DEIS does not attempt to further characterize demand for new seasonal homes. The DEIS does not assess demand that might arise from the three casinos that have been authorized, contemplated expansion of the Belleayre Ski Center, or the post-September 11th demand.

Year-round residential demand

The DEIS concludes that the only source of demand for new year-round homes will stem from the resort's employment of new workers. The project developer has identified 16 to 20 mid- and upper-management positions with

annual wages of $50,000 or more. Those individuals and their families will require year-round housing.

However, the 1,295 new job opportunities near the resort will encourage individuals to move to the area. With the large number of low-income jobs, there will be increased demand for low rent multi-family housing units.

CATEGORY 2: CUMULATIVE DEVELOPMENT IMPACTS

Cumulative impacts are shaped by a variety of factors and are difficult to estimate. They depend on the underlying strength and character of the local economy, the strength and regional influence of the national economy, and the individual and aggregate decisions of countless business owners, tourists, residents, and government agencies. All those factors are difficult to predict, which makes the cumulative effects of the proposed Belleayre Resort difficult to estimate. An EIS for such a large development in an important water resource, such as the Belleayre Resort, should consider cumulative impacts. They are too important to ignore. For several reasons, cumulative impacts are certain to occur:

- The Belleayre Resort is intended to offer upscale resort opportunities that differ qualitatively from any others in the area. If true, the resort will change the character of the region and the firms, residents, and visitors who will find it attractive.
- The resort will attract visitors and part-time residents who may or may not ever visit the resort. The impacts of those visitors on the economy and land development are not counted in the DEIS.
- The resort will open soon after the Belleayre ski area is expected to expand.
- The Catskill region has been authorized by the state legislature as the location for three gambling casinos. The opening of even one casino could have major impacts on levels of development in the greater Catskill region.
- Collectively, the ski area expansion, casinos, and new resort will change the speed and character of development in the three counties and the Study Area.
- Natural expansion of the New York metropolitan area and post-September 11th increase in housing demand will increase development pressure.

To account for potential development within the watershed, we expanded our cumulative impacts analysis to cover more of the watershed than included in the 15-zip code Study Area defined in the DEIS. We estimated cumulative impacts using employment data for 30 zip codes that lie within the watershed and are connected by highways to the Belleayre Resort

(referred to as the Expanded Study Area). The Expanded Study Area has an estimated population of 46,613.

Table S-2 shows how households, total disturbed land, and impervious acres might increase over time in a larger study area more appropriate for evaluating long-run and cumulative impacts on the watershed in the Expanded Study Area. It shows the magnitude of change under different assumptions about average annual rates of growth and the density of the development pattern. It is a simulation that attempts to provide an approximation that put some bounds on the likely amount of new disturbed land and impervious surface in the expanded Study Area. As discussed, a projected long-term cumulative growth rate of 3% is reasonable.

Table S-2: Potential long-run growth and its impacts on several variables for the expanded Study Area in 50 years.

	Average Annual Population Growth Rate		
	2%	3%	4%
Amount of Growth in 10 Years			
Households	4,149	6,515	9,098
Developed Area (Gross Acres)			
Low-density pattern	6,278	9,859	13,767
Mid-density pattern	3,706	5,820	8,127
Impervious Surface (Acres)			
Low-density pattern	1,065	1,673	2,336
Mid-density pattern	556	1,191	1,719
Disturbed Surface (Acres)			
Low-density pattern	4,708	7,394	10,325
Mid-density pattern	556	1,191	1,719
Amount of Growth in 20 Years			
Households	9,206	15,271	22,565
Developed Area (Gross Acres)			
Low-density pattern	13,930	23,108	34,145
Mid-density pattern	8,223	13,641	20,157
Impervious Surface (Acres)			
Low-density pattern	2,364	3,921	5,794
Mid-density pattern	1,234	2,753	4,195
Disturbed Surface (Acres)			
Low-density pattern	10,448	17,331	25,609
Mid-density pattern	6,168	10,231	15,118
Amount of Growth in 50 Years			
Households	32,045	64,105	115,685
Developed Area (Gross Acres)			
Low-density pattern	48,491	97,003	175,055
Mid-density pattern	28,626	57,264	103,340
Impervious Surface (Acres)			
Low-density pattern	8,228	16,460	29,704
Mid-density pattern	4,294	11,049	20,420
Disturbed Surface (Acres)			
Low-density pattern	36,368	72,752	121,291
Mid-density pattern	21,469	42,948	77,505

Source: Calculated by NCSGRE and ECONorthwest.

To read the table, consider an assumption of an annual average growth rate (of population, and implicitly, households) of 3% (the middle column of

numbers). The rows are about how much change (growth) will occur after 10, 20 and 50 years. One can read the changes for households, total disturbed land, or impervious surface, under conditions of low-density or moderate density development patterns. For example, at a 3% population growth rate, after 50 years there will be an estimated 16,460 additional acres of impervious surface and an additional 72,752 acres of disturbed surfaces if the pattern of development is low density.

Our purpose has been to give an estimate of how much impervious surfaces and disturbed lands might occur under certain assumptions rates of growth and densities of development.

Chapter 1

Introduction

1.1 OVERVIEW OF THIS REPORT

The Office of the Watershed Inspector General asked Dr. Gerrit Knaap of the National Center for Smart Growth Education and Research at the University of Maryland (with the assistance of Terry Moore and others at the consulting firm of ECONorthwest) to review a Draft Environmental Impact Statement (DEIS) for the Belleayre Resort and independently evaluate the amount of development that could accompany or follow the resort development. This analysis was undertaken to gain a better understanding of potential levels of new impervious surfaces and disturbed land and its impacts on water quality in the watershed that serves New York City.

This report presents the results of our evaluation. It is organized as follows:

- Section 1, **Introduction**, provides the background for the study, an overview of the proposed development and the methods, data, and assumptions we used to evaluate those concerns.
- Section 2, **Evaluation**, explains our analysis, results, and conclusions. The evaluation is divided into two principal sections: *economic impacts* (primarily an evaluation of the DEIS's input/output model and its estimates of employment growth in the three counties and in the smaller Study Area) and *development impacts* (an evaluation of how the economic growth and other factors could or is likely to change the amount of developed land and impervious surface and disturbed land in the counties and Study Area).
- Section 3, **End Notes**, contains more detailed documentation of data, assumptions, and calculations.
- **Appendices** that accompany this report cover the following topics:
  - Appendix A, **Value of Environmental Services**, provides the economic reasons that the preservation of natural areas may have more economic value than extractive uses, based on the professional literature.
  - Appendix B, **Overview of Input/Output Models,** describes the software we used (IMPLAN) to develop independent estimates of the employment and income impacts of the proposed resort.
  - Appendix C, **Summary Output from our Land Development Spreadsheet**, presents the key results and assumptions for our high, medium, and low estimates.
  - Appendix D, **Qualifications**, provides information about the qualifications of Dr. Knaap, Terry Moore, and ECONorthwest to conduct the evaluation and comment on land use impacts.

1.2 BACKGROUND

Crossroads Ventures LLC proposes to construct a large, four-season resort (Belleayre Resort) spanning the Town of Shandaken in Ulster County and the Town of Middletown in Delaware County, New York. The project includes two resort complexes, with hotels, single-family residential subdivisions, and golf courses. An estimated 573 acres would be disturbed to establish the project that would involve approximately 130 new structures on the top and the sides of mountains located within the Catskill Park and Forest Preserve, an area subject to special protections pursuant to the New York State Constitution.

There is a substantial professional literature about the value of natural areas as providers of *ecosystem services*. ECONorthwest has written substantially on this topic. This literature implies that, in some cases, there are good reasons why the value of natural resources and ecosystems in non-extractive uses (e.g., forests as watershed and recreation for urban users) is greater than their value in extractive uses (e.g., logging). See Appendix A for a full discussion of the arguments.

This argument is not theoretical in the case of the Study Area. The proposed development is in the watersheds of the Ashokan and Pepacton Reservoirs, both of which are a part of the water-supply system of New York City. The reservoirs are in the Catskill and Delaware Watershed, which supplies approximately 90% of the drinking water to over 9 million people, almost half the state's population.

The water supply is of such a high quality that, for the most part, it does not need to be filtered. The only treatment the water receives from reservoir to tap is chlorine disinfection. If the water quality declines, the water will require treatment. The capital cost of a facility to filter this water supply is estimated at $6 billion with additional annual operating costs of approximately $300 million.[1]

Protecting this watershed and the quality of its water supply over the very long term is a central concern of the Office of the Watershed Inspector General within the New York State Attorney General's Office. The analysis presented in this report is provided to help assess the impact of the proposed resort development on drinking water quality.

The Office retained Dr. Gerrit Knaap and ECONorthwest to review the DEIS and provide an analysis of and opinion about its estimates of the total amount of growth that could accompany the proposed resort development, both immediately and in the long run. Dr. Knaap is a professor of Urban Studies and Planning, in the School of Architecture, Planning and Preservation, and Director of the National Center for Smart Growth Education and Research at the University of Maryland. Terry Moore is a fellow of the American Institute of Certified Planners and a vice president of ECONorthwest, a consulting firm with over 25 years experience in land use and economic evaluation. More information about our qualifications is included in Appendix D of this report.

1.3 EVALUATION METHODS

1.3.1 THE LOGIC OF THE EVALUATION

The analysis in this report is based on the following assumptions about the chain of cause of effect:

1. The resort development proposed, and described in the DEIS, is a new development to the area. If it did not occur, there would be that much less development in the area.
2. The DEIS is correct about the scope of the resort development: what will be built, where, and when.
3. The development envisioned for the resort will, perforce, require what are now pristine or partially disturbed natural areas to become developed areas. The money that it brings into the local economy (during both its construction and operation; both directly and indirectly) will cause development to occur both on the resort site, and around the site elsewhere in the watershed. Land now covered with soil and vegetation will become land covered with buildings, asphalt, and concrete. Land will also be subject to construction disturbance.
4. The Belleayre Resort notwithstanding, development will occur in the watershed, but that development may be different in amount, type, or timing because of the resort. That development will also increase impervious surface and disturbed land.
5. Increases in *impervious surface* means that runoff will be greater, faster, and less pure, even if steps are taken to mitigate those impacts.
6. Increases in disturbed land will mean that protective natural vegetation will be removed, soils will be graded and compacted, and soil will be exposed to stormwater and snowmelt erosion.
7. Thus, there is a direct connection between development and water quality. The *direction* of the impact, in the absence of mitigation, is unambiguously negative. Estimating its *magnitude* is a much more complicated technical issue.

Our analysis includes Steps 1 through 6 above: we review the estimated economic impacts as reported in the DEIS, adjust them if we think adjustment is necessary, look at the relationship between economic impacts and land development impacts, and estimate how land development will increase the amount of impervious surface and disturbed land. Our analysis does not include Step 7: estimating the impact of impervious surface on water quality.

Note also that though impervious surface certainly has a negative impact on water quality, it is not the only way that development can have a negative impact on water quality. Consider the following:

- Development impacts water quality not only by the impervious surface it presents when fully developed, but also by the disruption and

impaction of soil that occurs during construction, when erosion can be substantial.

- Development means wastewater from kitchens and bathrooms is generated and goes somewhere, presumably to be treated at a sewage treatment plant or to be filtered through septic systems. Such treatment may end up discharging into streamwater with some level of contamination.
- Golf courses or other landscaped areas get treated with fertilizers and pesticides, some of which run off and find their way into streams, lowering water quality. Moreover, the conversion of pristine natural areas to developed open space can cause compressed soils and changes to the ability of the land to rapidly absorb rain, thus increasing runoff.

Our task is the narrow one of using economic forecasts to estimate the amount of development and impervious surface.

We divide our estimates into two categories, which are consistent with our scope of work:

- **Impervious surface and disturbed land that can be linked through standard economic models to the development proposed at the Belleayre Resort.** We evaluated all the work in the DEIS relative to economic impacts (including the reported results of regional input/output models), and used a different model to crosscheck these results. We developed an integrated spreadsheet model to facilitate the conversion of the estimated economic impacts into related land development, by type, in the three-county region for economic analysis (Green, Ulster, Delaware) and in the watershed Study Area.
- **Impervious surface and disturbed land that might occur in the watershed Study Area in the future, with the Belleayre Resort and other growth inducing factors.** The key point here is that the Belleayre Resort may be at the leading edge of an amount of development that could cumulatively cause water quality to become impaired. In that sense, the resort project is important not primarily for its impacts, but because how it is allowed to develop sets a precedent for the amount, type, location, and design of future development that, in the aggregate, could have a negative impact on water quality.

It is easy to get lost in the jargon of a DEIS or an economic impact study. Some of the terms that define types of impacts are used differently in different studies. Our experience with EISs is that there is no absolutely correct and professionally accepted way to parse the impacts. Thus, we start this report by defining *how we will use terms in this report*, which we believe is logical and not inconsistent with how those terms are used most often in other EISs.

Impacts have many dimensions. The key ones for our purposes are:

- *Type of **system or activity** impacted.* In our analysis we are concerned with two broad types of activities: **economic** activities and **land development** activities. The fact that the two are strongly correlated is important to part of our analysis, which uses forecasted changes in economic activities to estimate accompanying changes in land development.
- *The **spatial distribution** of those impacts.* For example, it makes a difference to development and ultimately water quality in the Study Area whether the aggregate economic impacts are **concentrated** in the Study Area or **dispersed** more broadly throughout the state.
- *The **temporal distribution** of those impacts.* Some impacts occur **immediately**: money spent to clear land and build infrastructure has an immediate economic effect, and the clearing and building has an immediate development effect. Other impacts occur **later** because, for example, (1) the spending and development is phased over time, or (2) the initial spending and development creates a second or third round of effects. Given the purposes of this investigation, the precise timing of impacts is less important than their aggregate amount after some period of time.
- *The **directness of the connection** between the proposed action and the subsequent effects.* This idea touches on the previous ideas of spatial and temporal distribution. Many studies will distinguish between **direct** effects (those that are close by in space and time) and **indirect** or **secondary** effects, which are farther removed. Even though effects may become less direct over time, it is possible that the **cumulative** effects (the sum of all the subsequent changes, whether directly caused by the action or not) could lead to large negative impacts, and that decisionmakers could decide not to approve the project—not because the project itself would directly have unacceptable negative impacts, but because it increases the likelihood that many more projects will follow and collectively (cumulatively) have significant negative impacts.

Some confusion in the nomenclature gets introduced when economic analysis gets merged with land use analysis in a DEIS. Economists have developed input/output (I/O) models for estimating how a change in economic activity (e.g., an increase in expenditures in a particular employment sector) ripples through a regional economy to create additional economic activity (referred to as an **economic multiplier** effect). Such studies refer to the initial expenditure as the **direct** economic effect: for example, spending $1 million to build a retail outlet. Almost all of those expenditures are payments *to* a construction company to build the retail outlet. But they become payments *by* that construction company to (1) other companies for materials and supplies, and (2) its own employees for labor. Those other companies, in turn, use some of the money to buy supplies and labor, and the employees use the money they are paid to buy food, clothing, housing, transportation, entertainment, and so on. Economic modelers refer to these effects as the

indirect and induced economic effects. Such multipliers are typically in the range of 1.5 to 3.0 (depending on the type of expenditure and the ability of the regional economy, however defined geographically, to provide the required goods and services within its boundaries), which means that $1 of direct expenditure is ultimately responsible for induced expenditures of $1.50 to $3.00.

We illustrated direct economic effects using *construction* as an example. But there are also direct economic effects that continue on for the life of the resort during its *operation*. The direct economic stimulus during operation is that additional people (visitors, tourists) will come to the resort, in particular, and the Study Area, in general, and spend money for goods and services (e.g., lodging, food, golf, clothes, souvenirs, gasoline). To be able to offer the desired goods and services, the resort and other businesses will require people to operate and maintain facilities. The direct economic effects cause indirect economic effects (for example, the restaurant buys from a food wholesaler) and induced economic effects (employees will use their wages to buy other goods and services).

All that terminology can be difficult, but it gets worse. In an I/O model the direct economic effects do not necessarily have to happen soon or close by. Paying money to build a Phase III in Year 8 is a direct economic effect. Even if the project is built in one phase immediately, the direct economic impacts may not be all, or even primarily, *local* economic effects. If a big part of the expenditure for the development goes to contractors, and the contractors and their labor forces are all from New York City and Albany, than most or all of the direct economic effects of construction happen outside the local Study Area.

The land use and development jargon adds more confusion. Even though some of the direct *economic* effects occur outside the Study Area, most EISs will say (either explicitly or implicitly) that all the direct *development* effects occur inside the Study Area. We think it is accurate to say that the DEIS for this project defines the direct development effects as the development associated with primarily the on-site improvements at the resort (e.g., homes, retail, recreational facilities, roads).

It then uses the term **secondary effects** to refer to other development not on the resort site but in the Study Area that follows the direct development, in the same way that indirect and induced economic impacts follow direct economic impacts. For example, the direct economic impacts during operation mean that new employees will be hired and paid wages. Since many of those employees will want to live and shop within commuting distance of their work at or around the resort, one should expect the development of housing, shopping, and recreation opportunities *outside the resort* for employees at the resort, and for employees at other businesses that will be necessary to provide goods and services to the workers at the resort.

Indirect and induced economic impacts, and secondary development impacts, are positively correlated, but the extent of the relationship depends on many variables. For example, is the real estate market tight, or is there a

lot of vacant and redevelopable building stock? If the latter, the secondary development might be relatively small, and what does occur might not have a big effect on new impervious surface, because currently developed land is redeveloped, and possibly at greater densities.

This discussion is not fussy academic caviling. The point we are making is that fuzzy definitions will lead to fuzzy analysis and fuzzy numbers, and that the fuzziness is less the fault of the DEIS than it is of the state of practice.

There is no ideal solution. Either we try to stay with the sometimes fuzzy and inconsistent definitions of the DEIS, or we introduced some revised definitions that sharpen the discussion. Both have problems; we have chosen the latter. Table 1-1 summarizes how we will discuss impacts.

Table 1-1. Definitions of types of impacts

Approximate timing of the impact	Type and location of impact	Economic Impacts		Development Impacts	
		In Study Area	Outside Study Area	In Study Area	Outside Study Area
First-round effect; *now* or *later*; Construction and Operation	Example	Payments to build resort to *local* firm; expenditures by visitors at new resort	Payments to build resort paid to *non-local* firm; expenditures by visitors at new resort	Construction at the resort itself	N/A
	Impact called...	**Direct**	**Direct**	**Direct**	**N/A**
Second-round effect; *now* or *later*; Construction and Operation	Example	Builders and service firms purchase local supplies and labor	Builders and service firms purchase non-local supplies and labor	Other development outside resort in Study Area (e.g., housing, retail, service)	N/A
	Impact called...	**Indirect or Induced**	**Indirect or Induced**	**Secondary**	**N/A**
Long-term effects; Construction and Operation	Example	More expenditures for new resorts or second homes in Expanded Study Area	N/A	More resorts or second homes in Expanded Study Area	N/A
	Impact called...	**Cumulative**	**N/A**	**Cumulative**	**N/A**

Source: Prepared by the authors for this report.
Notes. See text for explanation. N/A = Not Applicable. All development impacts outside the Study Area are considered N/A because they presumably have no impact on water quality. Long-run effects outside the Study Area are considered N/A because they are not addressed in the DEIS and presumably have no impact on water quality

After reviewing the DEIS it is our conclusion that it reasonably addresses all of the direct and indirect impacts. In general, its use of its I/O model and assumptions about how to allocate the results to the Study Area are reasonable. The DEIS makes many undocumented assumptions about the location of secondary development impacts, and in Section 2 we discuss why there is likely to be more such impacts than described in the DEIS.

The DEIS does not, however, address the long-run impacts (the shaded cells of Table 1-1). This is where the main potential for greater estimates of land development and impervious surface exists. In the longer run, the resort is likely to be a catalyst that stimulates much more development to occur in the area. In the context of the evaluation logic described above, there will be more development in the area around the resort in later years if the resort is built than if it is not.[2] The reasons: (1) the resort development could be the nucleus around which other development coalesces; (2) it could precipitate investments in infrastructure that facilitate additional development; and (3) it could create the public policy precedents that imply that development is desired and encouraged in the area.

We call those long-run effects *cumulative impacts,* which is how the term is used in other EISs. Note that the I/O modeling does not address cumulative impacts. They are outside the model and have to be estimated some other way. A cumulative impact analysis provides insight into the long-term effects of a proposed developed, and an EIS should include a thorough cumulative impacts analysis. The EIS for the proposed Belleayre Resort should have a cumulative impacts analysis because the Resort has the potential to change demand for housing and commercial services in this very important watershed.

In the rest of this report we work from estimates of economic and land use impacts provided in the DEIS to our estimates of full, long-run land use impacts and the associated increase in impervious surface and disturbed land.

A fundamental principle of any impact evaluation is that one must describe *what is different* between alternative actions. That principle is always referenced in an Environmental Impact Statement (e.g., the "Action" and "No-Action" alternatives), but the analyses often get confused. In this project, the precipitating action is clear: the resort gets built. The alternative is also clear: the resort does not get built. The analytical challenge is to describe how development will be different in the area (in amount, type, location, and timing) if the Action alternative is pursued. We structure our analysis accordingly.

1.3.2 SPECIFIC METHODS OF EVALUATION

The previous section provides our definitions of economic and development impacts for this report. So our task is to evaluate those economic and development impacts. Table 1-2 shows that such an evaluation has two principal tasks for each type of impact: evaluate the work done in the

DEIS, and make (where indicated and feasible) independent estimates of the impacts. Though the independent estimates are distinct from the review of the DEIS as an analytical tasks, it is awkward for exposition to present them separately. Thus, the evaluation in Section 2 of this report is not organized as Table 1-2 is, but Table 1-2 is a useful organization for providing an overview of our evaluation methods.

Table 1-2. Structure of the evaluation

	Evaluation of the impact analysis presented in the DEIS	Independent estimates of impacts
Economic Impacts	x	x
Development Impacts	x	x

Source: Prepared by the authors for this report. See text for explanation.

There is not a lot that we need to describe about our methods for evaluating the work in the DEIS. In general, we draw on our experience with evaluating economic and development impacts to see whether the DEIS:

- Gets the underlying concepts right. Does it appear to estimate all the relevant impacts? For example, does it address all employment sectors, or just some?
- Gets the numbers right. For example, do its various estimates appear to be in what we judge to be the relevant range: for economic multipliers for various sectors; for direct impacts outside the Study Area; for converting economic growth to land coverage? Does the DEIS or related documents provide adequate documentation of assumptions and calculations?

Where we identify what we consider conceptual or numerical errors, or places where alternative assumptions could be justified, we provide alternative estimates. In some cases we can justify such estimates based on references to the professional literature or other studies. In other cases we make independent estimates of some of the economic and development impacts.

We start our evaluation with the **economic impacts** on the assumption that they can provide us some insight into our real interest: development impacts, increases in impervious surface, and disturbed land. The DEIS makes estimates of how much economic growth will occur in an area in and around the watershed. The critical issues with respect to the economic analysis are:

- The total amount of direct economic impact; the percent of that impact likely to occur outside and inside the Study Area; and how that percent might change over time.
- The amount of additional economic impacts (indirect and induced) that the direct economic impacts will create; the percent of that impact that is likely to occur outside and inside the Study Area.

To address these issues we:

- Reviewed the impact analysis and I/O results reported in the DEIS.
- Compared those results to those of a similar but different I/O model (the IMPLAN model, which we describe in Appendix B). We compared the multipliers for key sectors for the larger region (state of New York) and for the counties that compose the Study Area, and we compared multipliers in the study-area counties to those in other similar counties. In general, we were looking to see if anything looked very different from what the DEIS had estimated.
- Made some judgments about the appropriate allocation of economic effects to subareas of the defined I/O regions. For example, the direct economic effects of operations were estimated using a three-county I/O model, but the Study Area is a subarea of those three counties. Somehow the three-county impacts must be allocated to the Study Area. The DEIS made the allocation in proportion to population. We looked at other methods as well.

The **development impacts** are measured primarily in terms of new buildings, their footprint (square footage, disturbed land associated with new buildings) and correlated increases in impervious surface (primarily roads and parking lots). The DEIS acknowledges that economic growth will be correlated with land development—with new buildings to accommodate that growth.

There is really nothing we could do to make a better estimate of the direct development impacts associated with construction. We have to assume that the DEIS describes accurately the master plan for the proposed resort. Thus, there is no value in trying to work from the direct economic impacts to the direct development impacts: the DEIS is the best estimate of what the direct development will be. The critical issues with respect to the development analysis are:

- The secondary impacts that derive from the indirect and induced economic effects from operation: how much off-resort development will occur in the Study Area in response to the new expenditures by visitors to the resort or that the resort otherwise helps to draw to the area?
- The longer-run, cumulative development impacts: estimates of these impacts depend on some assessment of the demand for development (residential, commercial) in an Expanded Study Area (which is larger than the original Study Area, to better estimate impacts on the watershed), and the supply of built space, redevelopable space, and buildable land in the Study Area (which depends in part on ownership and public policy).
- The relationship between new development, by type, and the amount of impervious surface and disturbed land.

To address these issues we:

- Did research to allow us to justify the assumptions we used to convert the indirect and induced economic effects from the I/O model to new, off-resort development.
- Interviewed people knowledgeable about the real estate market in the region to get an idea about recent changes in and the likely future of demand and supply conditions for land and buildings in the Study Area.
- Conducted an analysis to determine where new development will locate. We used Geographic Information Systems (GIS) analysis to determine where new development can locate. We began with all available vacant lots within a prescribed radius around the resort. We used GIS to identify land with development constraints—including steep slopes, proximity to waterways, publicly held land, and land with conservation easements, and subtracted that subset from available land.
- Looked at the pattern and amount of growth in other areas that we considered comparable in some way to the Study Area.
- Estimated the footprint, road frontage, driveway, and parking area square footage to calculate total expected impervious surface.

1.3.3 DATA

The information we used for our evaluation is of three general types:

- Existing studies. These studies include but are not limited to the DEIS and related studies covering the watershed. We reviewed a variety of planning documents, legal documents, journal articles from economics and planning journals, and reports from local and state government agencies. For a full list of documents, see Section 3, Endnotes.[3]
- Data sets. We used IMPLAN data, GIS data provided by New York City Department of Environmental Protection and the Catskill Center, employment and income data from the New York Department of Labor, and population data from the U.S. Census Bureau and Claritas.
- Interviews. We interviewed representatives of state agencies and non-profit organizations, and members of the local communities.[4]

1.3.4 ASSUMPTIONS AND LIMITATIONS

Any analysis of this type requires many assumptions. The DEIS made them; we did too. One's evaluation of forecasts typically depends heavily on one's evaluation of the assumptions that drive those forecasts. Rather than listing the assumptions here, we provide them in context in Section 2. For every estimate or forecast we try to be clear about our assumptions.

To state the obvious, our analysis tries to describe an uncertain future. Many more variables than we can possibly evaluate affect that future, and even some of the ones we consider could vary substantially in response to market and policy forces that are hard to predict. Our analysis must be interpreted in the light of those inherent limitations. That said, we believe that the analysis we provide meets the professional standards that make our assessment a "best estimate" of the likely future impacts of the proposed development.

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[1] New York State Department of Environmental Conservation (www.dec.state.ny.us/website/ppu/dialslsnow.html).

[2] From a local, economic-development perspective, that is good news. From a regional, water-quality perspective, that is bad news.

[3] The key documents are:

Draft Environmental Impact Statement for Belleayre Resort at Catskill Park. September 2003.

Resource Protection and Economic Development Strategy for the Route 28 Corridor. 1994. For the Town of Shandaken by Planning Consultants and Shuster Associates in Stone Ridge, New York.

Town of Shandaken, Comprehensive Planning Committee. Draft Comprehensive Plan. December 2002.

Rules and Regulations for the Protection from Contamination, Degradation and Pollution of the New York City Water Supply and Its Sources.

Specific documents are cited throughout the text.

[4] The people interviewed were:

Tom Alworth, Executive Director at the Catskill Center, Arkville, New York. Interviewed January 24, 2004.

Helen Budrock, Assistant Director at the Catskill Center, Arkville, New York. Interviewed January 21, 2004.

Pete DiModica, former Supervisor of the Town of Shandaken. Interviewed January 27, 2004.

Chris Olney, Director of Conservation at the Catskill Center, Arkville, New York. Interviewed between January 21 and January 31, 2004.

Rolf Pendall, Associate Professor at the City and Regional Planning Department, Cornell University. Interviewed January 23, 2004.

Sandy Presloe, Nonpoint Education for Municipal Officials (NEMO) at the University of Connecticut, Cooperative Extension System. Interviewed January 23, 2004.

Kurt Rieke, First Deputy Director at the New York City Department of Environmental Protection. Interviewed January 23, 2004.

James Ross, New York Department of Labor. Interviewed January 16, 2004.

Dean Schwanke, Urban Land Institute. Interviewed January 21, 2004.

Terry Spies, New York City Department of Environmental Protection. Interviewed January 22, 2004.

Eric Wedermeyer, Realtor at Timberline Properties. Interviewed January 21, 2004.

Chapter 2

Evaluation

In this section, we first describe the action that has precipitated the EIS process—the building of the Belleayre Resort. We then discuss the economic and development impacts of the proposed Belleayre Resort, and finally the implications of those impacts for new impervious surface and disturbed land.

2.1 THE ACTION

Crossroads Ventures, LLC proposes to construct the Belleayre Resort, a large four-season resort spanning the Town of Shandaken in Ulster County and the Town of Middletown in Delaware County, New York. There would be two resort complexes—one on either side of the existing state-operated Belleayre Mountain Ski Center.

Figures 2-1, 2-2, and 2-3 place the location of the proposed resort in a local and regional context. Figure 2-1 shows the Belleayre Resort within a regional context. Figure 2-2 shows the boundaries for the counties, Catskill Park and the Watershed. Figure 2-3 shows the Watershed, the 15-zip code Study Area used in the analysis, the Route 28 Corridor, and the location of the proposed resort.

The eastern portion of the project has been named Big Indian Plateau, and will be located on a 1,242-acre site. The Big Indian Plateau development would include the Big Indian Country Club; an 18-hole golf course and accompanying clubhouse; a hotel building with 150 rooms, two restaurants, a ballroom, meeting rooms, and a spa; 55 buildings housing 95 lodging units; and 22 buildings housing 88 lodging units. The developers also plan to convert the existing Brisbane (Turner) Mansion into a social activities center with office space on the upper floor.

The western portion of the project has been named Wildacres Resort, and it will be located on a 718-acre site. Wildacres Resort would include an 18-hole golf course and accompanying clubhouse; a hotel building with 250 rooms (50 would be suites with kitchens), 10 retail shops, a conference center, two restaurants, a bar, and a chapel; 21 buildings containing 168 lodging units; a 21-lot residential subdivision for single-family homes; and a Children's Center. The developers also plan to use the existing Marlowe Mansion as a restaurant and to convert the former Highmount Ski Area into a Wilderness Activity Center. Complete construction of the Resort would involve approximately 130 new structures.

Figure 2-1. Regional Context

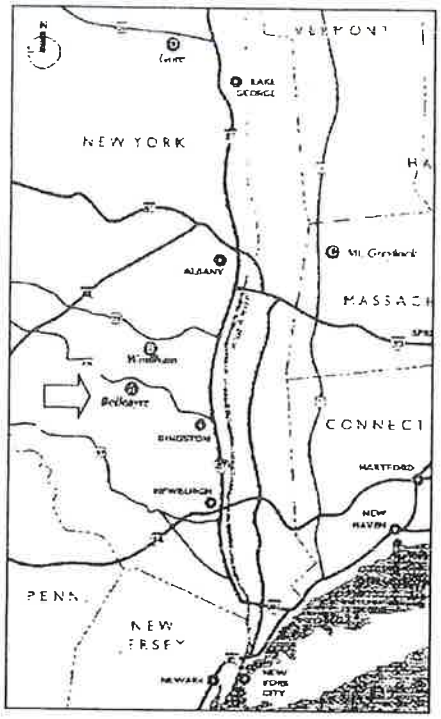


Figure 2-2. Catskills Vicinity Map

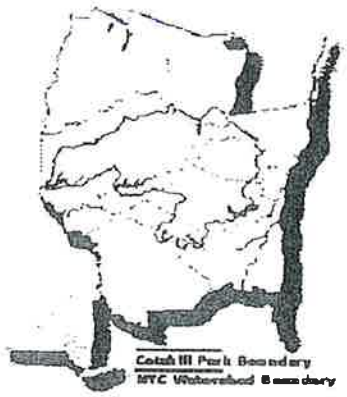
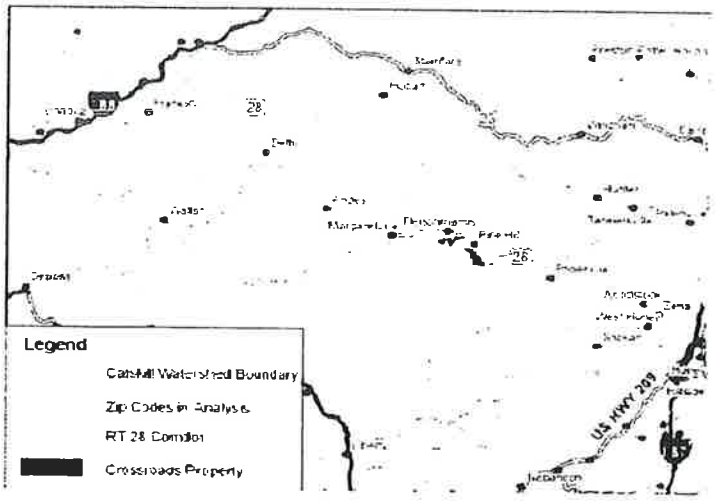


Figure 2-3. Study Area



Source: Figure 2-1: The Catskill Center, Catskills GIS Atlas (www.catskillcenter.org/atlas/). Figure 2-2: DEIS, Case Study Analysis, Page 6-2.; Figure 2-3: Map generated by ECONorthwest with data from the New York City Department of Environmental Protection and the Catskill Center.

Approximately 573 acres would be disturbed to establish the project on the top and the sides of mountains located within the Catskill Park and Forest Preserve and the Catskill and Delaware Watershed.

All of the lodging units associated with the resort would be available on an interval ownership basis (except for the single-family homes). Through membership in the Big Indian Country Club or through purchase of shares in a timeshare unit, individuals could purchase lodging units on a fractional basis, for increments ranging from one week to three months.

Table 2-1 summarizes the impacted acreage and lodging units for the resort.

Table 2-1. Planned acres and lodging units for the proposed Belleayre resort, at full operation

	Total Acres	Disturbed Acres	Impervious Acres	Number of Hotel Rooms	Number of Lodging Units	Number of Single-Family Lots
Big Indian-eastern portion	1,242	331	na	150	183	0
Wildacres-western portion	718	242	na	250	168	21
Total	**1,960**	**573**	**85**	**400**	**351**	**21**

Source: DEIS.

The privately owned resort will be a separate entity from the existing state-operated Belleayre Ski Area. While there are plans to expand the Ski Area, the DEIS and this review focuses on the impacts of the resort project; only implicitly in the analysis of cumulative impacts does it consider the effects of the expanded ski area.

2.2 IMPACTS OF THE ACTION

In this section, we discuss the expected impacts of building the Belleayre Resort. We review the impacts described in the DEIS, and describe impacts not included in the DEIS. Our discussion of the impacts is divided into five categories, consistent with the discussion in Section 1 and in Table 3:

- Direct *economic* impacts
- Indirect *economic* impacts
- Direct *development* impacts
- Secondary *development* impacts
- Cumulative *development* impacts.

Our analysis addresses four geographic areas: the state of New York, the *three-county area* of Greene, Ulster, and Delaware counties (whose boundaries meet near the resort area), the *Study Area*, which is a subset of those three counties (defined by 15 zip codes that cover the Route 28 corridor within the watershed[1]) and an Expanded Study Area employed for an evaluation of cumulative impacts. The state of New York is relevant only for the discussion of the direct economic impacts of construction, which are the least important for the purposes of our analysis. Thus, we can simplify by saying that most of our analysis is for the three-county area and for the Study Area (i.e., the watershed in those three counties). The DEIS also refers to the Route 28 corridor, which covers the length of Route 28 between Shokan and Andes. Figure 2-3 shows the Watershed, the 15-zip code Study Area, the Route 28 Corridor, and the location of the proposed resort.

With one small exception, all of the estimates of employment impacts—whether direct or indirect, whether from the DEIS or from our

IMPLAN analysis—are generated for the three-county area.[2] Thus, the primary challenge for the analysis is to find credible ways to allocate the three-county employment and development impacts to the Study Area. We developed an integrated spreadsheet model for this task. It has various parameters regarding the percentages of Direct, Indirect, and Induced economic impacts that get allocated from the state model to the three-county area to the Study Area, and how those employment impacts become land use impacts (total area developed and impervious surface). Appendix C shows some of the summary results and assumptions for our high, expected, and low estimates of the model. In the text that follows, we report the range of results from the model and our best estimate of expected value for the impact being discussed, for both the three-county area and Study Area (where appropriate).

2.2.1 DIRECT *ECONOMIC* IMPACTS

CONSTRUCTION

What the DEIS says

The DEIS states that building the resort will take place over an eight-year period, and will cost about $235.8 million (2001 dollars). In addition, they estimate that buyers of the 21 lots designed for single-family residences will spend $5.25 million to build those homes. These expenditures exclude any costs not directly a part of the expenditures for construction, such as financing, the value of the land, marketing, and so forth. Total construction costs are expected to equal $241.03 million.

To model the direct economic impacts, the DEIS relied on a regional I/O model, known as the Regional Input-Output Modeling System, or RIMS II. RIMS II was developed by the Bureau of Economic Analysis in the U.S. Department of Commerce. The DEIS modeled construction activities based on four sectors: commercial building construction, new residential single-family construction, new residential attached unit construction, and non-building construction (including construction of highways and streets).

The RIMS II model estimated the construction activities will generate demand for 2,114 person-years of employees over the eight-year construction period. A person-year is the equivalent of one person working full-time for one year. The DEIS divides the total person-years by eight years, to calculate the average number of person-years employed each year: 264 person-years of employment each year of construction. The model estimated annual average wages and salaries to equal $10.14 million.

The DEIS states that construction activity will have a positive, but marginal, effect on the local economy. The existing construction sector in the area is relatively small and is oriented toward construction of single-family homes and local government needs, such as roads, and water and sewer lines. Therefore, most of the construction workers will not come from the local area.

Our review

In our estimation, the underlying concepts of the I/O analysis of direct economic impacts of construction activities are reasonable. The DEIS has addressed the affected industrial sectors and geographic regions in a reasonable way. However, we are unable to determine if their results are accurate, because the DEIS did not include the actual multipliers used in their RIMS II analysis. Without those multipliers, we can only guess at how the I/O analysis distributed direct economic impacts.[3] In the absence of the raw data used in the DEIS, we estimated the direct economic impacts in an independent I/O analysis using IMPLAN (see Appendix B for a detailed description of the IMPLAN model).

An important difference between our IMPLAN analysis and the RIMS II analysis in the DEIS is the definition of a job. RIMS II calculates person-years, or full-time equivalent. It is equal to one person working full-time for one year. IMPLAN calculates number of jobs, regardless of part-time or full-time status. Therefore, the number of jobs we estimated is not directly comparable to the number of person-years estimated by RIMS II. Translating jobs into person-years is not a straightforward task, there is no simple ratio we could use to convert job in person-years. The ratio varies by industry and occupation.

In our IMPLAN analysis, we used the construction cost estimates from Table 3-1 on page 3-2 of the DEIS as inputs. Given the lack of the specialized construction contractors and labors in the local economy, we developed a statewide model to accommodate the $235.78 million in construction spending on the resort. We agree with the DEIS that a great many of the firms and individuals who build the resort will not be from the local area. The local economy, however, does have some indigenous residential construction firms and workers. We allocated $5.25 million of residential construction to a three-county model, including Greene, Ulster, and Delaware counties.

In our analysis, we estimate approximately 1,747 jobs and $70.99 million in wages and salaries are directly attributed to spending on building the resort. If we average this economic activity over the eight-year construction period, each year there will be 218 jobs and $8.9 million in wages and salaries.

We agree with the DEIS that few construction impacts will be local. Most of the construction work at the resort will be handled by workers coming from outside the area. Workers with specialized skills needed to build large resort complexes are unlikely to live in the Study Area. Most of the expenditures on direct construction activities will go to workers living outside of the three-counties. Our I/O analysis indicates that 34 jobs and $641,000 in wages and salaries will be distributed within Ulster, Delaware, and Greene counties. If we average this economic activity over the eight-year construction period, each year there will be 4 jobs and about $80,000 in wages and salaries. The number of jobs is very low within the three counties because the IMPLAN model bases its model on existing employment activity. Building the resort

will require specialized skills within the construction sector, and there are few such firms within the three counties. IMPLAN therefore assumes that the jobs will come from parts of the state that already have firms that provide such specialized services.

We do not attempt to allocate the direct economic impacts of construction activities to the Study Area. Economic impacts of construction activities in the Study Area will be temporary, and will cease once construction ends. In addition, we already have an independent estimate of the impact the activities will have on impervious surface and disturbed land in the Study Area, that is, the impervious surface developed at the resort site.

OPERATIONS

The DEIS considers the direct economic impact of operating the resort as the impacts of gross revenues spent at the resort, that is, jobs and income earned by those employed by the resort. The DEIS fails to include the direct economic impacts stemming from the money that resort visitors spend off-site. The DEIS does discuss how much money the resort visitors will spend off-site, but it does not discuss the economic impacts of that spending. We do. In this section, we break direct economic impacts of operating the resort into two categories: on-site impacts and off-site impacts.

What the DEIS says

Direct impacts of on-site activities

To simplify the analysis of operational effects, the DEIS assumed that all operations impacts would begin only after full construction of the resort. The DEIS does not account for any of the direct impacts of operating the resort for some time during its eight-year construction phase. This point is not very important to our purpose, however, because the exact *timing* of the operation impacts is not nearly as important as how much it will grow, and how much development and impervious surface that growth is likely to generate. Whether some development occurs a few years sooner makes little difference to the evaluation of the ultimate impacts of the development on water quality.

The direct impacts of operating the Belleayre Resort were provided by the developer, Crossroads Ventures, LLC. The developer provided employment and wage projections. The DEIS concludes that there will 542 full-time jobs, and 330 part-time or seasonal jobs, calculated to be 747 full-time equivalent jobs.

The DEIS states that about half of the jobs will have annual earnings between $20,000 and $30,000 and 23% of the full-time jobs will have annual salaries greater than $30,000. The median annual wages for full-time-equivalent positions would be about $27,000. Total annual wages and salaries are projected to $20,485,693. The DEIS does not state explicitly which dollar year, so we assume all dollars to be in 2001 dollar years.

The DEIS states that the new employment demand will not overburden the existing labor supply in Ulster and Delaware counties. Using 2001 data, they show that there are 3,700 unemployed individuals, and 1,573 of those are the experienced unemployed, that is, those who have been laid off or fired, not new entrants to the labor force. To estimate the size of the labor force that resides in the 15-zip code Study Area, it calculates the Study Area's population portion of the total population in Ulster and Delaware counties and applies that percentage to the total labor force, equaling 4,629 labor force members in the Study Area. Using a 3.9% unemployment rate, it calculates that 181 individuals in the Study Area are unemployed.

The DEIS reports that, based on discussions with labor analysts at the New York State Department of Labor, many individuals in the area are "underemployed"—workers either employed part-time or at jobs beneath their skill level. The DEIS reports that local unemployed and underemployed individuals will be the primary labor pool. The DEIS also provides evidence that many workers in the Towns of Middletown and Shandaken commute to jobs along the Interstate 87 corridor. Those individuals are likely to change jobs in favor of a job closer to home.

Direct impacts of off-site activities

The direct economic impacts stem from money spent by resort visitors off the resort site. The visitors to the resort would generate economic activity off-site as they purchase supplies, meals, gasoline, and souvenirs. The DEIS estimates the visitors will spend $11.81 million off-site during stays at the resort, and uses that information to estimate demand for new buildings. The DEIS does not estimate the number of jobs and wages that spending will generate.

Without such an analysis, the DEIS implicitly assumes that off-site spending by resort visitors will generate no jobs or income.

Our review

Direct impacts of on-site activities

Direct impacts of operating the resort are jobs and income generated by visitor spending at the resort. The DEIS did not estimate these numbers with an I/O model, but instead relied on job and wage projections provided by the developer. In order to check those figures, we estimated jobs and incomes directly generated by expected gross annual revenues for each project component, as shown in Table 4-3 on page 4-4.

Our IMPLAN analysis calculated that jobs and wages generated by the projected $43.4 million in gross annual revenues was lower than the jobs and wages reported in the DEIS. We calculated that resort revenues would yield 525 jobs, 42% fewer than the DEIS projects. We calculated that resort revenues would yield $7.75 million dollars in wages, less than half of the wages projected by the DEIS. Our experience suggests that workers in the

hotel, food service, and retail industries typically earn less than the DEIS expects them to earn at the Belleayre Resort.

Our analysis suggests that there is no rationale for arguing that the DEIS has underestimated either direct employment or wages, which has implications for our assessment of induced offsite impacts (later in this report).

Direct impacts of off-site activities

The DEIS provides detailed estimates of spending by various visitor groups (hotel visitors, golf country club visitors, etc.) and how that spending would occur off-site. However, it does not use the RIMS II model to estimate the economic impacts from such spending. The $11.8 million dollars that visitors are expected to spend each year off-site would create jobs and income, and those effects should have been included in the DEIS. The DEIS simply ignores the direct economic impacts of off-site spending.

To estimate the direct economic impacts of off-site spending, we ran an IMPLAN analysis modeling local, off-site spending by visitors. In the DEIS, Table 4-23 breaks out the total $11.81 million in annual off-site spending into the following categories: restaurants, groceries, gas and oil, recreational fees, shopping and souvenirs, and other. We used the spending estimates for each of those categories as inputs into the IMPLAN model.

Our I/O model calculated that the spending would generate 152 direct jobs, such as people working at restaurants, grocery stores, gas stations, and souvenir shops. The spending would generate $2.12 million in direct wage impacts each year.

Most of the direct job impacts would be located in the service and retail sectors, such as eating and drinking establishments, miscellaneous retail, amusement, and food stores. These are typically lower paying jobs. For instance, the average annual wage for direct hires is approximately $14,000. Because some of these jobs are part-time, that figure cannot be directly translated to an hourly wage.

SUMMARY AND CONCLUSIONS

Our review of direct job and income effects of constructing and operating the resort does not measurably change the expected number of jobs stemming from those activities. Table 2-2 summarizes the employment impacts of direct economic activities, as estimated by the I/O models.

Table 2-2. Direct employment and income effects in the three counties, jobs/year

	DEIS		Our Review	
	Number of Jobs	Average wage per job	Number of Jobs	Average wage per job
Construction	not specified	not specified	4	$20,000
Operations, on-site	747	$27,424	525	$14,762
Operations, off-site	no estimate	No estimate	152	$13,947

Source: DEIS and NCSGRE and ECONorthwest calculations.

But having done all this analysis of the direct employment impacts, we must return to the basic logic of the analysis to make it clear how the analysis bears on the question of impervious surface and disturbed land. We have no need to use the estimates of direct construction or on-site employment—neither those in the DEIS nor the ones we generated—to estimate *on-site development* impacts. Those impacts, and the estimates of the impervious surface they generate, are already provided in the DEIS. We accept those estimates in our analysis. The impacts that create additional impervious surface and disturbed land are off-site: both the direct impacts discussed in this section, and the indirect impacts discussed in the next section.

We used an integrated spreadsheet model to allocate the direct jobs to the three counties and the Study Area. The model provides low, high, and expected estimates for jobs. The model distributes jobs based on assumptions about where direct, indirect, and induced jobs will be located:

- The Low model assumes that 3% of direct jobs will be in the Study Area;
- The Expected model assumes that 10% of direct jobs will be in the Study Area;
- The High model assumes that 20% of direct jobs will be in the Study Area.

We do not attempt to allocate the indirect economic impacts of construction activities to the Study Area. The economic impacts of construction activities in the Study Area will be temporary, and will cease once construction ends. Table 2-3 shows low, expected, and high estimates of where jobs will be located.

Table 2-3. Allocation of direct employment effects in the three counties and Study Area, jobs/year

	Low		Expected		High	
	3 Counties	Study Area	3 Counties	Study Area	3 Counties	Study Area
Operations, on-site	525	0	525	0	525	0
Operations, off-site	152	4	152	15	152	30

Source: Calculated by NCSGRE and ECONorthwest.

2.2.2 INDIRECT (AND INDUCED) *ECONOMIC* IMPACTS

CONSTRUCTION

What the DEIS says

The RIMS II model estimated that the $241.03 million in direct construction expenditures will generate indirect employment and income. The model calculated that construction activities will indirectly generate 1,765 person-years of employees over the eight-year construction period, or an annual average of 221 person-years. The model also estimated that the construction activities would generate $64.40 million in indirect wages and salaries, or an annual average of $8.05 million.

The DEIS states that these effects would occur throughout the regional economy in southern New York State, the local effect would be positive, but small. The DEIS does not provide specifics on the distribution of indirect economic effects of the construction activities. The DEIS argues that construction workers would be expected to travel fairly long distances to work at the project site, and vendors and businesses serving the construction activities would also be drawn from a wide area. The workers would not be expected to relocate close to the site because the construction phase is temporary. Constructing the resort would not induce permanent growth in the construction industry in the local area.

Our review

In our estimation, the underlying concepts of the I/O analysis of indirect economic impacts of construction activities are reasonable.

In our IMPLAN analysis, we used the construction cost estimates from Table 3-1 on page 3-2 of the DEIS as inputs. As with the direct construction impacts, we used a statewide model to accommodate the $235.78 million in construction spending on the resort. We allocated $5.25 million of residential construction to a three-county model, including Greene, Ulster, and Delaware counties.

In our analysis using the IMPLAN model, we calculated that the eight years of construction activities will indirectly generate 2,549 jobs and $100.67 million in wages and salaries. If we average this economic activity over the eight-year construction period, each year there will be 319 jobs and $12.58 million in wages and salaries.

Our analysis estimated 44% more jobs than the DEIS. There are two possible explanations for the discrepancy: jobs versus person-years, and the type of multiplier the I/O models use. [4] As discussed under direct construction impacts, RIMS II calculates person-years, or full-time equivalent, while IMPLAN calculates number of jobs, regardless of part-time or full-time status. In our I/O model, we used a multiplier that accounts for direct, indirect, and induced spending, which may have captured more impacts than the RIMS II model.

Most of the indirect impacts of construction activities will go to workers living outside of our three-county Study Area. Our analysis indicates that indirect impacts will generate 89 jobs and $2.11 million in wages and salaries within Ulster, Delaware, and Greene counties. If we average this economic activity over the eight-year construction period, each year there will be 11 jobs and about $264,000 in wages and salaries.

We do not attempt to allocate the indirect economic impacts of construction activities to the Study Area. Indirect economic impacts of construction activities in the Study Area will be temporary, and will cease once construction ends. New businesses will establish themselves during the construction phase to serve the demands of construction activities. When the construction phase ends, those businesses will not disappear, they will instead start to serve the demands generated by operating the resort.

OPERATIONS

What the DEIS says

The indirect impacts of operating the resort stem from two categories: on-site and off-site activities. The indirect impacts of on-site activities include the impacts stemming from the revenue generated at the resort. Guests pay for hotel rooms, golf-course fees, dinner, massages, and so on. That revenue is the direct impact: it gives income to the resort, and the resort uses that income to, among other things, hire employees (the direct employment impacts).

But to run the resort, the resort operator will need to purchase goods and services from other businesses. These businesses may be in the Study Area, in the larger three-county area, or farther still. Those are *indirect* economic impacts. Moreover, employees of the resort will use the wages that the resort pays them to buy goods and services from yet other businesses: these are the *induced* economic impacts. The DEIS appears to refer to these combined effects jointly as indirect impacts of the on-site spending at the resort.

Indirect impacts of off-site activities are similar. For example, when visitors go to, stay at, or come from the resort, buy gasoline, food, or souvenirs in a nearby town, they create a direct economic impact off-site. The gas station buys gas from its supplier (indirect economic impact) and the gas station employee buys goods and services with income from his job (induced economic impact).

Indirect impacts of on-site activities

To estimate indirect impacts of employment at the resort, the DEIS used the RIMS II model. The DEIS modeled indirect activities from employment based on six sectors: hotels; other lodging places; membership sports and recreation clubs; retail trade; eating and drinking places; and other amusement and recreational services.

The indirect impacts analysis is based on employment projection of 665 full-time equivalent employees. As discussed above, the DEIS asserts that the resort will actually create 747 full-time equivalent position. The indirect analysis in the DEIS had already been completed when the total number of jobs was revised upwards. Therefore, the indirect impact of the employment-based operational impacts underestimates the total impacts.

The RIMS II analysis assumes that the Study Area includes Delaware, Ulster, and Greene counties, and that the resort will indirectly generate 211 jobs. These jobs will be located off-site. The employment-based indirect impacts will generate $7.43 million in wages and salaries.

Indirect impacts of off-site activities

In the analysis of indirect effects of visitor spending, the DEIS estimates how much visitors will spend during stays at the resort. The analysis does not include an I/O analysis, and instead uses industry data to derive expected visitation levels and spending patterns of those visitors. The visitors to the resort would generate economic activity as they purchase supplies, meals, gasoline, and souvenirs.

A distinct feature of the Belleayre Resort is the number of fractional-ownership units. There would be timeshare units and "vacation club" units. Timesharing allows individual to purchase vacation properties in intervals of one or more weeks per year, but typically for two weeks. The vacation club units would be distinct from a timeshare management concept. The units would be sold on a membership basis. Unlike the timeshare system, the club member would acquire fractional ownership shares, known as "membership shares" of their units, ranging from 10% (five-week shares) to 25% (three-month shares). The club membership system is designed to accommodate members who want to experience longer stays at the resort. The DEIS reports that it would enable members to enjoy a higher degree of luxury and obtain special privileges available only to club members.

The DEIS estimates occupancy rates for the timeshare and vacation club units, specifically, it estimates that there will be 108,810 visitor parties per

year. Both the timeshare and vacation club visitors are expected to prepare food for themselves in their units, so they would make regular purchases at local grocery stores. The units will be furnished by the resort, so those visitors are unlikely to purchase home furnishings or appliances. Off-site spending would primarily be expected to involve purchases of gas and oil, groceries and liquor, newspapers and magazine, and souvenirs. The DEIS states that an analysis by Allee King Rosen & Fleming, Inc. indicates that about 50% of timeshare and vacation club visitors would occur off-site, or $9.2 million annually. The DEIS also calculates that the 96,725 hotel visitor parties each year will spend about $2.4 million annually. Finally, the 21 lots designed for single-family residences will generate about $0.2 million in off-site spending.[5] Total off-site spending will $11.81 million annually.

The DEIS states that the $11.81 million would occur throughout the Route 28 corridor, especially in the village and hamlet centers where businesses and shops are concentrated. The DEIS shows projected spending patterns, summarized in Table 2-4. The spending patterns are based on a composite average of spending behavior of timeshare owners, seasonal homeowners, golfers, and overnight visitors to resort regions.

Table 2-4. Resort visitor annual off-site spending, in the three counties, at full resort operation, according to the DEIS

Trip Spending Category	Total Off-Site Expenditures ($millions)
Restaurants	3.23
Groceries	1.79
Gas and Oil	1.77
Recreation Fees	0.96
Shopping and Souvenirs	1.95
Other	2.09
Total	11.81

Source: DEIS, Appendix 26, Table 4-23, p. 4-26.

Our review

Indirect impacts of on-site activities

In our estimation, the underlying concepts of the I/O analysis of indirect economic impacts of on-site operations are reasonable.

The DEIS estimates the indirect impacts of on-site operations with direct impacts that were later revised upward. The DEIS reports the initial direct job estimate was 665 full-time equivalents, but the figure was subsequently increased to 747 full-time equivalents, an increase of approximately 12%. The initial direct wage estimate was $18.81 million, but the figure was increased to $20.5 million, or by about 9%.[6] The DEIS did not revise the indirect impact analysis. On that basis alone, even if one accepts all the rest of the analysis,

the indirect impacts reported in the DEIS would be underestimated by 9%: indirect jobs would increase from 211 to 237, paying wages would increase from $7.4 to $8.1 million.

In our IMPLAN analysis, we used the estimate of gross annual revenues for each project component as reported in the DEIS (Table 4-3 on page 4-4) as inputs into the IMPLAN model to measure the indirect and induced effects on the three-county area. We estimated the on-site activities would generate 309 indirect and induced jobs and $8.2 million in indirect and induced wage impacts.

Comparing our job estimates to the adjusted estimates in the DEIS, our indirect job impacts are about 30% greater than those estimated by the DEIS. There are two possible explanations for the discrepancy: jobs versus person-years, and the type of multiplier the I/O models use (see Section 2.2.1 for a discussion of multipliers). As discussed under direct construction impacts, RIMS II calculates person-years, or full-time equivalent and IMPLAN calculates number of jobs, regardless of part-time or full-time status. In our I/O model, we used a multiplier that accounts for direct, indirect, and induced spending, which may have captured more impacts than the RIMS II model captured.

Comparing our wage estimates to the adjusted estimates in the DEIS, our indirect wage impacts are only 2% greater than those estimated by the DEIS.

We allocated the new jobs with an integrated spreadsheet model. The model provides low, expected, and high value estimates for jobs. It distributes jobs based on assumptions about where direct, indirect, and induced jobs will be located. Table 2-6 shows the allocation of indirect employment effects.

Indirect impact of off-site activities

The DEIS provides detailed estimates of spending by various visitor groups (hotel visitors, golf county club visitors, etc.), and the amount of spending that occurs off-site. The DEIS does not estimate the indirect economic impacts from such spending. The $11.8 million dollars that visitors are expected to spend off-site will indeed have ripple effects throughout the economy, and those effects should have been included in the DEIS. The DEIS simply ignores the indirect economic impacts of off-site spending.

To estimate the indirect economic impacts of off-site spending, we ran an IMPLAN analysis modeling local, off-site spending by visitors. In the DEIS, Table 4-23 breaks out the total $11.81 million in annual off-site spending into the following categories: restaurants, groceries, gas and oil, recreational fees, shopping and souvenirs, and other. We used the spending estimates for each of those categories as inputs into the IMPLAN model.

Our IMPLAN analysis calculated that the spending would indirectly generate 87 jobs. We used an integrated spreadsheet model to allocate those new jobs to the three counties and the Study Area. The model provides low, high, and expected value estimates for jobs based on assumptions about

where direct, indirect, and induced jobs will be located. Our low estimate indicates that 69 of the jobs will be in the three counties and six of those will be in the Study Area; our high estimate indicates that 87 of the jobs will be in the three counties and 26 of those will be in the Study Area. Our expected estimate is that 87 of the jobs will be in the three counties and 26 of those will be in the Study Area.

SUMMARY AND CONCLUSIONS

Table 2-5 summarizes the employment impacts of indirect economic activities, as estimated by the I/O models.

Table 2-5. Indirect employment effects in the three counties, jobs/year

	DEIS	Our Review
Construction	not specified	11
Operations, on-site	211 (adjusted to 237)	309
Operations, off-site	not estimated	87

Source: DEIS and NCSGRE and ECONorthwest calculations.

The reason we have estimated the indirect employment impacts is so we can determine how much impervious surface and disturbed land would be generated as a result of building the proposed resort. The estimate of construction impacts has no bearing on that analysis: most of the impacts are outside the three counties and all impacts are temporary. Any new firms that establish themselves to respond to demand generated by construction activities will then seek to serve demands generated by operating the resort.

We used an integrated spreadsheet model to allocate the direct jobs to the three counties and the Study Area. The model provides low, expected, and high estimates for jobs. The model distributes jobs based on assumptions about where direct, indirect, and induced jobs will be located. The model distributes jobs based on assumptions about where direct, indirect, and induced jobs will be located:

- The Low estimates assumes that 3% of indirect jobs and 10% of induced jobs will be in the Study Area;
- The Expected estimates assumes that 10% of indirect and 25% of induced jobs will be in the Study Area;
- The High estimates assumes that 20% of indirect and 33% of induced jobs will be in the Study Area.

We do not attempt to allocate the indirect economic impacts of construction activities to the Study Area. Indirect economic impacts of construction activities in the Study Area will be temporary, and will cease

once construction ends. Table 2-6 shows low, high, and expected estimates of where jobs will be located.

Table 2-6. Allocation of indirect employment effects in the three counties and Study Area, Jobs/Year

Source of Impact	Low		Expected		High	
	3 Counties	Study Area	3 Counties	Study Area	3 Counties	Study Area
Operations, on-site	309	21	309	68	309	94
Operations, off-site	87	6	87	19	87	26

Source: Calculated by NCSGRE and ECONorthwest.

2.2.3 DIRECT *DEVELOPMENT* IMPACTS

WHAT THE DEIS SAYS

The Belleayre Resort will have two assemblages of properties—an eastern portion and a western portion. The properties total 1,960 acres, and through deed restrictions and conservation easements, 1,387 acres will be preserved and not developed. The remaining 573 acres make up the project site. According to the Executive Summary of the DEIS (page xii), 85 acres of the project site will contain impervious surfaces.

OUR REVIEW

The key point is that there is no point in trying to use direct *economic* impacts to estimate onsite development impacts when the DEIS gives an exact estimate of total onsite development and impervious surface based on take-offs from its master plan. We accept those estimates (573 acres of disturbed area on the project site, and 85 acres of impervious surfaces).

Our understanding is that the estimate is for the resort at full build out, which occurs in Year 8. Thus, those are the total onsite direct development impacts. (Given this point, there are no secondary onsite development impacts—all the secondary development impacts must occur offsite.)

There are direct economic impacts offsite during operation: people using the resort spend money directly offsite. Arguably that new spending requires new development (though in the short run, of course, it could be accommodated by more sales per square foot in existing buildings). Since the DEIS treats these impacts as secondary development impacts, we will comment on them there.

2.2.4 SECONDARY *DEVELOPMENT* IMPACTS

The DEIS describes how indirect economic effects will affect local commercial development, seasonal residential housing development, and year-round housing development.

WHAT THE DEIS SAYS

Commercial

The DEIS estimates the level of increased expenditures in the impact area generated by the proposed development, and the resulting level of new demand for commercial space these expenditures will generate. Table 2-7 below shows the expected level of increased expenditures and the resulting level of demand for commercial space, by category of expenditure as estimated in the DEIS.

To convert increased expenditures to demand for commercial building space, the DEIS assumed that $250 of revenue would yield one square foot of building space. This conversion factor is based on the average sales per square foot at neighborhood shopping centers.[7] As presented in Table 2-7, the DEIS estimates that the $19.2 million in increased expenditures induced by operating the resort is expected to result in demand for 76,700 square feet of commercial space in the Study Area.

Table 2-7. DEIS estimate of expected new demand for building space, in square feet, for three-county area, at full resort operation

Expenditure Category	New Sales	New Demand (Sq. Ft.)
General & Misc. Merchandise	5,378,832	21,515
Eating & Drinking	4,395,216	17,581
Automotive	3,466,789	13,867
Food Stores	3,142,363	12,569
Amusement	1,359,042	5,436
Apparel/Accessories	815,305	3,261
Personal Services	298,174	1,193
Building Materials	181,070	724
Home Furnishings	143,675	575
Total	19,180,466	76,722

Source: DEIS, Appendix 26, Table 7-1, p. 7-5.

If the new demand for commercial space shown in Table 2-7 is met by new construction, the DEIS states this level of development could be accommodated in a single neighborhood shopping center anchored by a grocery or general merchandise store, or as several stand-alone buildings. The DEIS estimates that this level of construction would affect, at most, 5 to 10 acres in the three-county area, assuming a maximum building coverage of 30% and 5 parking spaces per 1,000 square feet of building space.

The DEIS argues that most of the new demand for goods and services would be met by existing businesses in the Study Area.

Seasonal residential development

The resort developer intends to build 400 hotel rooms, 351 fractional ownership homes, and 21 single-owner homes. The DEIS states that the Belleayre Resort is designed to capture the demand for seasonal residences generated by the existing ski area and the resort's on-site amenities. The DEIS states that the proposed resort would absorb many, but not all of the overnight and seasonal home demand generated by the area's winter amenities. Existing facilities will meet remaining demand for wintertime lodging.

A separate but related development is the New York State Department of Environmental Conservation's proposed expansion of the Belleayre Ski Area. The expansion would increase the quantity and quality of skiing in the Study Area, and demand for winter services, including housing, would increase. The DEIS reports that the increased demand is likely, but not quantifiable.

Because the resort is adding to the non-wintertime amenities in the Study Area, the resort is expected to increase the attractiveness of the region. The area will become an increasingly attractive option for second homebuyers. However, the DEIS does not attempt to further characterize demand for new seasonal homes. The DEIS does not assess demand that might arise from the three casinos that have been authorized or the post-September 11th demand.

The DEIS concludes that the Belleayre Resort will absorb the bulk of seasonal and second home demand that the resort creates. It argues that any increase in off-site demand is expected to be offset by on-site lodging, resulting in a marginal increase, if not a potential net decrease, in off-site seasonal real estate activity. The DEIS asserts that the resort may satisfy demand in the area for new housing, thereby reducing the expanded Belleayre Ski Area's growth-inducing effects.

The DEIS argues that demand for seasonal homes not at the resort would not be any greater than the demand for seasonal homes in the absence of the resort. Because the resort will satisfy a portion of the ski area's demand for housing, it may reduce the ski area's growth-inducing effects.

Year-round residential development

The DEIS argues that the resort will not impact year-round residential development in the Study Area. The DEIS concludes that the only source of demand for new year-round homes will stem from the resort's employment of new workers. Because most of the new workers will come from the local community, very few new workers will move to the area. The most likely candidates to relocate to work at the resort are those employed in mid- and upper-management jobs. The jobs will require specialized skills that are unlikely to exist in the local labor pool. The project developer has identified

16 to 20 positions that fall into this category, and those individuals and their families will require year-round housing. The expected salaries for these positions range from $50,000 to $150,000, measurably higher than the median income level for the area. With their relatively high income, these individuals are likely to pursue relatively high quality housing. The DEIS argues that most of these individuals will rent or purchase an existing home, and they are unlikely to build a new home. To support this argument, the DEIS reports that timeshare and hospitality industry workforce is highly mobile, and often rotate jobs within the industry. Because they are mobile, they are unlikely to commit the time and effort to construct a new home. The DEIS concludes that only a small fraction of the 16 to 20 workers may stay in the area for the long term and build a permanent year-round residence. Thus, the existing housing stock will be able to meet most demand for year-round housing.

OUR REVIEW

Commercial

The DEIS estimates that if all the new commercial demand were accommodated in a new shopping center, the new construction would affect, at most, 5 to 10 acres in the Study Area. The DEIS argues that most new demand will likely be absorbed by existing businesses or by redevelopment of abandoned or underused sites. We believe that this is unlikely, for several reasons:

- Even in the absence of increased expenditures in a local economy, we have observed that new development occurs to take market share from existing businesses and to meet increasing demand by consumers for selection, convenience, and value. Capturing a share of existing expenditures and meeting consumer demand, not increased expenditures, is a primary reason for the development of chain stores such as Wal-Mart and fast food restaurants.
- Increased traffic and expenditures generated by the proposed resort development will be a strong attractor for entrepreneurs and corporations seeking a place to locate or expand their business.
- The DEIS argues that existing restaurants are likely to meet new demand by increasing table turnover, staying open later, and staying open an additional night. However, meal times are not that flexible. A restaurant cannot double its capacity by doubling dinner hours. Customers want dinner at dinnertime, and if the wait is too long, they will go elsewhere. Staying open an additional night will not add much capacity, because the visitors are most likely to eat in the Study Area on weekends and holidays. Existing restaurants will meet what demand they can, but the substantial growth in vacationers and demand will encourage entrepreneurs to develop new restaurants in the Study Area.
- The DEIS estimates additional expenditures at Eating & Drinking Places would be ~~$4.4 million,~~ which is more than sufficient to support

development of several new restaurants in the impact area. Retail industry benchmarks reported by BizStats.com show that 53% of profitable incorporated eating and drinking places have average annual sales of $274,000, and another 35% have average annual sales of $950,000. Many familiar restaurant chains have average sales per store less than $4.4 million, including McDonalds ($1.6 million), Starbucks Coffee ($780,000), Applebee's ($2.7 million), Domino's Pizza ($605,000) and Denny's ($1.3 million).[8]

- The DEIS estimates that 70% of new expenditures in the Automotive category, or $2.4 million, will be for additional sales of gasoline, oil, and service to employees and visitors of the resort. The remaining 30% will be for buying and renting cars. This level of expenditures on gasoline, oil, and automotive service will be sufficient to justify construction of a new gas station. Retail industry benchmarks show that 57% of profitable incorporated gasoline stations and convenience stores (which frequently share the same location) have average annual sales of $1.6 million.[9]
- New development in response to increased expenditures generated by the resort will want to locate in locations that are visible and conveniently accessible to traffic traveling to and from the resort. This will create strong demand for locations on Highway 28. Existing businesses and redevelopment of abandoned sites are unlikely to capture new demand generated by the resort if they lack the visibility and accessibility characteristics favored by businesses.

The DEIS states that most of the new development will take place within the hamlets and villages. It argues that this is true because the zoning codes in the Towns of Shandaken and Middletown direct commercial development into the existing villages and hamlets and those local zoning codes are the primary method for controlling location, scale, appearance, and character of any new development. New businesses, however, in the impact area will have a strong economic incentive to locate on sites visible and accessible from Highway 28. Businesses will also seek development sites with the capacity for the larger stores typical of new commercial development. Development sites in existing town centers are unlikely to have these characteristics. These local communities will likely face the choice of approving development on Highway 28 outside of the town center or not getting the development at all. Local communities will have incentives to approve such development for the tax revenue such development will provide.

These points are supported by the actual experience of communities in the impact area. The DEIS states that approval has already been granted for an expanded supermarket on Highway 28 between Margaretville and Arkville. Local sources report that this will actually be a new supermarket that will compete with an existing A&P located in the center of Margaretville.[10] This new development is occurring without a sharp increase in local expenditures, and will be located on the highway outside of existing town centers.

Finally, the DEIS fails to include secondary impacts stemming from anything other than the retail sector. The spending by resort employees and resort visitors will affect more than the retail sector.

Seasonal residential demand

The DEIS makes two different arguments. At one point, it states that the resort will not meet all the demand for seasonal housing and that existing lodging facilities in the villages and hamlets will meet the remainder of demand. The DEIS also argues that any increase in off-site demand is expected to be offset by on-site lodging, resulting in a marginal increase, if not a potential net decrease, in off-site seasonal real estate activity. It is not entirely clear from the DEIS if the resort is expected to meet all demand for seasonal housing in the area, or is expected to stimulate more demand for off-site seasonal housing.

We expect that the resort would provide high-end lodging facilities and many amenities to accompany them. The resort, like any other, would market its facilities to likely customers, many of whom are currently not visiting the area. The new visitors will seek a resort experience, very different from what existing visitors experience. The resort will generate new demand for a different product, thereby increasing the number of visitors to the area. Overall demand for housing is likely to grow.

Year-round residential demand

The resort plans to employ 747 new workers when it is fully operating. In addition to these jobs directly generated by the resort, new jobs will be generated by off-site spending of visitors and the indirect impacts of operating the resort. In our I/O analysis, we estimated that an additional 548 new jobs would be generated by the resort and its visitors. In total, when the resort is fully operational 1,295 new jobs would be created.

At this time, there is low unemployment (about 4%) in the Towns of Shandaken and Middletown. We estimate that there are fewer than 300 unemployed individuals in the 15-zip code local area.[11] Anecdotal evidence suggests that our estimate may be high. Many local businesses have "help wanted" signs. Local sources told us that individuals with construction skills are in great demand, and it is difficult to find an available contractor.[12] For example, it took at least six months for the Town of Shandaken to find a contractor to repair the dog kennels—no one was available. The Town also had difficulty finding a contractor to repair a leak in a roof that was damaging court records.[13]

Because there is so little unemployment within the Study Area, the resort will have to rely on larger labor pools within the three-county area, but outside the immediate Study Area. The closest large source of potential workers would be Kingston and New Paltz. The time and distance between the resort and these communities is not trivial. Kingston is only 37 miles

away, but the drive takes 53 minutes. New Paltz is 52 miles away, and the drive takes 1 hour and 6 minutes.[14]

The 1,295 new job opportunities near the resort will encourage individuals to move to the area. With the large number of low-income jobs, there will be increased demand for low rent multi-family housing units.

We used an integrated spreadsheet model to allocate the number of new households likely to relocate in the three counties and the Study Area. The model provides low and high estimates for jobs, and the expected value. Table 2-8 shows the projected number of new households.

Table 2-8. Allocation of new households in the three counties and Study Area, at full resort operation

	Low		Expected		High	
	3 Counties	Study Area	3 Counties	Study Area	3 Counties	Study Area
New Households	648	128	900	332	1,042	479

Source: Calculated by NCSGRE and ECONorthwest.

SUMMARY AND CONCLUSIONS

All of the estimates of employment impacts—whether direct or indirect, whether from the DEIS or from our IMPLAN analysis—are generated for the three-county area.[15] Thus, the primary challenge for our analysis is to find credible ways to allocate the three-county employment and development impacts to the Study Area. We developed an integrated spreadsheet model for this task. It has various parameters regarding the percentages of Direct, Indirect, and Induced economic impacts that get allocated from the state model to the three-county area and to the Study Area, and how those employment impacts become land use impacts (total land disturbed and impervious surface). Appendix C shows some of the summary results and assumptions for our high, expected, and low runs of the model.

But having done all this analysis of the direct employment impacts, we must return to the basic logic of the analysis to make it clear how the analysis bears on the question of impervious surface and disturbed land. Our model allocates the direct jobs to the three counties and the Study Area. The model provides low and high estimates for jobs, and the expected value. The model distributes jobs based on assumptions about where direct, indirect, and induced jobs will be located.

We used our model to allocate the total direct jobs to the three counties and the Study Area. The model provides low and high estimates for jobs, and the expected value. With data produced by our I/O analysis, we calculated the number of commercial, office, industrial, and government jobs. We estimated the number of acres and impervious surface and disturbed land that the new jobs would generate. The model distributes jobs based on assumptions about

where direct, indirect, and induced jobs will be located. Table 2-9 shows low, high, and expected estimates of where jobs will be located.

Table 2-9. Allocation of total employment effects in the three counties and Study Area, jobs/year

Land Use Category	Low		Expected		High	
	3 Counties	Study Area	3 Counties	Study Area	3 Counties	Study Area
Commercial	169	9	211	33	211	52
Office	139	10	174	33	174	48
Industrial	56	4	71	13	71	20
Government	74	7	93	23	93	30
Total	438	31	548	102	548	150

Source: Calculated by NCSGRE and ECONorthwest.

In the discussion below, we discuss how we convert jobs and households into impervious surfaces.

IMPLICATIONS FOR IMPERVIOUS SURFACES AND DISTURBED LAND FOR DIRECT AND INDIRECT IMPACTS

With one small exception, all of the estimates of employment impacts—whether direct or indirect, whether from the DEIS or from our IMPLAN analysis—are generated for the three-county area. Thus, the primary challenge for the analysis is to find credible ways to allocate the three-county employment and development impacts to the Study Area. We developed an integrated spreadsheet model for this task. It has various parameters regarding the percentages of Direct, Indirect, and Induced economic impacts that get allocated from the state model to the three-county area and to the Study Area, and how those employment impacts become land use impacts (total area disturbed and impervious surface). Appendix C shows some of the summary results and assumptions for our high, expected, and low runs of the model.

Table 2-10 summarizes the results of our modeling.

Table 2-10. Impacts of the direct and indirect economic effects of Belleayre resort on several variables, for the three-county area and Study Area, at full operation

Area	Households	Employment	Impervious Acres On Resort	Impervious Acres Off Resort	Impervious Acres Total	Impervious Acres On Resort	Impervious Acres Off Resort	Impervious Acres Total
Three Counties								
Low	648	438	85	82	167	529	99	628
Expected	900	548	85	157	242	529	171	700
High	1,042	548	85	218	303	529	240	769
Study Area								
Low	128	31	85	14	99	529	17	546
Expected	332	102	85	52	137	529	59	588
High	479	150	85	94	179	529	105	634

Source: Calculated by NCSGRE and ECONorthwest.

Our spreadsheet model begins with estimates of employment from the input-output model, allocates those impacts to the three-county and Study Areas, converts estimates of employment to acres of residential and nonresidential development, then converts developed acres into acres of impervious surfaces and disturbed land. These conversions are based on assumptions about the following parameters:

- The share of employment that will occur in the three-county and Study Areas;
- The number of employees per households;
- The housing vacancy rate;
- The percent of households that will demand new housing;
- The distribution of households into single family and multifamily housing units; and
- The lot coverage of single family, multifamily, and nonresidential development.
- A mix of densities for single-family homes.

Appendix C shows the key assumptions behind our spreadsheet model. Though it is impossible to ascertain the exact values of these parameters, our experience with these kinds of analysis provides us with reasonable information about the range over which the parameter values might vary. By presenting the results of the model with different parameter values we not only demonstrate the range over which the results can vary, but we obtain information about the sensitivity of the results to changes in each of the parameters.

Table 2-10 presents estimates of households, employment, acres of impervious surfaces, and acres of disturbed land (both on and off the resort) for the three counties and the Study Area using parameter values that yield high estimates, low estimates, and our best estimate. High estimates result from parameter values based on assumptions that: (1) a large percentage of employment will occur in the three county and Study Areas, (2) low numbers of employees reside in each household, (3) large numbers of households need newly constructed housing, (4) residential development occurs at low densities, and (5) construction of all types yield high levels of impervious

surfaces and disturbed land. Low estimates reflect parameter values near the opposite end of the range of reasonable parameter values. The expected estimates reflect our best point estimates of parameter values.

As shown in Table 2-10, acres of impervious surfaces and acres of disturbed land on the resort site are the same in the three counties and the Study Area for each of three estimates. That is because these values are given by the DEIS. All the other estimates of effects are lower for the Study Area than for the three counties; how much lower depends on assumptions about the proportion of employment and households that remain in the Study Area. More detail on the parameter values and their effects on the estimates are shown in Appendix C.

To be consistent with the DEIS, we conducted our analysis for the 15-zip code study area defined by the DEIS. From the perspective of impacts on water quality, however, there is a good argument to be made that the relevant study area should be larger. We did, in fact, define such a larger study are for our cumulative impacts analysis (see next section).

The results offer two important insights. First, our estimates of impervious surface caused by the proposed development are greater than those in the DEIS (which equals approximately 5 to 10 acres for the three-county area), even our low estimate. Second, though the percentage differences between our high estimates and those of the DEIS may be large, the differences in acres of impervious surface is not large relative to the size of the Study Area.

An analysis of the potential for increased levels of impervious surfaces and disturbed land resulting from cumulative impacts appears to be far more significant. An analysis of cumulative impacts was not, however, presented in the DEIS.

2.2.5 CUMULATIVE *DEVELOPMENT* IMPACTS

Large developments like the Belleayre Resort can have effects that extend beyond those caused by new funds flowing through the local economy. Those impacts, which we refer to here as *cumulative impacts*,[16] occur because the development may change the local business climate, alter the decisions and preferences of tourists, businesses, and residents, and thus change the entire trajectory of economic and development trends. An EIS for such a large development in an important water resource, such as the Belleayre Resort, should consider cumulative impacts. They are too important to ignore.

Cumulative impacts are shaped by a variety of factors and are difficult to estimate. They depend on the underlying strength and character of the local economy, the strength and regional influence of the national economy, and the individual and aggregate decisions of countless business owners, tourists, residents, and government agencies. All are difficult to predict. While the cumulative effects of the proposed Belleayre Resort are difficult to estimate, for a number of reasons they are certain to occur:

- As discussed in the DEIS, the Belleayre Resort is intended to offer upscale resort opportunities that differ qualitatively from any others in the area. If true, the resort will change the character of the region and the individuals who will find it attractive.
- Also as discussed in the DEIS, the resort will attract visitors and part-time residents who may or may not ever visit the resort.
- The resort will open soon after the Bellearye ski area is expected to expand. It is thus likely that the expansion of the ski area will magnify the effects of the proposed resort.
- The Catskill region is a potential site for three gambling casinos that have been approved by the state legislature. The opening of even one casino could have major impacts on development patterns in the greater Catskill region.
- Growth of the New York metropolitan area and post-September 11th increase in housing demand.

To evaluate the likely range of the cumulative impacts (in this case, the total amount of growth and development that the Study Area might see over some extended period) we looked at various indicators of the ability of the Study Area to *supply* land to accommodate growth, and of the *demand* for growth.

SUPPLY OF AVAILABLE LAND

The DEIS assumes that any additional residential development would occur close to the Route 28 corridor. There is, however, potential for development outside this corridor (principally second-home development), and impervious surface and developed land is a certain byproduct of such development. To understand the supply of land available for development, we conducted a Geographic Information Systems (GIS) analysis. The New York City Department of Environmental Protection and the Catskill Center provided ECONorthwest with electronic data for that analysis.

Time and available resources did not permit, a detailed evaluation of land supply. The biggest gap in our data and analysis is that we do not report a data layer for plan or zone designation: we do not know, for example, how much of what appears to be buildable land is in, say, a designation that allows residential development of 4 to 6 dwelling units per net acre. Thus, we conducted the analysis to get just a rough idea (in thousands of acres) how much buildable land was in the Study Area, and whether the supply was so small that it would constrain development and suggest that we adjust our independent forecasts of the demand for land downward.

We began with all land parcels within a 25-mile radius by road, around the resort (data provided to us). That area clearly does not match the 15-zip code definition of the Study Area that we used in other parts of our analysis, but it does allow us to get a rough idea of land supply within the watershed. Figure 2-4 shows the area.

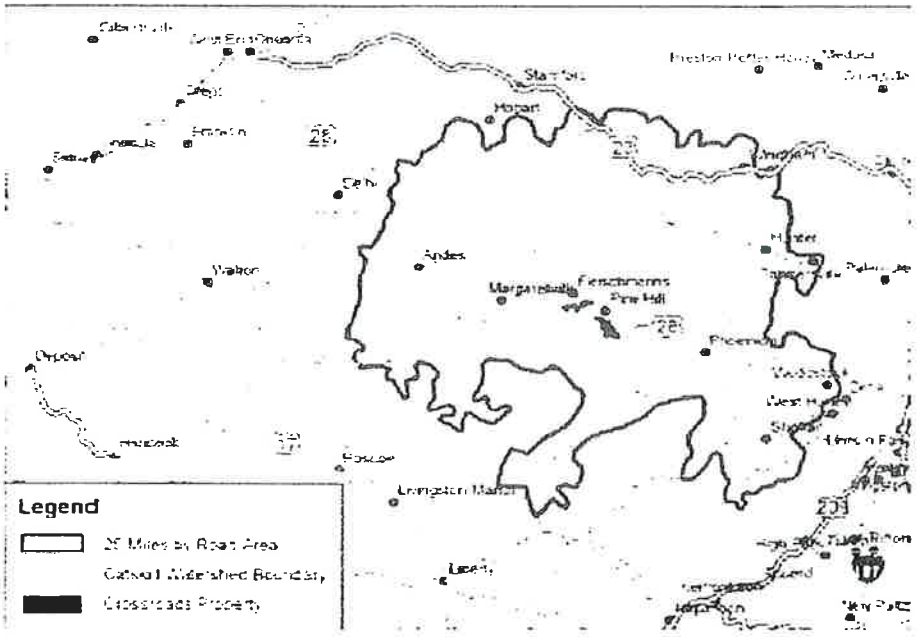
Much of the land within this radius is subject to development restrictions. We used GIS to subtract land that would be difficult to develop, either because of physical or regulatory constraints (the reservoirs themselves were excluded from the analysis). We subtracted the following lands:

- Protected lands—New York City and New York State have made aggressive efforts to buy land or acquire conservation easements for parcels within the watershed. These areas are removed as shapes over all or parts of individual tax parcels.
- Wetlands—development of impervious surfaces is prohibited within 100 feet of a wetland.[17]
- Streams—development of impervious surfaces is prohibited within 100 feet of a watercourse.
- Road access—many parcels lack current road access. There is, of course, potential for new roads to be built, but our baseline amount of developable lands begins with road access at least 150 feet from the tax parcel.
- Property type designations—We used property tax codes to determine if development is "highly unlikely" (roads, cemeteries, etc), "possible" (lands already developed that could be redeveloped), or if it was "vacant land". We subtracted out parcels where development is "highly unlikely" or "possible", leaving only vacant land.

We did not consider the following limiting factors, either because of data limitations or accuracy problems:

- Soil composition—septic systems require the soil to reach at least four feet in depth. Although data exist for this factor, its accuracy was not considered reliable for excluding land sections. Sewage treatment plants could allow for development on areas with soils that are inadequate for subsurface disposal systems.
- Inaccessible lands—some developable land may exist at the top of hills too steep for auto travel. The GIS data did not make it feasible to determine these locations accurately. Because these locations present potentially better views for residential development, we concluded it was not reasonable to exclude them.
- Odd-shaped lands—there may be parcels that are not suitable for development because of their shape, e.g., a long slice of land, too narrow for development.
- Reservoir lands—development of impervious surfaces within 300 feet of reservoirs is prohibited.

Figure 2-4. Area for the GIS analysis of land supply



Source: ECONorthwest from data provided by New York City Department of Environmental Protection and the Catskill Center.

Table 2-11 shows developable lands within 25 miles by road of the proposed resort. The first column of data shows all land parcels within the watershed that are within a 25-mile drive from the proposed Resort. The second column excludes parcels that lack road access within 150 feet of the property. The third column excludes land that is "highly unlikely" to be developed, such as roads and cemeteries. The final column excludes already developed land, leaving only those parcels that have vacant land.

Table 2-11. Developable Lands within 25 miles by road of the resort, by parcel classification, 2003

	All Parcels in Watershed, 25 miles by road from Resort	Parcels with road access within 150 feet	Parcels unlikely to be developed	Parcels with vacant land
Number of Parcels	29,474	23,060	21,573	6,310
Total Acres	485,598	351,090	271,405	79,854
Protected Land				
City	28,224	23,960	13,211	6,171
State	115,059	43,397	12,898	3,873
Regulated Land				
Wetlands	8,338	7,923	4,032	1,407
Streams	34,697	27,302	21,793	5,769
Total Undevelopable	186,318	102,583	51,933	17,220
Overlap	14,547	9,531	3,583	1,242
Net Developable	313,827	258,038	223,054	63,876

Source: Data from New York City Department of Environmental Protection and the Catskill Center, GIS Manipulation by ECONorthwest.

The bottom row of Table 2-11 shows that the estimates of "net developable land" vary substantially depending on what is backed out: from roughly 314,000 to 64,000 acres. This is a large amount of land. We needn't quibble

over the exact estimate. Even if the low estimate is used, a quick calculation shows substantial room for growth. In our discussion below of impervious impacts we show that population growth in the Expanded Study Area could consume all available land.

INDICATORS OF DEMAND FOR LAND, AND POTENTIAL GROWTH IN POPULATION, EMPLOYMENT, AND DEVELOPED AREA

If the supply of land does not impose a constraint on development in the watershed, the next question is whether there is or will be demand for development. Economic theory suggests that the demand for development is derived from the demand for economic activities in the area, which is determined by a large set of factors. These factors include the price of land, the price of other development inputs, the attractiveness of the area to businesses, tourists, and residents, and the proximity of the area to centers of economic activities. A review of the factors that influence demand, however, suggests that development demand in the area is likely to grow. More specifically, the watershed offers:

- Accessibility from New York City, the nation's largest metropolitan area;
- Scenic views, clean air, hiking, skiing and other recreation opportunities;
- Relatively low land and housing prices;
- A growing array of hotels, resorts, spas, and other tourist attractions.

These characteristics suggest the watershed has great potential for growth in development demand.

Despite the potential for growth in development demand, recent growth has not been rapid. Extrapolating past rates of growth far into the future, however, is hazardous. Foreseen and unforeseen events have the potential to radically change the development environment and thus cause significant changes in development paths. The question then becomes this: is there reason to expect, or anticipate, events or conditions that might change the trajectory of development trends? The answer is, yes, for the following reasons:

- Research by Rolf Pendall at Cornell University demonstrates that low-density development is accelerating in Upstate New York outside incorporated cities and villages.[18]
- The Belleayre ski resort is currently planning to expand significantly.
- Three casinos have been authorized by the New York State Legislature and Governor for the Catskill area, Ulster and Sullivan Counties.
- The September 11th terrorist attacks have increased the demand for second homes in the study area.[19]

- Scenery has increasingly become an important determinant for where economic growth happens in rural America, and mountains and lakes have become powerful magnets of economic activity.[20]
- The proposed Belleayre resort is intended to bring upscale resort opportunities to the area.
- Evidence of high growth rates in the Hudson Valley.[21]

Given that the demand for urban development in the watershed may accelerate and that the available supply of land does not serve as a constraint, how fast might development occur in the watershed? It is difficult to estimate long-term trends with any degree of certainty, but it is possible to gain additional insights from other fast growing winter resort communities.

Rural counties with ski resorts near metropolitan areas, such as Aspen, Colorado, Squaw Valley, California, and Sun Valley, Idaho, have experienced growth rates greater than the national average. From 1950 to 2000, the average rate of growth for these fast-growing counties was 3.4 percent, while the U.S. average was 2.2 percent. Of course, growth in population probably understates growth in second homes, hotels and tourist facilities, stores and gas stations, and other types of development that occurred in these counties.

Growth rates in the Study Area could easily exceed 3% for 10 or 20 years. Population numbers are low now, so new population will cause a large percentile growth change. Over the long time, however, high growth rates will be difficult to sustain.

Given all the variables that influence the demand for built space and the rate of development in a region, economists, demographic forecasters, and planners have learned that no single estimate of future development is likely to be correct, especially for a small area (like this Study Area), where a few large developments can substantially alter the amount of development in the area. There is professional agreement that such forecasting is better presented as set simulations than as a single prediction. However, a long-term 3% growth rate appears to be a reasonable projection of the cumulative rate of growth. That is how we proceeded in Section 2.2.5, Implications for Impervious Surface, where we discussed how we converted growth in households into impervious surfaces.

POTENTIAL IMPACTS OF SKI AREA COMBINED WITH CASINOS

There is growing interest on the part of Indian tribes to develop casinos in the Catskills. Three casinos have been authorized by the New York State Legislature and Governor for the Catskill area, including Ulster and Sullivan counties. A recent article in the New York Times[22] describes why the tribes, local communities, and the State of New York have a strong interest in casino development. This article cites "experts" who say that "a major casino in the Atlantic City style about 90 miles from Times Square would probably do about $1 billion a year in business." Since tribes must agree to revenue-sharing plans to get State approval, casinos with this much business could

generate hundreds of millions of dollars for state and local government. A casino could also stimulate local economic development—the New York Times article states that "the tribes have found a warm welcome from Catskills businesses hoping that casinos would mean a return to the glory days of the Borscht Belt resorts, and then some."

The strong economic incentives to develop a casino in the Catskills, recent State legislative action that limits casinos in eastern New York to Sullivan and Ulster Counties, and the potential resort development on Belleayre Mountain all suggest that a casino development near the proposed resort is a possibility. This possibility has been raised by local residents, as evidenced by a recent editorial in the Phoenicia Times[23] and the Catskills Heritage Alliance web site.[24] The Catskills Heritage Alliance web site quotes Neil Woodworth, counsel for the Adirondack Mountain Club and the New York-New Jersey Trail Conference, as saying that "because casinos require federal approval, they may not be subject to the State Environmental Quality Review law." The status of tribes as sovereign nations reduces the chances that state and local regulations could prevent a casino from locating near the proposed Belleayre Mountain resort.

The impacts of a casino on the surrounding economy vary depending on market conditions. In areas that are popular for visitors, the addition of a casino complements other tourism-related activities by enhancing the array of activities available to visitors. Casinos in such areas tend to increase overall visitation to the area by making the region as a whole more attractive to more people. For this reason, visitor spending generated by a casino in the Belleayre Mountain area would be in addition to visitor spending generated by the proposed resort. Given the small population base in the area, much of this increased spending would be from outside of the region, generating job and income impacts in addition to those generated by the proposed resort.

Casino visitors spend large amounts outside the casino. This is especially true for people coming as couples or groups, because some partners or group members will not be interested in gambling (only about 30 percent of adults like to gamble in a casino). Even among adults who like to gamble, fewer than half will wager in a casino in any given year. More than half of the entire non-airfare tourist spending in Las Vegas, for instance, is on shows, shopping, and attractions—not gambling.

Research on the economic impacts of casinos by ECONorthwest shows that spending by casino employees, rather than visitor spending, generates the greatest impacts on the local economy. Since casinos operate 24 hours a day, their workers prefer to live nearby—typically within a half-hour drive—to avoid long commutes at odd hours. Casino operators typically offer good wages and benefits to reduce employee turnover, because of year-round demand, high licensing and training costs, and casino players' almost obsessive concerns about friendly service. In addition, gratuities are often a significant source of income for casino workers, which is not fully reflected in published government wage or payroll statistics. For these reasons, the main economic impact of a casino is typically spending by casino workers at local

stores, movie theaters, dentists, plumbers, and all the other places that average people spend their money in day-to-day life.

The degree of population growth and new development in an area where casinos are introduced depends in large part on the condition of the local labor force and the housing vacancy rate. Places with under-employed populations and ample housing capacity would see less population growth and new development than places with low vacancy rates and low unemployment. Given the low unemployment rates in Ulster and Delaware counties, we would anticipate some population growth and a resulting demand for new housing from a new casino in the Belleayre Mountain area.

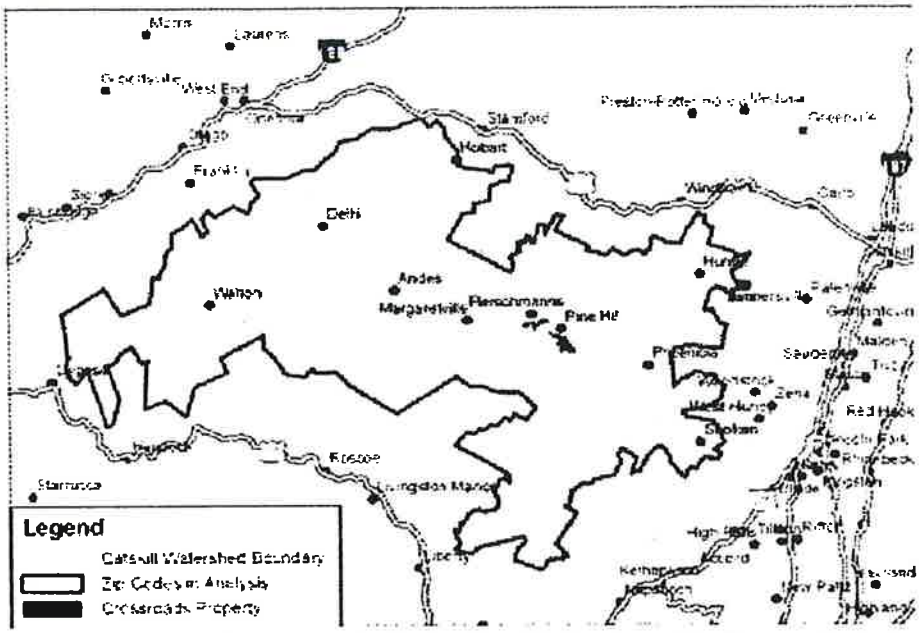
IMPLICATIONS FOR IMPERVIOUS SURFACE AND DISTURBED LAND FOR CUMLATIVE IMPACTS

Because so many variables influence the demand for built space and the rate of development in a region, economists, demographic forecasters, and planners have learned that no single estimate of future development is likely to be correct, especially for a small area (like this Study Area), where a few large developments can substantially alter the amount of development in the area. There is professional agreement that such forecasting is better presented as set simulations than as a single prediction. That is how we proceed.

Throughout our analysis we have assumed that the primary affected area is the Study Area as defined in the DEIS. The authors of the DEIS selected the 15 zip codes based on journey-to-work data and where the majority of the employment and other economic impacts of the proposed project would be expected to occur. We are concerned with the entire Catskill and Delaware watershed system, however, not only with the area where current economic activity takes place.

To account for potential development within the watershed, we expanded our cumulative impacts analysis to include more zip codes. We identified a larger impact area, called the Expanded Study Area, which includes 30 zip codes that lie within the watershed and are connected by main highways to the Belleayre Resort. Figure 2-5 shows our Expanded Study Area, which now includes 30 zip codes.

Figure 2-5. Expanded Study Area



Source: ECONorthwest from data provided by New York City Department of Environmental Protection and the Catskill Center.

The Expanded Study Area represents a larger portion of current economic activity within the three counties. The original Study Area accounted for about 3% of all employment within the counties, and the Expanded Study Area accounts for about 9% of all employment in the counties.

Table 2-12 shows the starting conditions: our estimates of population, households, and employment *in the Study Area* (i.e., the 15-zip code area selected to approximate the affected part of the watershed). Table 2-12 also shows population, number of households, and employment for our Expanded Study Area and the 30-zip code area. [25] Table 2-12 is meant only to provide context.

Table 2-12. Population, Households, Employment in the Study Area and Expanded Study Area, 2003

Measure	15-Zip Code Study Area (defined in DEIS)	% of 3 Counties	Expanded Study Area	% of 3 Counties
Population	13,827	5.0%	43,613	15.7%
Households	6,006	5.5%	18,944	17.5%
Employment	2,698	2.9%	8,510	9.1%

Source: New York Department of Labor, Claritas data, and analysis by NCSGRE and ECONorthwest.

Table 2-13 shows how a new household, new total disturbed land, and new impervious acres might occur over time in the Expanded Study Area, using the 30-zip code region as a proxy for the watershed, under different

assumptions about average annual rates of growth, and the density of the development pattern. To repeat the main caveats:

- Table 2-13 is a simulation that attempts to get some approximations that put some bounds on the likely amount of development and impervious surface in the watershed. This analysis is not a substitute for a full cumulative impact analysis that, in our opinion, should have been undertaken in the DEIS.
- Making the estimates required dozens of assumptions about demand and supply variables (both explicit and implicit). The uncertainty around the estimates of the input variables multiplies the uncertainty around the estimates of the outputs (increases in disturbed and impervious acres).
- That said, we would not be surprised for our estimates of impervious surface and disturbed land to be off by a factor of two. We would be surprised if they were off by a factor of five.
- Thus, those evaluating the impacts of our estimates should consider: Are the best estimates of the total amount of impervious surface enough to cause concern about overall water quality? If not, would they be of concern if they were twice as big?
- It is reasonable to project a 3% growth rate, cumulatively over the long-term, given the circumstances of the watershed and experienced elsewhere in the nation with large regional resorts.

To read the table, consider an assumption of an annual average growth rate (of population, and implicitly, households) of 3% (the middle column of numbers). The three blocks of rows are about how much change (growth) will occur, after 10, 20, and 50 years. Inside of each block, one can read the changes for households, total disturbed land, or impervious surface, under conditions of low-density or moderate density development patterns. For example, at a 3% growth rate, after 20 years there will be 3,921 additional acres of impervious surface and 17,331 acres of disturbed land in the Expanded Study Area if the pattern of development is low density. For context this would be equivalent to 5.8 square miles of new impervious surfaces and 30 square miles of construction disturbances within the Expanded Study Area. This certainly appears to be a level of new development that could raise significant water quality concerns and that should be addressed in the DEIS.

Table 2-13: Potential long-run growth and its impacts on several variables for the Expanded Study Area; 10, 20, and 50 years.

	Average Annual Population Growth Rate		
	2%	3%	4%
Amount of Growth in 10 Years			
Households	4,149	6,515	9,098
Developed Area (Gross Acres)			
Low-density pattern	6,278	9,859	13,767
Mid-density pattern	3,706	5,820	8,127
Impervious Surface (Acres)			
Low-density pattern	1,065	1,673	2,336
Mid-density pattern	556	1,191	1,719
Disturbed Surface (Acres)			
Low-density pattern	4,708	7,394	10,325
Mid-density pattern	556	1,191	1,719
Amount of Growth in 20 Years			
Households	9,206	15,271	22,565
Developed Area (Gross Acres)			
Low-density pattern	13,930	23,108	34,145
Mid-density pattern	8,223	13,641	20,157
Impervious Surface (Acres)			
Low-density pattern	2,364	3,921	5,794
Mid-density pattern	1,234	2,753	4,195
Disturbed Surface (Acres)			
Low-density pattern	10,448	17,331	25,609
Mid-density pattern	6,168	10,231	15,118
Amount of Growth in 50 Years			
Households	32,045	64,105	115,685
Developed Area (Gross Acres)			
Low-density pattern	48,491	97,003	175,055
Mid-density pattern	28,626	57,264	103,340
Impervious Surface (Acres)			
Low-density pattern	8,228	16,460	29,704
Mid-density pattern	4,294	11,049	20,420
Disturbed Surface (Acres)			
Low-density pattern	36,368	72,752	121,291
Mid-density pattern	21,469	42,948	77,505

Source: Calculated by NCSGRE and ECONorthwest.

Comparing the growth estimates in Table 2-13 to the land supply analysis summarized in Table 2-11, we can see that all available land could be developed within 50 years. Table 2-11 shows that the estimates of "net developable land" varies from roughly 314,000 to 64,000 acres. Table 2-13 shows that a 4% growth rate at a mid-density development pattern consumes almost all the land. If land is developed at a low-density pattern, demand for land could easily exceed supply.

SUMMARY AND CONCLUSIONS

We do not know how much impervious surface will be judged as having "too much negative impact" on water quality. Our purpose has been to give a range of by how much impervious surface might grow.

One clear conclusion is that the direct and indirect economic impacts of the proposed resort development is low compared to the cumulative impacts. In that sense, significance of the impacts of the Belleayre Resort on water quality stem less from its direct impacts than from its contribution to the potential for long-term development in the watershed.

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[1] We assume the local study area to be the same 15 zip codes identified in the DEIS. The zip codes are: 13740, 13731, 12455, 12430, 12492, 12406, 12465, 12410, 12480, 12464, 12416, 12457, 12412, 12481, and 12494.

[2] The exception is that construction impacts, both direct and indirect, are estimated using a statewide model, and the results are therefore for the state as a whole. Some share would have to be allocated to the three-county area, and then to the study area. As described in more detail elsewhere in this report, this component of economic impact is not very important because we already have an independent estimate of its primary direct impact on impervious surface in the study area: construction at the resort.

[3] With the help of the New York Attorney General's office, we attempted to acquire the RIMS II multipliers from New York State Department of Environmental Conservation. We did not receive before we completed our analysis.

[4] There are three types of multipliers. A Type 1 multiplier measures the direct and indirect effects from a change in spending. In essence, a Type 1 multiplier measures only the economic impacts associated with industries buying from other local, backward-linked industries. In addition to the indirect effects, a Type 2 multiplier includes the induced effects associated with increased income and expenditures by households. A Type SAM multiplier (Social Accounting Matrix) measures the direct, indirect, and induced effects. However, it assumes full employment so each new job adds to the population and includes some additional induced spending for that population change. We used a Type SAM multiplier.

[5] DEIS, Appendix 26, Table 4-16 through 4-20, pp. 4-19 through 4-23.

[6] As reported in Tables 4-4 and 4-5 in the DEIS.

[7] Urban Land Institute. 2000. Dollars and Centers of Shopping Centers.

[8] http://www.bizstats.com/rest.netcorps.htm and http://www.bizstats.com/spf.rest.htm. Accessed January 26, 2004.

[9] http://www.bizstats.com/gas.netcorps.htm Accessed January 26, 2004.

[10] Personal communication with Helen Budrock.

[11] The average unemployment rate for Delaware, Ulster, and Greene counties is 4.2% (from the New York Department of Labor). The population 16 years and older in the 15-zip code local area is 11,348, and the area's labor force participation rate 61.3%, yielding 6,952 individuals in the labor force (from the U.S. Census). We multiplied the average unemployment rate for the three counties by the estimated labor force, calculating 295 unemployed persons in the 15-zip code local area.

[12] Personal communication with Eric Wedermeyer and Pete DiModica.

[13] Personal communication with Pete DiModica.

[14] Travel time and distance calculated with MapQuest (www.mapquest.com). Accessed January 27, 2003.

[15] With the exception of construction impacts, which are estimated using a statewide model, and the results are therefore for the state as a whole. Some share would have to be allocated to the three-county area, and then to the study area. As described in more detail elsewhere in this report, this component of economic impact is not very important because we already have an independent estimate of its primary direct impact on impervious surface in the study area: construction at the resort.

[16] We use that term in a way we think is consistent with the way it is used in EISs.

[17] All regulatory constraints are from Rules and Regulations for the Protection from Contamination, Degradation and Pollution of the New York City Water Supply and Its Sources.

[18] Pendall, Rolf. "Upstate New York's Population Plateau," for the Center on Urban and Metropolitan Policy. August 2003.

Pendall, Rolf. "Sprawl without growth" for Center on Urban and Metropolitan Policy, October 2003.

[19] Personal communication with Pete DiModica and Tom Alworth.

[20] Drabenstott, Mark. 2003. "A New Era for Rural Policy" in Economic Review. 88(4):81-98.

[21] Pendall, Rolf. "Upstate New York's Population Plateau," for the Center on Urban and Metropolitan Policy. August 2003.

[22] Peterson, Iver. 2004. "Casino Deals Are Stalled by State, U.S. and Tribal Hurdles." *The New York Times*. January 20. P. B1.

[23] The Phoenicia Times. 2004. "Editorial: What If?." January 24. Shandaken, NY. http://www.phoeniciatimes.com/phoenicia/editorial.html Accessed 1/26/04.

[24] Catskills Heritage Alliance. "Casino Gambling in the Catskills." http://www.catskillheritage.org/issues/gambling/ Accessed 1/26/04.

[25] Employment in the watershed grew from 2,698 to 8,510, or 2.9% of 3-county employment to 9.1% of 3-county employment. To estimate the population in the Expanded Study Area, we took the ratio of population to employment in the 15-zip code Study Area and applied that ratio to employment in the Expanded Study Area to calculate estimated population in the Expanded Study Area. To estimate the number of households in the Expanded Study Area, we took the ratio of number of households to employment in the 15-zip code Study Area and applied that ratio to employment to calculate estimated number of households in the expanded study area.

Appendix A Value of Environmental Services

THE ECONOMIC VALUES OF ECOSYSTEM SERVICES

The economic importance of ecosystem services provided by riparian areas, upland forests and other natural areas is well documented throughout the economic literature. Many economists and other researchers have described the ecosystem services provided by natural areas and the economic values of these services. They include Balmford (2002), Costanza (1997), Costanza (1998), Farber (2002), Howarth (2002), Hueting (1998), Templet (1998), de Groot (2002), and Heal (2000).

Costanza (1997) describes the relationship between ecosystem services and their benefits to society as,

> "Ecosystem functions refer variously to the habitat, biological or system properties or processes of ecosystems. Ecosystem goods (such as food) and services (such as waste assimilation) represent the benefits human populations derive, directly or indirectly, from ecosystem functions." (page 253)

King (2003) describes the relationship between ecosystem services and their values to society as,

> "Ecosystem functions are the physical, chemical, and biological processes or attributes that contribute to the self-maintenance of an ecosystem; in other words, what the ecosystem does. Some examples of ecosystem functions are provision of wildlife habitat, carbon cycling, or the trapping of nutrients. Thus, ecosystems, such as wetlands, forests, or estuaries, can be characterized by the processes, or functions, that occur within them."
>
> "Ecosystem services are the beneficial outcomes, for the natural environment or people, that result from ecosystem functions. Some examples of ecosystem services are support of the food chain, harvesting of animals or plants, and the provision of clean water or scenic views. In order for an ecosystem to provide services to humans, some interaction with, or at least some appreciation by, humans is required. Thus, functions of ecosystems are value-neutral, while their services have value to society."

Costanza (1997) and de Groot (2002) describe individual ecosystem functions and related services provided by natural areas. Their descriptions include ecosystem functions such as water regulation, waste treatment, and biological controls, and related ecosystem services such as drainage, pollution control, and control of pests and diseases.

In an attempt to develop a common understanding and description of the relationship between ecosystem services and their values, de Groot (2002) presents a conceptual framework for describing, classifying and valuing ecosystem services. The major components of his framework include:

- The ecosystem structure and processes
- The resulting ecosystem functions
- The ecosystem goods and services generated by the functions
- The ecological, socio-cultural, and economic values of ecosystem goods and services

Researchers describe two classes of economic benefits of ecosystem services, macro and micro benefits. At the macro level, ecosystem services have global importance and values because they affect critical biological processes that sustain life on earth (Costanza et al. 1997; de Groot et al. 2002; Howarth and Farber 2002). Costanza (1997), describes the values of these services as,

> "The services of ecological systems and the natural capital stocks that produce them are critical to the functioning of the Earth's life-support system. They contribute to human welfare, both directly and indirectly, and therefore represent part of the total economic value of the planet." (page 253)

At the micro or local level, information on the relative scarcities and qualitative conditions of natural resources sends signals regarding the changes in economic benefits and values of these services to society (Howarth and Farber 2002). For example, degrading riparian areas that protect water quality also degrades the values of water quality services provided by these areas. These signals have implications for local land-use and restoration decisions.

At both the macro and micro level, many ecosystem services are not captured by, or valued in, commercial markets (Balmford et al. 2002; Costanza et al. 1997; Daily 1997; de Groot et al. 2002). For example, markets can account for the values of trees harvested for lumber but not the costs associated with the erosion and sedimentation caused by logging steep hillsides. This lack of market information makes valuing ecosystem services more challenging. For this reason, information on the values of ecosystem services has been limited. This is changing rapidly, however, as more and more researchers focus on this issue (Balmford et al. 2002). De Groot (2002) concludes that methods now exist that can estimate economic values for the range of ecosystem functions and services found in nature. Farber (2002) and Heal (2000) describe these methods and their application to studies of the economic values of ecosystem services. (We describe these methods in greater detail in the following subsection.)

Balmford (2002) and Farber (2002) note that measures of the economic values of ecosystem services estimated for marginal changes in the supply of services are not representative of the values of the services for larger or what

they refer to as "threshold" changes in supply. As described by these researchers, at the margin, there is a linear relationship between changes in the supply of services and changes in values. This relationship holds for relatively small changes in supply. However, once the supply of ecosystem services reaches a critical or threshold level, changes in services and changes in values exhibit a nonlinear relationship. For example, as water becomes scarce in a region, the value of water may increase dramatically once the supply falls below a critical or threshold amount.

Double counting of economic values may occur when a given ecosystem function supplies multiple services (de Groot et al. 2002; Turner et al. 1998). For example, a wetland's ability to regulate surface runoff and flooding may be valued separately but these services are also related. De Groot (2002) suggests that one method of avoiding double counting services and values is to develop dynamic models that account for the interrelationships among ecosystem functions, services and values.

COMPETITION FOR NATURAL RESOURCES

In the past, it may have made sense to conclude that there was no competition for natural resources. The resources were abundant, and the economy made use of the resources in limited ways. Jobs, wealth, and prosperity were derived from natural resources through extractive industries that converted resources into commodities or via development industries that displaced natural resources with human-made assets, such as housing, commercial-industrial complexes, or roads.

In those days, resource-conservation proposals could be seen as involving a distinct tradeoff between the economy and the environment. One could have a healthy economy or a healthy environment, but not both. When resources were abundant relative to the demands placed on them, there was, in effect, no economic competition for them—the natural resources were free for the taking.[1]

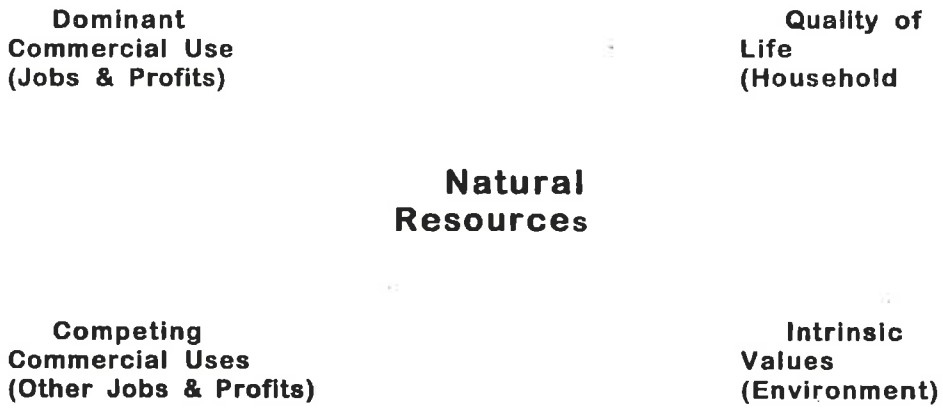
Today, things have changed. Economic competition for natural resources is real, complex, and growing. Natural resources no longer are abundant, as growing human populations and expanding economic activities have increased both the types and the overall levels of demand. Scarcity has materialized and natural resources cannot satisfy all the human demands placed on them. Hence, whenever natural resources—through inertia, public policy, markets, or some other mechanism—are allocated to one use, other, competing uses go without. These tradeoffs mean that resource-allocation decisions, such as protection or development decisions, generate both benefits and costs, with ramifications for the current and future residents of nearby communities and entire regions.

[1] Of course, perceptions that there was no competition for natural resources ignore the long-lived competition among different Indian groups, and between Indians and Euro-American settlers, for some resources. They also overlook the implicit competition among current and future generations over the sustainability of resources and resource uses over time.

In this appendix, we present an analytical framework for conceptualizing and examining this demand-supply interaction. The framework rests on the observation that no natural resource—from a watershed, forest, or other natural area—can satisfy all the demands for the goods and services it provides. Consequently, to understand the potential economic consequences of protecting or developing natural resources, one must understand how it will affect this competition.

To describe the competition for natural resources, we employ a taxonomy that distinguishes among four types of demands, as illustrated in Figure 1. The left side of the figure shows two types of demand from *commercial uses*, i.e., for natural resources that help firms earn profits. The right side shows two types of demand directly from *consumers*, i.e., for natural resources that directly influence individuals' quality of life and standard of living. The competition among the four types of demand is best understood by assuming that one prevails, and then looking at the consequences for the others.

Figure 1: The Competing Demands for Natural Resources



Source: ECONorthwest.

Competition from commercial uses

The most easily identifiable commercial demands entail the extraction or development of natural resources. We use the term *extraction* to embrace activities, resource uses, and industries associated with timber production, crop production, mining, grazing, and other activities that chemically, electrically, or physically remove one or more elements (flora, fauna, mineral, or energy) of the ecosystem from its source.

We use the term *development* to refer to the occupation of a site by human structures, such as occurs during urbanization. Development also includes intense human activity—converting open land to housing and commercial buildings, changing the composition of a forest's floral community, developing industrial-recreation sites, and so forth—that substantially alters an ecosystem's natural processes. Commercial demand for natural resources comes from private and public enterprises, which we define broadly to include any groups that sponsor extractive or development activities.

Dominant Commercial Demand. We distinguish between two types of commercial demand for natural resources. We first identify a specific, extractive or development use of a specific parcel of land that has three important characteristics: it directly uses natural resources; depletes the stocks of some resources; and has a dominant position relative to competitors because of its economic competitiveness, political support, or historical momentum. The identification of a particular use as the dominant one is arbitrary, but purposeful. This type of demand usually is associated with a familiar extractive industry, such as industrial farming, forestry, or mining, or with common development activities: urbanization; developed recreation; road construction; and the like. In general, only one commercial industry benefits from a particular use of natural resources, but sometimes there may be more than one.

In public discussions of resource-protection or development proposals, the economic importance of the dominant commercial use of a set of natural resources usually is expressed in terms of jobs and incomes for local residents, as well as profits for local firms. In many cases, this commercial use is portrayed as the sole way for local residents to derive jobs, incomes, and profits from the area's natural resources. It is common to hear the belief that, if land development or extractive uses are allowed, then the local economy will gain jobs, incomes, and profits, but if these activities are restricted, then the land will have no positive impact on the economy.

Other Commercial Demands. In today's economy, the dominant commercial use generally is not the only one competing for natural resources. We purposefully distinguish between the two categories of commercial uses to drive home the message that there often is competition, within the extractive and development sectors themselves, for natural resources. This message is important because, too often, the competition for natural resources is characterized as simply a jobs-vs.-environment contest between a (dominant) industry, such as a developer seeking to develop a specific parcel, and those who want to protect the environment. By highlighting competing commercial industries that incur economic costs from the dominant one's use of natural resources, we emphasize the point that the positive consequences arising from one set of extractive or development activities frequently have negative effects on one or more others.

Competition directly from consumers

On the left side of Figure 1, natural resources are economically important because they are inputs in the production of things, such as wood products and other goods, that consumers want. On the right side, the connection between these resources and consumers is more direct. That is, consumers consider these resources economically important for what they are and for how they directly contribute to consumers' well-being. There are two types of demand for natural resources coming directly from consumers: one affects consumers' residential location decisions; the other does not.

Quality-of-Life Demand. We use the term *quality-of-life demand* to represent natural-resource amenities that influence location decisions. Sometimes natural resources produce amenities, such as scenic vistas, healthy environments, and clean air and water, which contribute directly to the well-being of people who have access to them. In the language of economics, these are known as consumption amenities. They increase the well-being of nearby residents because their value exceeds the cost consumers incur to enjoy them. This increment of value-minus-cost is known as consumers' surplus. Their contribution to consumers' well-being makes consumption amenities economically important in their own right, but they also influence the location decisions of households and firms (Knapp and Graves, 1989; Mathur, 1993; Mueser and Graves, 1995), thus, adding to their economic interest.

Whitelaw and Niemi (1989) have likened this relationship to a *second paycheck* residents receive by living in a place where they have easy access to amenities, so that the total welfare of residents within commuting distance of the amenities is the sum of this second paycheck plus the purchasing power of their money income. The size of the second paycheck affects behavior in the local and regional economies by influencing household demand for residential location.[2]

If the second paycheck is large enough, it will attract households that otherwise would have located elsewhere. The influx of people increases both the labor pool and the number of consumers. The former attracts firms seeking workers, and the latter attracts firms seeking consumer sales. Both mechanisms allow natural-resource amenities to affect where goods and services are produced. Thus, the quantity and quality of natural resource amenities can affect the levels and types of jobs, incomes, profits, and economic activities in general throughout the local and regional economies, including sectors with no direct link to the use of natural resources.

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[2] That location-specific consumption amenities are an important influence in residential location decisions is well documented. The early contributions are Rosen (1979), Roback (1982). For more recent work on this topic see Beeson (1991), Berger and Blomquist (1992), Blomquist et al. (1988), Brady (1995), Brown (1994), Browne (1984), Cooper (1994), Cromartie (1998), Cushing (1987), Figlio (1996), Gabriel et al. (1996), Gottlieb (1994), Greenwood et al. (1991), and Sherwood-Call (1994).

Intrinsic Economic-Value Demand. The lower right corner of Figure 1 represents the demand for elements or characteristics of an ecosystem that people value for their intrinsic properties. Intrinsic values, often termed "existence values," do not entail an explicit current use of the resource.[3] They arise whenever individuals place a value on maintaining the existence of a species, scenic desert vista, or other resource for its own sake, or on the prospect that the resource will be useful, for example, to future generations. Actions that increase the robustness of the resources, for example, by preventing degradation of critical habitat for an endangered species or by ensuring the continued existence of the scenic vista, increase the welfare of those concerned about these issues, and actions that degrade the resources decrease this welfare.

Unlike the other three demands for natural resources, demands related to intrinsic values, by themselves, are unlikely to have any manifest economic effect on jobs, income, or other indicators of economic activity. The protection of scenic vistas in the Catskills, for example, may be of intrinsic value to some residents of Miami, Los Angeles, and other distant places, but the effect of this on economic activity in and near the Catskills will be small unless it is articulated through tourism (in which case it appears as a commercial demand) or the political system. Still, the existence and status of these resources affect the real well-being of real people, and this well-being belongs in any comprehensive, economic analysis of the resources.

For some environmental issues, intrinsic values may be surprisingly large, especially to those who are used to equating the economic importance of natural resources to their extractive and development uses. The undisturbed landscapes of wilderness areas can offer opportunities for private, secluded recreation, provide habitat for native species, and support scientific monitoring and research that cannot be conducted on lands that have been heavily roaded or developed. Given these characteristics, plus a widespread desire to protect wild lands for future generations, most Americans see wilderness areas as national assets that warrant protection.

Studies indicate that the intrinsic values of natural resources in their native, undeveloped state can be substantial. Resource-management decisions that fail to recognize the economic benefits of actions that safeguard these intrinsic values run the risk of overlooking what may be the single largest economic consequence of such decisions.

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[3] Intrinsic values also embody other elements, such as a desire for resources to be available for future use by oneself (option value) or by future generations (bequest value). Some argue that there is a separate category of value, which recognizes the importance of the life-support services ecosystems provide that make the earth habitable (Baskin, 1997). We do not debate the point here but, instead, expand the category of intrinsic values to include this life-support value.

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Appendix B Overview of Input/Output Models

INPUT-OUTPUT MODELING

One economic modeling framework that captures the direct, indirect, and induced effects of spending on a project is called input-output modeling. Input-output models provide an empirical representation of the economy and its inter-sectoral relationships.

Because input-output models generally are not available for state and regional economies, special data techniques have been developed to estimate the necessary empirical relationships from a combination of national technological relationships and county-level measures of economic activity. This planning framework, called IMPLAN (for IMpact Analysis for PLANning), is the technique that ECONorthwest applied to the estimation of impacts.

THE ORIGINS OF THE IMPLAN MODEL

IMPLAN was developed by the Forest Service of the US Department of Agriculture in cooperation with the Federal Emergency Management Agency and the Bureau of Land Management of the US Department of the Interior to assist federal agencies in their land and resource management planning. U.S. government agencies, other public agencies, and private firms including ECONorthwest have applied the model to a wide variety of public and private sector projects.

The model is distinguished from typical input-output models in that it is not survey based; survey-based input-output models place significant demands on data, and are uneconomical to apply in most situations. Rather, IMPLAN employs secondary source data, available by state and county, to define a model for any region in the United States.

Two sources of data are particularly central to the IMPLAN models: the National Income and Product Accounts published annually by the Bureau of Economic Analysis (BEA) of the U.S. Commerce Department, and the BEA input-output model for the United States. The IMPLAN modeling process utilizes the national input-output model and county-level economic activity data to derive input-output models for units as small as a county.

The process that develops the county-level input-output model generates coefficients that are internally consistent, in that county data sum to state totals and state data sum to national totals. This generally is not the case with survey-based input-output models, which limits their applicability to large-scale projects that affect a number of interrelated regions. (Arguably, however, an input-output model estimated from survey data has more accurate coefficients, because the survey can be customized to the problem at

hand. In contrast, IMPLAN *derives* its coefficients using a combination of the national input-output survey model and local activity data; conceivably, this will produce somewhat different results from a direct, local survey. Given the difficulty and expense of input-output surveys, however, the disadvantages of the IMPLAN approach are slight.)

MODELING

The process of modeling involves three steps:

- Creation of study area database;
- Customization of IMPLAN coefficients;
- Estimating the impact of an activity on the model of the study area economy.

The IMPLAN model allows substitution and incorporation of primary data at each stage of the model-building process, greatly increasing the model's accuracy and flexibility. In addition to being able to directly modify the IMPLAN database statistics, the user can alter import and export relationships, utilize modified input-output functions, and change industry groupings. IMPLAN allows the creation of aggregate models consisting of industries grouped together for a specific purpose.

Once a regional input-output model has been specified, impact analysis may be performed on that model. New industries or commodities can be introduced to "shock" the regional economy, industries or commodities may be removed or disaggregated, and reports can be generated to show the consequences (on output, employment, and value-added) of various impacts.

The key to input-output analysis is the construction of the input-output or transactions table, which shows the flow of commodities from each of a number of producing industries to all consuming industries and final demand (ultimate consumers). Given that many industries produce more than one commodity, production information is often tabulated on an industry-by-commodity basis into a "Make" matrix, containing the value of commodities produced by different industries, and a "Use" matrix, containing the value of commodities used by each industry in the production process. These matrices are combined to produce the input-output transactions table showing each industry buying and selling from other industries.

From these industry flows, two other structural tables are developed: (1) a table of technical coefficients or direct requirements and (2) a table of direct and indirect coefficients or total requirements. The entries in the former are interpreted as the dollar value of the minimal requirements from each of the contributing industries in order for each producing industry to produce one dollar's worth of output. The entries in the latter table are to be interpreted as the amount of output from the contributing industries required, both directly and indirectly, to deliver one dollar's worth of the producing industry's output to final demand.

DEFINING THE STUDY AREAS

The IMPLAN program uses an ordered series of steps to build the model. We describe them here to provide the interested reader with a view of the sequence of steps employed, and the types of data needed to model the impacts.

The first step is the definition of the study area or study areas. Study area Databases are created corresponding to these areas. These databases contain the representation of the behavior of the study area economies, but do not contain any information about the specific project under study.

CUSTOMIZING THE IMPLAN COEFFICIENTS

The process of customizing the IMPLAN model does not stop with the development of the Study Area Databases. Part of the expertise of input-output practitioners is in the customization of the model coefficients. In this section, we describe the various steps in the customization process.

CONSTRUCTING THE SOCIAL ACCOUNTING MATRIX

From the Study Area Databases, a mathematical concept called the Social Accounting Matrix is constructed, using computer procedures incorporated in the IMPLAN modeling system. The initial study area data in this transformation can be viewed and edited in a spreadsheet-like program. There are 22 IMPLAN data elements appearing in columns and 528 industry/commodity names forming the rows. The database elements are organized into five main groups: Final Demand, Sales, Value Added, Employment, and Total Industry Output. These elements can be further divided into those that are specific to commodities and those that relate to industries.

The user may edit the Regional Purchase Coefficient and the Directly Allocated Exports Coefficient for each commodity. Both of these coefficients are calculated from the Social Accounting Matrix so they may only be modified after that matrix has been constructed. The IMPLAN program contains internal checks, which enforce data integrity and will not allow values outside the specific, valid range for these coefficients to be accepted by the model.

BUILDING THE INPUT-OUTPUT ACCOUNTS

After creating the social accounting matrix, the input-output accounts for the model are constructed. The input-output accounts are formed by transforming parts of the social accounts from an "industry-by-commodity" format to an "industry-by-industry" format; it combines submatrices into a single "transactions" submatrix, as described in general above. The input-output accounts may be constructed with either aggregated or unaggregated

industry data. The former will reduce the size of the industry matrix (and processing time) by creating aggregate industries from individual industries.

ESTIMATING MULTIPLIERS

The last step in building the model is to estimate the multipliers. Five different sets of multipliers are estimated by IMPLAN corresponding to five measures of regional economic activity: Total Industry Output, Personal Income, Total Income, Value Added, and Employment. Multiplier analysis is used to estimate the regional economic impacts resulting from a change in final demand. Impacts can be in terms of direct and indirect effects (commonly known as Type I multipliers), or in terms of direct, indirect, and induced effects (Type II and Type III multipliers). More specifically, direct effects are production changes associated with the immediate effects of final demand changes. Indirect effects are production changes in backward-linked industries caused by the changing input needs of directly affected industries. Induced effects are the changes in regional household spending patterns caused by changes in household income--generated from the direct and indirect effects.

IMPLAN calculates two types of multipliers for each of the five impact measures. The first output multiplier represents the value of production, from indirect and direct effects, required from all sectors by a particular sector in order to deliver one dollar's worth of output. The second output multiplier adds in the induced requirements. The size of the multiplier is not a measure of the amount of activity or the importance of a given industry for the economy. It is an estimation of what would happen if that industry's sales to final demand increased or decreased. In other words, output multipliers can be used to gauge the interdependence of sectors; the larger the output multiplier, the greater the interdependence of the sector on the rest of the regional economy.

PERFORMING IMPACT ANALYSIS

Once the model is complete, impact analysis can be performed on the model. Impact analysis involves posing a change in the demand for commodities and using the multiplier model to examine the effects that producing and delivering the commodities may have on a region's employment, income, and population. Several types of economic impact analyses can be carried out simply by varying structural, technological, and/or trade factors within the model. For instance, the user may add or remove sectors from the model, or change the size of an industry, or the user may change production functions, or make changes in commodity imports and exports. To perform a full economic impact analysis with IMPLAN, all of the relevant structural, technological, and trade related adjustments must already be incorporated in the regional model.

In order to keep track of and organize all of the information needed to describe a change in the final demand for commodities, IMPLAN uses the

general concept of a "scenario" to capture all of the information about the change(s) in commodity demand for which impacts are being estimated. Scenarios are made up of several building blocks.

At the lowest level is a transaction; this is the actual expenditure that represents the final demand for a commodity. Descriptive information about this transaction, such as what commodity is involved, when it occurred, and how it was measured, are collectively referred to as an event. A collection of events, which have descriptive information in common, occurring together, are referred to as an activity. For instance, the group of events that make up an activity may be related to each other by who caused them to take place or why they took place.

A scenario is a collection of one or more activities (which includes, in turn, events with transactions), specifying where the activity(s) occurred and at what level(s). A scenario may be viewed as equivalent to a management, planning, or policy alternative. Units of measure are assigned to each activity and can be in physical terms, monetary terms, household consumption, or any other terms appropriate for the problem under study. The unit price represents the transaction rate--the total amount of purchases necessary to participate in one unit of an activity.

In order to run an economic impact analysis, the user must build a datafile of changes in final demand. All activities to be included in the analysis must be defined, providing information about who initiated the demand change, the base year of the activity, the transaction basis (commodity purchase or an industry's output), conversion rate (which gives a scale of the transactions occurring in the activity), and measurement units. There is a finite list of causal agents to choose from when describing the activity, comprised of the following choices: households, federal government, state/local government, enterprises (investment), and industry. Once the activity is defined, the next step is to define events that occur in the activity, in much the same way as for the activity itself.

MODEL OUTPUTS

The IMPLAN model provides estimates of impacts of the expenditures on income, and employment that follow from direct, indirect, and induced expenditures. By writing special fiscal impact modules, the model also can be used to estimate impacts on the tax revenue collected through property taxes, sales taxes, corporate income taxes, and other fiscal devices. In addition, IMPLAN can provide estimates of stimulus to population growth that will result from project expenditures.

Appendix C

Summary Output

In this appendix, we provide the output of our integrated spreadsheet models that estimate impervious acres.

The first three pages show the low, expected, and high estimates from the model estimating impervious surface stemming from direct and indirect economic activities. The fourth page shows the model estimating impervious surface stemming from cumulative impacts.

Impervious Surface and Disturbed Land Stemming from Direct and Indirect Economic Activities
Low

Key Assumptions- Employment

Off-site land use impacts in 3-county area

	Type of Economic Impact		
	Direct	Indirect	Induced
Construction	0%	0%	0%
Operations: On-site	0%	80%	80%
Operations: Off-site	80%	80%	80%

Allocation of 3-county employment to Study Area

% of direct & indirect jobs	3%
% of induced jobs	10%

Average employees per acre:	18

Key Assumptions - Residential Growth and Development

Population to employment ratio:	1.8
Persons per household	2.4
Vacancy rate:	5%

Percent of population getting new housing

	3-counties	Study Area
From resort workers:	80%	10%
From non-resort workers	70%	25%

Key Assumptions - Land use

Lot Coverage - Commercial Activity

	% Impervious	% Disturbed
Office	60%	95%
Mfg Warehouse	60%	95%
Retail	60%	95%
Average commercial	60%	95%

Lot Coverage - Residential Activity

	% Impervious	% Disturbed
Single-family	40%	58%
Multi-family	70%	95%
Average residential	52%	73%

Dwelling Units per Net Acre

Single-family	5
Multi-family	20
Singe-family as % of all d.u.	60%

Road, Other Impervious Surface as % of developed acres	20%

A weighted average of single-family & multi-family dwelling units.

Single Family-Disturbed Acreage

% DU by type	Lot Size Sq ft	Acre/DU	DU/Acre	of SF DUs	% Disturbed		
SF type 1	435600	10.00	0.1	5%	40%	500	200
SF type 2	217800	5.00	0.2	5%	50%	250	125
SF type 3	87120	2.00	0.5	5%	75%	100	75
SF type 4	43560	1.00	1	10%	85%	100	85
SF type 5	21780	0.50	2	20%	90%	100	90
SF type 6	10890	0.25	4	15%	95%	38	36
SF type 7	7260	0.17	6	35%	95%	58	55
SF type 8	5445	0.13	8	5%	95%	6	6
				100%		1000	1152	672
				Weighted Average.		58%		

Estimated Amount of Development in the Three-County Area

			Total Acres			Impervious Acres			Disturbed Acres		
Development Type	HH	Emp	On-Resort	Off-Resort	Total	On-Resort	Off-Resort	Total	On-Resort	Off-Resort	Total
Residential	648		100	96	196	36	42	78	65	61	126
Commercial		169	23	10	33	5	6	11	14	6	20
Office		139	0	6	6	0	4	4	0	4	4
Industrial		56	0	5	5	0	3	3	0	3	3
Government		74	0	3	3	0	2	2	0	2	2
Roads&OtherImprovements			450	24	474	44	24	68	450	24	474
Total	648	438	573	145	718	85	82	**167**	529	99	**628**

Estimated Amount of Development in the Study Area

			Total Acres			Impervious Acres			Disturbed Acres		
Development Type	HH	Emp	On-Resort	Off-Resort	Total	On-Resort	Off-Resort	Total	On-Resort	Off-Resort	Total
Residential	128		100	19	119	36	8	44	65	12	77
Commercial		9	23	1	24	5	0	5	14	1	15
Office		10	0	1	1	0	0	0	0	0	0
Industrial		4	0	0	0	0	0	0	0	0	0
Government		7	0	0	0	0	0	0	0	0	0
Roads&OtherImprovements			450	4	454	44	4	48	450	4	454
Total		31	573	25	598	85	14	99	529	17	**546**

Estimates based on direct and secondary land development estimated from direct and indirect economic effects of the resort (based on estimates reported in DEIS and other analysis documented in the technical memorandum that summarizes these results). Estimates do NOT include what that memorandum refers to as *Cumulative Impacts*. Those effects are estimated separately and reported in the technical memorandum (roughly, 5 direct employees > 1 acre impervious).

Numbers in yellow are not reported in the DEIS: just the total. We estimated to distribute the total.

Impervious Surface and Disturbed Land Stemming from Direct and Indirect Economic Activities expected

Key Assumptions- Employment

Off-site land use impacts in 3-county area

	Type of Economic Impact		
	Direct	Indirect	Induced
Construction	0%	0%	0%
Operations: On-site	0%	100%	100%
Operations: Off-site	100%	100%	100%

Allocation of 3-county employment to Study Area

% of direct & indirect jobs	10%
% of induced jobs	25%

Average employees per acre:	12

Key Assumptions - Residential Growth and Development

Population to employment ratio:	2
Persons per household:	2.2
Vacancy rate:	5%

Percent of population getting new housing

	3-counties	Study Area
From resort workers:	85%	33%
From non-resort workers:	75%	25%

Key Assumptions - Land use

Lot Coverage - Commercial Activity

	% Impervious	% Disturbed
Office	70%	95%
Mfg Warehouse	70%	95%
Retail	70%	95%
Average commercial	70%	95%

Lot Coverage - Residential Activity

	% Impervious	% Disturbed
Single-family	50%	58%
Multi-family	80%	95%
Average residential	61%	73%

Dwelling Units per Net Acre

Single-family	4
Multi-family	16
Singe-family as % of all d.u.	65%

Road, Other Impervious Surface as % of developed acres	20%

A weighted average of single-family & multi-family dwelling units.

Single Family-Disturbed Acreage

% DU by type	Lot Size Sq ft	Acre/DU	DU/Acre	of SF DUs	% Disturbed		
SF type 1	435600	10.00	0.1	4%	40%	400	160
SF type 2	217800	5.00	0.2	4%	50%	200	100
SF type 3	87120	2.00	0.5	4%	75%	80	60
SF type 4	43560	1.00	1	8%	85%	80	68
SF type 5	21780	0.50	2	25%	90%	125	113
SF type 6	10890	0.25	4	15%	95%	38	36
SF type 7	7260	0.17	6	35%	95%	58	55
SF type 8	5445	0.13	8	5%	95%	6	6
				100%	1000	987	597
				Weighted Average:	61%		

Estimated Amount of Development in the Three-County Area

			Total Acres			Impervious Acres			Disturbed Acres		
Development Type	HH	Emp	On-Resort	Off-Resort	Total	On-Resort	Off-Resort	Total	On-Resort	Off-Resort	Total
Residential	900		100	175	275	36	94	130	65	110	175
Commercial		211	23	13	36	5	9	14	14	9	23
Office		174	0	8	8	0	6	6	0	5	5
Industrial		71	0	6	6	0	4	4	0	4	4
Government		93	0	4	4	0	3	3	0	3	3
Roads&OtherImprovements			450	41	491	44	41	85	450	41	491
Total	900	548	573	247	820	85	157	242	529	171	700

Estimated Amount of Development in the Study Area

			Total Acres			Impervious Acres			Disturbed Acres		
Development Type	HH	Emp	On-Resort	Off-Resort	Total	On-Resort	Off-Resort	Total	On-Resort	Off-Resort	Total
Residential	332		100	64	164	36	34	70	65	40	105
Commercial		33	23	2	25	5	1	6	14	2	16
Office		33	0	1	1	0	1	1	0	1	1
Industrial		13	0	1	1	0	1	1	0	1	1
Government		23	0	1	1	0	1	1	0	1	1
Roads&OtherImprovements			450	14	464	44	14	58	450	14	464
Total		102	573	84	657	85	52	137	529	59	588

Estimates based on direct and secondary land development estimated from direct and indirect economic effects of the resort (based on estimates reported in DEIS and other analysis documented in the technical memorandum that summarizes these results). Estimates do NOT include what that memorandum refers to as *Cumulative Impacts*. Those effects are estimated separately and reported in the technical memorandum (roughly, 5 direct employees > 1 acre impervious).

Numbers in yellow are not reported in the DEIS: just the total. We estimated to distribute the total.

Impervious Surface and Disturbed Land Stemming from Direct and Indirect Economic Activities
high

Key Assumptions- Employment

Off-site land use impacts in 3-county area

	Type of Economic Impact		
	Direct	Indirect	Induced
Construction	0%	0%	0%
Operations: On-site	0%	100%	100%
Operations: Off-site	100%	100%	100%

Allocation of 3-county employment to Study Area

% of direct & indirect jobs	20%
% of induced jobs	33%

Average employees per acre:	12

Key Assumptions - Residential Growth and Development

Population to employment ratio:	2
Persons per household:	1.9
Vacancy rate:	7%

Percent of population getting new housing

	3-counties	Study Area
From resort workers:	85%	45%
From non-resort workers:	75%	25%

Key Assumptions - Land use

Lot Coverage - Commercial Activity

	% Impervious	% Disturbed
Office	80%	95%
Mfg Warehouse	80%	95%
Retail	80%	95%
Average commercial	80%	95%

Lot Coverage - Residential Activity

	% Impervious	% Disturbed
Single-family	50%	58%
Multi-family	80%	95%
Average residential	62%	76%

Dwelling Units per Net Acre

Single-family	3
Multi-family	15
Singe-family as % of all d.u.	60%

Road, Other Impervious Surface as % of developed acres	20%

A weighted average of single-family & multi-family dwelling units.

Single Family-Disturbed Acreage

% DU by type	Lot Size Sq ft	Acre/DU	DU/Acre	of SF DUs	% Disturbed		
SF type 1	435600	10.00	0.1	3%	40%	300	120
SF type 2	217800	5.00	0.2	3%	50%	150	75
SF type 3	87120	2.00	0.5	3%	75%	60	45
SF type 4	43560	1.00	1	6%	85%	60	51
SF type 5	21780	0.50	2	20%	90%	100	90
SF type 6	10890	0.25	4	20%	95%	50	48
SF type 7	7260	0.17	6	40%	95%	67	63
SF type 8	5445	0.13	8	5%	95%	6	6
				100%		1000	793	498
				Weighted Average:		63%		

Estimated Amount of Development in the Three-County Area

			Total Acres			Impervious Acres			Disturbed Acres		
Development Type	HH	Emp	On-Resort	Off-Resort	Total	On-Resort	Off-Resort	Total	On-Resort	Off-Resort	Total
Residential	1042		100	254	354	36	136	172	65	159	224
Commercial		211	23	13	36	5	10	15	14	10	24
Office		174	0	8	8	0	6	6	0	6	6
Industrial		71	0	6	6	0	5	5	0	5	5
Government		93	0	4	4	0	3	3	0	3	3
Roads&OtherImprovements			450	57	507	44	57	101	450	57	507
Total	1042	548	573	342	915	85	218	**303**	529	240	**769**

Estimated Amount of Development in the Study Area

			Total Acres			Impervious Acres			Disturbed Acres		
Development Type	HH	Emp	On-Resort	Off-Resort	Total	On-Resort	Off-Resort	Total	On-Resort	Off-Resort	Total
Residential	479		100	117	217	36	62	98	65	73	138
Commercial		52	23	3	26	5	2	7	14	3	17
Office		48	0	2	2	0	2	2	0	2	2
Industrial		20	0	2	2	0	1	1	0	1	1
Government		30	0	1	1	0	1	1	0	1	1
Roads&OtherImprovements			450	25	475	44	25	69	450	25	475
Total		150	573	150	723	85	94	**179**	529	105	**634**

Estimates based on direct and secondary land development estimated from direct and indirect economic effects of the resort (based on estimates reported in DEIS and other analysis documented in the technical memorandum that summarizes these results). Estimates do NOT include what that memorandum refers to as *Cumulative Impacts*.

The total number for developed, impervious, and disturbed acres for the on-resort numbers come from the DEIS. Numbers in yellow are not reported in the DEIS the distribution of development types.

RESULTS FROM CUMULATIVE IMPACTS MODEL
FOR EXPANDED STUDY AREA

Start Here with existing population and households

	2003 Estimate
Population	0
Tri-Counties	278558
Expanded Study Area	43,613
% of Tri-Counties	16%
Households	
Study Area	18,944

Note: the "Expanded Study Area" for the cumulative analysis is not the same as the 15-zipcode study area used for the the analysis of direct and indirect development impacts. It is an area defined, using zipcodes, to approximate the area in the 3-county area that is in the relevant watershed. Thus, it is larger and has approximately three times the population of that of the smaller study area.

Years into the Future

Avg Annual Growth	10	20	50
Total Households in Study Area at Various Growth Rates			
1%	20926	23115	31156
2%	23093	28150	50989
3%	25459	34215	83049
4%	28042	41509	134629
5%	30858	50264	217238
Growth in HH (and, thus, ~DU)			
2%	4149	9206	32045
3%	6515	15271	64105
4%	9098	22565	115685
Growth in Residential Land (Gross Acres)			
At Low Density			
2%	4708	10448	36368
3%	7394	17331	72752
4%	10325	25609	131291
At Mid Density			
2%	2594	5756	20038
3%	4074	9549	40085
4%	5689	14110	72338

Grow from 18944 HH at various growth rates

Just the NEW HH (Total - Existing)

See Tab 'DU Mix.' Divide HH by AvgDU/Acre

Tab 'DU Mix' works with lot size, which means **net** residential acres. To convert to **gross** res acres, add factor for streets, etc., typically 15% to 30% of net

Net-to-Gross factor this run 20%

Total Developed (Urbanized) Acres (all urban uses)
(Estimated Using Res % of Total Developed Land)

Residential % of total urban land	Low Dens	Mid Density
	75%	70%

At Low Density			
2%	6278	13930	48491
3%	9859	23108	97003
4%	13767	34145	175055
At Mid Density			
2%	3706	8223	28626
3%	5820	13641	57264
4%	8127	20157	103340

Convert "Developed" Land to "Disturbed" land use the following approximate percentages (disturbed as a percent of total lot size):

SF residential 60-70% (low because a small number of very large lots can reduce the %)
MF residential 90-95%
Commercial (retail / office) 90-95% (could be almost 100%, but some office parks may leave natural areas undisturbed)
Industrial 75-95% (depends on amount of industrial park / headquarters).

Overall average 70-85%

This Run
Disturbed as % of Developed 75%

Disturbed Acres	10	20	50
At Low Density			
2%	4708	10448	36368
3%	7394	17331	72752
4%	10325	25609	131291
At Mid Density	0	0	0
2%	2779	6168	21469
3%	4365	10231	42948
4%	6095	15118	77505

Impervious Acres	10	20	50
At Low Density			
2%	1065	2364	8228
3%	1673	3921	16460
4%	2336	5794	29704
At Mid Density	0	0	0
2%	556	1234	4294
3%	1191	2753	11049
4%	1719	4195	20420

Impervious Surface	
Residential (ac/100 DU)	
Low Density	6.8
Mod Density	5.4
Non Residential (All Other Developed)	
% of NonRes Acres that are impervious	
Low Density	50%
Mod Density	60%

These factors derived in Tab 'DU Mix' Avg impervious surface for an assumed mix of residential densities and types

% of total nonresidential acres that are impervious

Impervious surface = (New HH (~DU) /100 * Acres Imprv per 100 DU)
x (NonRes Acres * % of total nonresidential acres that are impervious)

Appendix D

Qualifications

Gerrit Knaap

CURRENT POSITION

Professor of Urban Studies and Planning, School of Architecture, Planning, and Preservation, University of Maryland, 1112M, Prienkert Fieldhouse, College Park, Maryland, 1/02 to present

CONCURRENT POSITIONS

Executive Director, National Center for Smart Growth Education and Research, University of Maryland, College Park, 1/02 to present.
Associate, ECONorthwest, 2000 to present.
Faculty Associate, Lincoln Institute of Land Policy, Cambridge, Massachusetts, 6/90 to present.

PREVIOUS POSITIONS

Professor, Department of Urban and Regional Planning and Department of Agricultural and Consumer Economics, University of Illinois, Urbana, Illinois 6180, 8/99-12/01.
Research Fellow, Center for Urban Policy and the Environment, School of Public and Environmental Affairs, Indiana University, 8/96 to 8/98.
Senior Research Fellow, American Planning Association, Chicago, Illinois, 6/96 to 6/97.
Assistant/Associate Professor, Department of Urban and Regional Planning, University of Illinois, Urbana, Illinois, 8/89 to 8/99.
Assistant Professor, Department of Urban and Public Affairs and Department of Economics, University of Wisconsin-Green Bay, Green Bay, Wisconsin, 8/83 to 8/89.
Visiting Assistant Professor, Department of Economics, University of Wisconsin-Madison, Madison, Wisconsin, 8/85 to 8/86.
Visiting Assistant Professor, Department of Economics, Willamette University, Salem, Oregon, 9/82 to 6/83.

EDUCATION

Post-Doctoral Fellow, Center for Health Economics and Law
University of Wisconsin-Madison, 8/85 to 8/86.
M.S., Ph.D., Economics, University of Oregon, 8/82.
B.S., Economics, Willamette University, 6/78.

ACADEMIC AWARDS

Nan and Will Clarkson Visiting Endowed Chair, Department of Urban and Regional Planning, University at Buffalo, 4/02.
Best paper presented at the 1997 meetings of the Association of Collegiate Schools of Planning, Fort Lauderdale, FL, Awarded by the American Planning Association, paper co-authored with Greg Lindsey, 4/98.
Chester Rapkin Award for Best Paper in Volume 10 of the Journal of Planning Education and Research, 7/91.

SELECTED PUBLICATIONS

Articles in Journals:

Song, Yan and Gerrit-Jan Knaap, forthcoming, Are mixed land uses marketable: reexamining consumers' preferences. Regional Science and Urban Economics.
Song, Yan and Gerrit-Jan Knaap, Measuring Urban Form: Is Portland Winning the Battle Against Urban Sprawl? Journal of the American Planning Association, forthcoming.
Song, Yan and Gerrit-Jan Knaap, 2003, New Urbanism and Housing Values: A Disaggregate Assessment, Journal of Urban Economics, 54: 218-238.
Rajamani, J., Bhat, C.R., Handy, S., Knaap, G., and Song, Y., 2003, Assessing the Impact of Urban Form Measures in Nonwork Trip Mode Choice After Controlling for Demographic and Level-of-Service Effects, Transportation Research Record, 1831: 158-165.
Talen, Emily and Gerrit J. Knaap, 2003, The Implementation of Smart Growth Principles: An Empirical Study of Land Use Regulation in Illinois, Journal of Planning Education and Research, 22, 4: 345-359.

Ding, Chengri and Gerrit-Jan Knaap, 2003, Property Values in Inner City Neighborhoods: The Effects of Homeownership, Housing Investment, and Economic Development, Housing Policy Debate, 13, 4: 701-727.
Knaap, Gerrit J., Chengri Ding, and Lewis Hopkins, Does Planning Matter? 2002, The Effects of Light Rail Plans on Land Values in Station Areas, Journal of Planning, Education, and Research, 21,1: 32-39.
Knaap, Gerrit J., Chengri Ding, and Lewis Hopkins, 2001, Managing Urban Growth for the Efficient use of Public Infrastructure: Towards a Theory of Concurrency, International Regional Science Review, 24,3: 328-343.
Knaap, Gerrit J. and Lewis Hopkins, 2001, The Inventory Approach to Urban Growth Boundaries, Journal of the American Planning Association, 67,3: 314-326.
Knaap, Gerrit J., 2000, Economics and the Smart Growth Movement, Virginia Environmental Law Journal, 19,3: 329-332.
Nedovic-Budic, Zorica, Gerrit J. Knaap, and Brandt Schiedeker, 1999, Advancing the Use of GIS for Park and Recreation Facility Management, Journal of Park and Recreation Administration, 17,4: 73-101.
Lindsey, Greg, and Gerrit J. Knaap, 1999, Willingness to Pay for Greenway Projects, Journal of the American Planning Association, 65,3: 297-313.
Ding, Chengri, Gerrit J. Knaap, and Lewis Hopkins, 1999, Managing Urban Growth with Urban Growth Boundaries: A Theoretical Analysis, Journal of Urban Economics, 46: 53-68.
Donaghy, Kieran P., Andrea M. Kelly, and Gerrit J. Knaap, 1999, Optimal Investment in a Tax Increment Financing District, Annals of Regional Science, 33: 1-22.
Knaap, Gerrit J., Robert Olshansky, and Debra Matier, 1998, Citizen Advisory Groups and Remedial Action Planning in the Great Lakes, Journal of Environmental Planning and Management, 41,3: 337-54.
Knaap, Gerrit J., Lewis Hopkins, and Kieran Donaghy, 1998, Does Planning Matter? A Framework for Examining the Logic and Effects of Land Use Planning, Journal of Planning Education and Research, 18,1: 25-34.
Knaap, Gerrit J., 1998, The Determinants of Residential Property Values: Implications for Regional Planning, Journal of Planning Literature, 12,3: 267-82.
Knaap, Gerrit J., Per Johnsen, and Larry Smith, 1997, Public Support for Remedial Action Planning: Willingness to Pay in Brown County, Wisconsin, Journal of Planning Education and Research, 16: 257-69.
Knaap, Gerrit J., 1996, Division of Assets following Annexation: An Economic Analysis, Environment and Planning C: Government and Society, 14,2: 179-192.
Kelly, Andrea, Gerrit J. Knaap, Sylvie Temperley, and Alison Simon, 1996, The Effects of Preprinting on Survey and Item Response Rates, Journal of Leisure Research, 28,2: 122-28.
Knaap, Gerrit J. and Alison Simon, 1994, Class Conflict in Rural Economic Development: Evidence From Illinois, Journal of the Community Development Society, Special Symposium Issue, 25,1: 130-149.
Johnsen, Per, Gerrit J. Knaap, and Larry Smith, 1992, Public Perceptions and Attitudes Towards Environmental Rehabilitation of the Lower Green Bay Watershed, Coastal Management Journal, 20: 9-23.
Knaap, Gerrit J. and Steve Juelich, 1992, The Fiscal Impacts of Detachment: Is It Better to Give Than to Receive, State and Local Government Review, 24,1:28-35.
Knaap, Gerrit J., 1991, Measuring the Price Effects of Growth Controls: A Comment, Journal of Policy Analysis and Management, 10,3:469-73.
Knaap, Gerrit J., 1990, State Land Use Planning and Inclusionary Zoning: Evidence from Oregon, Journal of Planning Education and Research, 10,1:39-46.
Knaap, Gerrit J., 1990, Contradictions of Capitalist Health Care: The Case of Proprietary Hospitals, Nature, Society, and Thought, 2,3:317-331.
Knaap, Gerrit J., 1990, The Political Economy of Growth Management: Lessons from Oregon, Review of Regional Studies, 19,1:1-7.

Books:

Wiewel, Wim and Gerrit-Jan Knaap, ed.s, Smart Growth and the Academy: University Efforts to Promote Smart Growth, New York, NY: M.E. Shape, forthcoming.
Knaap, Gerrit J., ed., Land Market Monitoring for Smart Urban Growth, Cambridge, MA: Lincoln Institute of Land Policy, 2001.
Knaap, Gerrit J. and T. John Kim, ed.s., Environmental Program Evaluation: A Primer, Urbana, Illinois: University of Illinois Press, 1997.
Knaap, Gerrit J. and Arthur C. Nelson, The Regulated Landscape: Lessons on State Land Use Planning from Oregon, Cambridge, Massachusetts: The Lincoln Institute for Land Policy, 1992.
Kim, T. John, Gerrit J. Knaap, and Iwan Azis, Spatial Development in Indonesia: Review and Prospects, Aldershot, Great Britain: Avebury Publishers, 1992.

Chapters in Books:

Knaap, Gerrit-Jan, forthcoming, Comment, in Anthony Downs, ed, Growth Management and Affordable Housing, Washington, DC: Brookings Institution.

Knaap, Gerrit-Jan, Government policy, smart growth, and the spatial pattern of development in the United States, in Faaij, F, J. Niemans & H. Verdonk, eds. Creatief Ruimtegebruik, de rol van de overheid ondersteboven. The Netherlands, 2003.

Knaap, Gerrit-Jan, 200, Talking Smart in the United States. In Quest for Partners in Research on Multifunctional and Intensive Land Use. H Haccou and D. Middleton, ed.s, Gouda, The Netherlands: Habiforum, 2003.

Knaap, Gerrit-Jan, An Inquiry into the Promise and Prospects of Smart Growth, in Andre Sorensen, Peter Marcotullio and Jill Grant, ed.s, Managing Urban Change: Global Perspectives on Sustainable Cities, Ashgate Publishers, 2002.

Knaap, Gerrit J. and Traci Severe, Monitoring Residential Land Markets, in Gerrit J. Knaap, ed., Land Market Monitoring for Smart Urban Growth, Cambridge, MA: Lincoln Institute of Land Policy, 2001.

Elson, Andrea M., Gerrit J. Knaap, and Clifford Singer, Using Tax Increment Financing to Provide Affordable Housing: A Financial Analysis of the King Park TIF District in Urbana, Illinois, in Craig Johnson and Joyce Mann, ed.s., Tax Increment Financing: Uses, Structures, and Impacts, Albany, NY: SUNY Press, 2001.

Knaap, Gerrit J., Cooperation can be Bought and is Habit Forming, in Susan Wachter, R. Leo Penne, and Arthur C. Nelson, ed.s, Bridging the Divide: Making Regions work for Everyone, Washington, DC: Department of Housing and Urban Development, Office of Policy Development and Research, 2000.

Hopkins, Lewis D., and Gerrit J. Knaap, An Inventory Approach to Land Supply Monitoring and its Implications for Database Design. In Monitoring Urban Land Supply with GIS, edited by A. Vernez-Moudon and M. Hubner. New York, NY: John Wiley and Sons, 2000.

Knaap, Gerrit J. and T. John Kim, Air Quality and Urban Planning: Towards an Integrative Approach, in T. Schneider, ed., Air Pollution in the 21st Century: Priority Issues and Policy, Oxford, UK: Elsevier Science, 1999.

Knaap, Gerrit J., "Planning and Politics," S. Adler, C. Abbott, and D. Howe, ed.s, in Planning the Oregon Way: A Twenty Year Review, Corvallis, OR: Oregon State University Press, 1994.

Knaap, Gerrit J. and T. John Kim, "Disparities in Regional Development," T. John Kim, et al. ed.s, Spatial Development in Indonesia: Review and Prospects, 1992.

Bulletins, Reports, and Proceedings

Knaap, Gerrit-Jan, Monitoring Land & Housing Markets: An Essential Tool for Smart Growth, Washington, DC: National Center for Housing and the Environment, 2004.

Knaap, Gerrit-Jan. Jungyul Sohn, John. Frece, and Elisabeth Holler. Smart Growth, Housing Markets, and Development Trends in the Baltimore-Washington Corridor. Prepared for the Maryland National Capital Building Industry Association and the Home Builders Association of Maryland. College Park, MD: National Center for Smart Growth, 2003.

Bolen, Richard, Gerrit-Jan Knaap, and Ethan Seltzer, The Regional Land Information System: The Virtual Key to Portland's Growth Management Success, working paper, Lincoln Institute of Land Policy, 2003.

Holler, Elisabeth and Gerrit-Jan Knaap, Web-based Planning: A Survey of Local Government Websites, Planning Advisory Service Memo, Chicago, IL: American Planning Association, 2003.

Song, Yan and Gerrit-Jan Knaap. Are mixed land uses marketable? Working Paper, Lincoln Institute of Land Policy. 2002.

Nelson, Arthur C., Rolf Pendall, Casey Dawkins, and Gerrit J. Knaap, The Link Between Growth Management and Housing Affordability: The Academic Evidence, Discussion Paper, Brookings Institution, Washington, DC, 2002.

Ding, Chengri and Gerrit Knaap, Land Values and the Emergence of Land Markets in Beijing, China, working paper, Lincoln Institute of Land Policy, 2001.

Knaap, Gerrit J., The Urban Growth Boundary in Metropolitan Portland, Oregon: Research, Rhetoric, and Reality, American Planning Association, PAS memo, 2001.

Knaap, Gerrit J, with Robert Olshansky, Emily Talen, and Clyde Forrest, Government and Urban Sprawl, prepared for the Illinois Department of Natural Resources, 2001, available at, http://dnr.state.il.us/orep/nrrc/balancedgrowth.

Knaap, Gerrit J, with Robert Olshansky, Emily Talen, and Clyde Forrest, State Government and Urban Development in Illinois, prepared for the Illinois Department of Natural Resources, 2001, available at, http://dnr.state.il.us/orep/nrrc/balancedgrowth.

Knaap, Gerrit J, with Robert Olshansky, Emily Talen, and Clyde Forrest, The Effects of Zoning on Urban Development Patterns in Illinois, prepared for the Illinois Department of Natural Resources, 2001, available at, http://dnr.state.il.us/orep/nrrc/balancedgrowth.

Knaap, Gerrit J, with Robert Olshansky, Emily Talen, and Clyde Forrest, Infrastructure Finance and Urban Development Patterns in Illinois, prepared for the Illinois Department of Natural Resources, 2001, available at, http://dnr.state.il.us/orep/nrrc/balancedgrowth.

Knaap, Gerrit J. and Terry Moore, Land Supply and Infrastructure Capacity Monitoring for Smart Urban Growth, working paper, Lincoln Institute of Land Policy, 2000.

Knaap, Gerrit J., Towards Model Statutes on the Economic Development Element of Local Comprehensive Plans, in Modernizing State Planning Statutes: The Growing Smart Working Papers, Planning Advisory Service Report #480/481, Chicago, IL: American Planning Association, 1998.

Knaap, Gerrit J., Towards Model Statutes on the Land Use Element of Local Comprehensive Plans, in Modernizing State Planning Statutes: The Growing Smart Working Papers, Planning Advisory Service Report #480/481, Chicago, IL: American Planning Association, 1998.

Contributing Author, Growing Smart Legislative Guidebook: Model Statutes for Planning and the Management of Change, Phase 1 Interim Edition, Chicago, IL: American Planning Association. 1997.

Hanley, Paul F. and Gerrit J. Knaap, The Spatial Reconfiguration of the Portland Metropolitan Area: A Preliminary Assessment and Baseline Analysis, Proceedings of the Conference on Transportation, Land Use and Air Quality, American Society of Civil Engineers, Portland, Oregon, 5/98.

Knaap, Gerrit J., Air Quality and Urban Planning: Towards an Integrative Approach, Presented at the 5th U.S.-Dutch international symposium on Air Pollution in the 21st Century: Priority Issues and Policy Trends, sponsored by the U.S. EPA and the Netherlands Ministry of Housing, Physical Planning and Environment, Noordwijk, The Netherlands, 4/97.

Phillips, J., A. Mitra, G. Knaap, A. Simon, S. Temperley, and E. Lackner, "The Determinants of Acquiescence to Preprinted Information on Establishment Survey Instruments," Proceedings of the American Statistical Association, 1994.

Knaap, Gerrit J., "Alternative Approaches to Economic Development in Rural Illinois: Evidence from Case-Study Research, in Rural Planning and Development: Visions of the 21st Century, Conference Proceedings, Orlando FL, February 1991.

JOURNAL REFEREE

American Economic Review, Annals of Regional Science, Coastal Management, Environment and Planning C: Government and Society, Growth and Change, Housing Policy Debate, Journal of the American Planning Association, Journal of the Community Development Society, Journal of Environmental Planning and Management, Journal of Human Resources, Journal of Planning Education and Research, Journal of Planning Literature, Journal of Policy Analysis and Management, Journal of Regional Science, Journal of Urban Affairs, Journal of Urban Economics, Land Economics, Nature Society and Thought, Papers in Regional Science, Regional Science and Urban Economics, State and Local Government Review, Urban Affairs Review.

RECENT RESEARCH GRANTS AND CONTRACTS:

Principal Investigator, Chinese Land and Urban Development Program, Lincoln Institute of Land Policy, 9/03 to 9/06 ($450,000).

Principal Investigator, Smart Growth under Parris Glendening: A Retrospective, Lincoln Institute of Land Policy, 1/04 to 12/04 ($20,000).

Principal Investigator, Smart Step Forward, Robert Wood Johnson Foundation, 9/02 to 12/04 ($150,000).

Principal Investigator, Modeling Pedestrian Behavior, Maryland Department of Transportation, 9/03 to 9/04 ($90,000).

Principal Investigator, Zoning as a Barrier to Affordable Housing, U.S. Department of Housing and Urban Development, Fannie Mae Foundation, and Lincoln Institute for Land Policy, 9/03 to 12/04 ($300,000).

Principal Investigator, Housing Supply Analysis for the State of Maryland, Maryland Homebuilder's Association and Maryland National-Capital Builders Association, 7/02 to 1/03 ($50,000).

Principal Investigator, Monitoring Urban Land Markets: A National Demonstration Project, U.S. Department of Transportation and U.S. Department of Housing and Urban Development, 8/02 to 7/03 ($150,000).

Principal Investigator, Measuring Urban Form, Brookings Institute and Lincoln Institute of Land Policy, 7/02 to 9/03 ($60,000).

Co-principal Investigator, with Lewis D. Hopkins, Using and Making Systems of Plans, Lincoln Institute of Land Policy, 6/00 to 5/01 ($30,000).

Co-principal Investigator, with Lewis D. Hopkins, Web Technology in Planning, Lincoln Institute of Land Policy, 6/01 to 10/02 ($40,000).

Co-principal Investigator, with Lewis D. Hopkins, Using and Making Systems of Plans, Lincoln Institute of Land Policy, 6/00 to 5/01 ($30,000).

Principal Investigator, Emerging Land and Housing Markets in the People's Republic of China, Lincoln Institute of Land Policy, 3/00 to 6/02 ($35,000)

Co-principal Investigator, with Alex Anas, David Boyce, and Lewis Hopkins, Infrastructure and Metropolitan Development, National Science Foundation, 1/99 to 12/02 ($450,000).

Principal Investigator, with Robert Olshansky and Emily Talen, Planning in Peoria, Tri-county Regional Planning Agency, 5/00 to 8/00 ($7,000)

Principal Investigator, with Robert Olshansky, Emily Talen, and Clyde Forrest, Government and Urban Sprawl, Illinois Department of Natural Resources, 2/00 to 9/00 ($30,000)

Principal Investigator, Land Market Monitoring, Lincoln Institute of Land Policy, 1/99 to 3/00 ($20,000).

Co-principal Investigator, with Lewis Hopkins, Do Plans Matter?, Lincoln Institute of Land Policy, 6/97 to 1/99 ($30,100)

Principal Investigator, Lewis Hopkins, Co-Principal Investigator, Do Transportation Plans Affect Spatial and Temporal Patterns of Urban Growth, REU supplement, National Science Foundation, 3/97 to 3/99 ($3,050).

Principal Investigator, Lewis Hopkins, Co-Principal Investigator, Do Transportation Plans Affect Spatial and Temporal Patterns of Urban Growth, National Science Foundation, 8/96 to 3/99 ($98,023).

Co-principal Investigator, with Zorica Nedovic-Budic, Macro-site Land Inventory and GIS Assessment, Illinois Department of Natural Resources, 8/96 to present ($82,400).

Principal Investigator, EnviroText Retrieval System, Construction Engineering Research Laboratory, U.S. Army Corps of Engineers, 3/94 to 11/96 ($653,395).

Principal Investigator, Environmental Technical Information System, Construction Engineering Research Laboratory, U.S. Army Corps of Engineers, 1/91 to 8/95 ($1.6 million).

Co-principal Investigator, with Lewis Hopkins, Do Plans Matter?, Lincoln Institute of Land Policy, 1/94 to 1996 ($19,000)

Principal Investigator, Environmental Trends, U.S. Army Corps of Engineers, 2/93 to 6/94 ($105,082).

Principal Investigator, Inventory of State Natural Resources Information System, U.S. Army Corps of Engineers, 2/92 to 6/92 ($27,493).

Principal Investigator, Illinois Recreation Facility Inventory, Illinois Department of Conservation, 1/92 to 8/92 ($74,788).

Co-principal Investigator with Eliza Husband, Downtown Development Workshop, City of Bloomington, 8/91 to 1/92 ($2,000)

Principal Investigator, Inventory of State Natural Resources Information System, U.S. Army Corps of Engineers, 8/91 to 2/92 ($9,597).

Principal Investigator, Institutional Structures for Remedial Action Planning in Great Lakes Areas of Concern, Illinois-Indiana Sea Grant Program, 7/91 to 12/91 ($2,000).

Principal Investigator, Illinois Recreation Facility Inventory, Dept. of Conservation, 8/91 to 8/92 ($74,988).

Co-Principal Investigator, with T.J. Kim, Assessing Policy Alternatives for Army Environmental Planners, 6/91 to 6/92 ($89,048).

PROFESSIONAL AND PUBLIC SERVICE

Member, Science and Technical Advisory Committee, Chesapeake Bay Commission, 8/02 to present.

Chair, Analytical Methods and Computer Applications Track, Association of Collegiate Schools of Planning, 8/98 to 11/2001.

Member, Urbana Planning Commission, 10/97 to 12/2001.

Member, Board of Directors, Lake Michigan Federation, Chicago, Illinois, 4/94 to 11/2000.

Editor, International Regional Science Review, 8/98 to 1/2000.

TERRY MOORE

M.U.R.P. Urban and Regional Planning, University of Oregon
M.A. Public Administration, University of Oregon
B.S. Environmental Engineering, Stanford University

Terry Moore, FAICP, has been a vice president and project manager at ECONorthwest since 1979. He has managed over 400 projects in land-use and transportation planning, policy analysis, and market analysis for private and public clients. His recent projects focus on growth management, the interaction of land-use and transportation policies, and strategic planning for public facilities and services.

Moore is an adjunct professor in the Department of Planning, Public Policy, and Management at the University of Oregon, where he has taught for over 20 years. He was a Fulbright Scholar on natural resource management and urban planning in Peru in 1986-1987. In 1994, his book *Understanding the Transportation/Land Use Connection* was published by the American Planning Association. Moore is a co-recipient of the American Planning Association's 1996 Current Topic Award for Transportation Planning.

Representative Projects

Growth Management

- Assessed market demand for nodal development in Springfield. Oregon Transportation and Growth Management (TGM) Program.
- Economic development strategy for the City of Portland, Portland Development Commission.
- Prepared an economic assessment and job-creation strategy for Portland's Central Eastside Urban Renewal Area. Portland Development Commission.
- *The Costs of Sprawl Revisited*, National Academy of Sciences' Transit Cooperative Research Program
- Evaluation of alternative urban development patterns in the Willamette Valley, Oregon Agricultural Education Foundation and 1000 Friends of Oregon
- Governor's Growth Study, Oregon Governor's Community Solutions Team
- Economic analysis of interim-development regulations, Oregon TGM Program
- Evaluation of new policies to manage urban growth, Oregon TGM Program
- Housing demand analysis and inventory of buildable lands, LCOG, TGM Program
- Analysis of urban growth management policies, statewide evaluation and case studies, Oregon Department of Land Conservation and Development (DLCD)
- *Region 2040*: regional plan and fiscal impact analysis of growth, Portland Metro
- Evaluation of no-growth and slow-growth policies for metropolitan areas, Metro
- Framework for evaluating the full costs of urban growth in the Portland metropolitan area, State Agency Council for Growth
- Social indicators of growth, City of Gresham
- Growth management strategy, City of St. Paul
- Assessment of policies for redirecting growth, Puget Sound Council of Governments
- Growth management strategy, Capital Regional District, Victoria, B.C.
- Coastal area water resources and growth management plan, DLCD, Clatsop County
- Comprehensive land-use plans and growth management policies, various cities

Land Use

- Guidebook for the State of Oregon on how local governments could evaluate commercial and industrial land needs. Oregon Economic and Community Development Department.
- Analysis of development opportunities, Washington County
- Urban reserve productivity analysis, Portland Metro
- Open space needs assessment, Portland Bureau of Parks and Recreation
- Housing needs assessment and policy analysis, Oregon Cascades West Council of Governments
- Inventory of industrial land, Port of Portland
- Buildable lands inventory, City of Corvallis
- Inventory of West Eugene industrial lands, Oregon Department of Transportation
- Land-use needs analysis and inventory of buildable lands, City of McMinnville
- Analysis of factors affecting residential development, City of Cascade Locks
- Economic forecasts of population, employment and land-use for development of revised comprehensive plan, City of Florence
- Development of land-use master plan and industrial development plan, Confederated Tribes of the Grand Ronde
- Economic analysis of neotraditional development in Eugene-Springfield area, LCOG
- Evaluation of UGB expansion, Medford and Brookings, Private clients
- Regional problem-solving, Deschutes County
- Evaluation of master plan for a municipal airport, City of Albany
- Land-use and economic impacts for EISs for various highway and bridge projects, including Portland's Sunrise Corridor and Western Bypass, ODOT
- Land-use policies for transit-oriented development at light-rail transit stations, City of Hillsboro

Transportation

- Reviewed Clark County's new concurrency methodology as used to measure transportation system performance for development applications and for long-range transportation planning. Clark County, Washington.
- Transportation System Plans for Oregon municipalities, including analysis of funding and transportation alternatives, Cities of Ashland, Florence, Reedsport, Astoria, Hood River, Grants Pass, Sweet Home, Scappoose, Sutherlin, Woodburn, and the Rogue Valley Council of Governments
- Benefit-cost analysis of land-use and transportation policies, Federal Highway Administration and ODOT
- Evaluation of Transportation Planning Rule requirements and recommendations for alternatives, ODOT and DLCD
- Land-use and growth impacts of highway improvements, ODOT
- Long-range, multi-modal plan for public transportation, ODOT
- Training workshops for transportation policymakers to reach Oregon's growth management objectives, Oregon Transportation Commission, Oregon DLCD
- Training workshops for implementation of Transportation Planning rule, ODOT
- Impacts of roadway improvements on rural development, ODOT
- Effects of land-use and demand-management policies on trips, Oregon Road Finance Study, ODOT
- Feasibility of high-speed rail in the Willamette Valley, ODOT

- Evaluation of impacts of transportation projects on alternative land-use patterns, Federal Highway Administration
- Economic impacts of congestion pricing, Portland Metro
- Transportation Master Plan for a rapidly developing urban corridor, including evaluation of alternatives, Clackamas County
- Implementation strategy for transit-supportive development standards, Pierce Transit, City of Tacoma
- Feasibility of transportation alternatives and corridor studies for three multi-modal routes, City of Corvallis
- Development of guidelines for land-use and design to encourage transit- and pedestrian-oriented development, LCOG
- Evaluation of market demand for pedestrian-oriented nodal development, LCOG
- Feasibility analysis of siting for southern terminus of Pacific Northwest High-Speed Rail Corridor, LCOG
- Potential impacts of transportation pricing policies in Eugene area, LCOG
- Effects of transportation and land use policy on air quality, 1000 Friends of Oregon
- Market analysis for real-estate products at light-rail stations, Portland Metro
- Urban form and transportation in Portland metropolitan area, Portland Tri-Met

Public Facilities and Infrastructure

- Evaluation of adequate public facilities requirements and focused public investment plans, City of St. Paul and Mid-Willamette Valley Council of Governments
- Economic analysis of the transition to a consolidation of service providers in a rapidly urbanizing area, Clackamas County
- Infrastructure for industrial development, City of Springfield
- Systems development charge update for parks, Bend Park and Recreation District
- Financial analysis of infrastructure, Oregon Department of Environmental Quality
- Evaluation of the full costs of landfills for municipal solid waste, Oregon DEQ
- Evaluation of USDOE method for selecting permanent repositories for nuclear waste, Washington Joint Legislative Committee on Science and Technology
- Feasibility of treating wastewater as a substitute for potable water, Seattle Metro
- Economic evaluation of proposals for a distant landfill, Seattle Solid Waste Department
- Evaluation of effectiveness of least-cost planning techniques on solid-waste management policies, Portland Metro
- System analysis of solid-waste management alternatives for Washington County, Portland Metro
- Solid waste flow forecast and market analysis for specific recycled materials, Portland Metro

Market and Feasibility Analysis

- Feasibility study of Salem conference center. City of Salem.
- Feasibility analysis of interpretive center, Oregon Department of Forestry
- Feasibility of convention center, City of Grants Pass
- Feasibility of museum expansion, Washington State Historical Society
- Socioeconomic impact analysis of a ski area, Winema National Forest
- Market analysis for aquatic park, Clackamas County
- Feasibility analysis of performance amphitheater at Blue Lake Park, Portland Metro
- Market and feasibility analysis for RV Parks at two urban sites, Portland Metro
- Evaluation of feasibility analysis for McKenzie Sports Arena, Eugene, private client

- Feasibility and funding analyses of proposed indoor soccer facility, City of Eugene
- Future revenue analysis for museum facilities, Butte Valley Museum
- Feasibility analysis for interpretive center, Applegate Trail Information Center
- Feasibility of conference/convention centers and fairgrounds expansion, Clackamas, Lane, Linn, and Josephine Counties, and Southern Oregon Community College
- Market analysis for port master plan, Port of Brookings Harbor, Brookings
- Market analysis of mixed-use waterfront development, City of West Linn
- Likely effects on downtown business of proposed commercial malls, City of Albany

Strategic Planning

- Market and regulatory analysis of regional plan for Portland metropolitan area, Portland Metro
- Municipal strategic plan (*Shaping Eugene's Future*), City of Eugene
- Strategic plan for economic development, Clackamas County
- Town center plan for City of Cedar Mill, Portland Metro, Washington County
- Strategic plan for the Confederated Tribes of the Grand Ronde
- Strategic plan for regional economic development, Emerald People's Utility District, Eugene
- Community-based strategic planning for municipal services in response to Measure 5 impacts (*Eugene Decisions*), City of Eugene

Environmental Policy and Resource Management

- Evaluation of Columbia River Gorge National Scenic Area Management Plan, Columbia River Gorge Commission
- Economic valuation of environmental impacts associated with development of solar, wind, biomass, geothermal, cogeneration and electric resources, Bonneville Power Administration
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5

	Pesticide Product	Active Ingredient	ERRATA	LEACHM	GLEAMS	WINPST							
						Leaching			Solution Runoff			Adsorbed Runoff	
						Loss Potential	Human Hazard	Fish Hazard	Loss Potential	Human Hazard	Fish Hazard	Loss Potential	Fish Hazard
1	2,4-D AMINE	Dimethylamine 2,4-dichlorophenoxyacetate				V	V	V	I	L	V	L	V
2	ACCLAIM 0.5 WE HERBICIDE	Fenoxyprop-ethyl				V	V	V	I	I	I	I	V
3	ALIETTE FUNGICIDE	Fosetyl-Al				V	V	V	I	V	V	L	V
4	BANOL	Propamocarb hydrochloride				V	V	V	L	V	V	I	V
5	BANVEL 720 HERBICIDE	Dimethylamine 2,4-dichlorophenoxyacetate				V	V	V	I	L	V	L	V
6	BASAGRAN HERBICIDE	Sodium bentazon				L	V	V	I	V	V	L	V
7	BATTALION HERBICIDE	Halosulfuron-methyl		X		V	V	V	I	V	V	L	V
8	BETASAN 4-E LF SELECTIVE HERBICIDE	Bensulide				V	V	V	I	I	I	I	V
9	DIMENSION 1EC TURF HERBICIDE	Dithiopyr				L	L	L	I	I	I	I	V
10	FOLISTAR 50WP	Flutolanil				V	V	V	I	V	L	I	V
11	MSMA 60 PLUS SURFACTANT	MSMA		X		V	V	V	I	L	V	I	V
12	PROGRASS EMULSIFIABLE CONCENTRATE	Ethofumesate (ANSI)				V	V	V	I	V	V	L	V
13	ROUNDUP HERBICIDE	Glyphosate, isopropylamine salt				V	V	V	I	V	V	I	V
14	SCOTTS TGR POA ANNUA CONTROL	Ethofumesate (ANSI)				V	V	V	I	V	V	L	V
15	TURCAM	Bendiocarb				V	V	V	I	I	I	L	V
16	TURFLON II AMINE	Dimethylamine 2,4-dichlorophenoxyacetate				V	V	V	I	L	V	L	V
17	TURFLON II AMINE	Triethylamine triclopyr				L	V	V	I	V	V	I	V
18		Bifenthrin											
19		Lamba-cyhalothrin											
20		Mefenoxam											
21		Spisosad A											
22	~~ACE LAWN FOOD WITH WEED CONTROL 22-6-8~~	~~2,4-dichlorophenoxyacetic acid~~		X		V	V	V	I	I	I	I	V
23	~~ACE LAWN FOOD WITH WEED CONTROL 22-6-8~~	~~Mecoprop~~		X		L	I	V	I	H	V	L	V
24	~~BALAN DRY FLOWABLE~~	~~Benfluralin~~				V	V	L	I	V	H	I	V
25	~~BANNER FUNGICIDE~~	~~Propiconazole~~		X	X	V	L	V	I	H	L	I	V
26	~~BARRICADE F HERBICIDE~~	~~Prodiamine (ANSI)~~				V	no eval.	V	I	no eval.	I	I	V
27	~~FUNGO 50 SYSTEMIC TURF FUNGICIDE~~	~~Thiophanate-methyl~~				V	V	L	I	V	H	I	L
28	~~KOBAN FLOWABLE~~	~~Etridiazole~~			X	V	L	V	I	H	L	I	V
29	~~MOCAP EC NEMATICIDE INSECTICIDE~~	~~Ethoprop (ANSI)~~		X		L	L	L	I	I	I	L	L
30	~~NEMACUR 10% TURF AND ORNAMENTAL NEMATICIDE~~	~~Fenamiphos~~				L	I	I	I	H	H	I	I
31	~~ORNALIN CONTACT FUNGICIDE 50% WETTABLE POWDER/TURF~~	~~Vinclozolin~~				V	no eval.	V	I	no eval.	L	L	V
32	~~ORTHENE 75 WSP (INSECTICIDE IN A WATER SOLUBLE BAG)~~	~~Acephate (ANSI)~~			X	V	L	V	I	H	V	L	L
33	~~PCNB 2 FLOWABLE TURF & ORNAMENTAL SOIL FUNGICIDE~~	~~2,4 Dichlorophenoxyacetic acid~~		X		V	L	V	L	I	L	I	V
34	~~RONSTAR 1% WITH FERTILIZER~~	~~Oxadiazon (ANSI)~~				V	L	V	I	H	I	I	V
35	~~TEAM 2G~~	~~Trifluralin~~			X	V	L	L	I	H	H	I	L
36	~~TUPERSAN HERBICIDE~~	~~Siduron (ANSI)~~				V	no eval.	V	I	no eval.	V	I	V
37	~~TWIN LIGHT CHLORONEB TURF FUNGICIDE~~	~~Chloroneb (ANSI)~~			X	V	V	V	I	L	V	I	V
38		~~Bentazon~~		X									
39		~~Quintozene~~			X								
40		~~Trifloxystrobin~~			X								
41		~~Spisosad D~~		X									

	Pesticide Product	Active Ingredient												
			ERRATA	LEACHM	GLEAMS	WINPST								
						Leaching			Solution Runoff			Adsorbed Runoff		
						Loss Potential	Human Hazard	Fish Hazard	Loss Potential	Human Hazard	Fish Hazard	Loss Potential	Fish Hazard	
42	~~ABOUND FLOWABLE FUNGICIDE~~	~~Azoxystrobin~~		X	X	V	V	V	I	V	I	I	V	
43	~~BANVEL 720 HERBICIDE~~	~~Dicamba, dimethlamine salt~~		X		missing	missing	missing	missing	missing	missing	missing	missing	
44	~~BAYLETON 009EC TURF AND ORNAMENTAL FUNGICIDE~~	~~Triadimefon~~		X	X	V	V	V	I	I	I	L	V	
45	~~CHIPCO 26019 FUNGICIDE~~	~~Iprodione (ANSI)~~			X	V	L	V	I	H	L	L	V	
46	~~DACONIL 2787 FLOWABLE FUNGICIDE~~	~~Chlorothalonil~~		X		V	V	L	I	I	H	I	L	
47	~~DACTHAL FLOWABLE HERBICIDE~~	~~Chlorthal-dimethl~~	X			V	L	V	I	H	V	I	V	
48	~~DURSBAN 4E INSECTICIDE~~	~~Chlorpyrifos (ANSI)~~			X	V	V	I	L	L	H	I	L	
49	~~DYLOX 80 TURN AND ORNAMENTAL INSECTICIDE~~	~~Trichlorfon~~		X	X	L	L	L	I	I	I	L	L	
50	~~FORE TURF AND ORNAMENTAL FUNGICIDE~~	~~Mancozeb~~	X			V	L	L	I	H	H	I	L	
51	~~LESCO TFC DISPERSIBLE GRANULE TURF HERBICIDE~~	~~Chlorsulfuron~~		X		L	V	V	I	V	V	I	V	
52	~~MERIT 60 WSP~~	~~Imidacloprid~~		X	X	L	V	V	I	V	V	I	V	
53	~~OFTANOL 1-5G INSECTICIDE~~	~~Isofenphos~~	X			V	L	V	I	H	L	I	V	
54	~~PRE-M 3.3 EC TURF HERBICIDE~~	~~Pendimethalin (ANSI)~~			X	V	V	L	I	L	H	I	V	
55	~~PROTURF PYTHIUM CONTROL~~	~~Metalaxyl~~	X	X		L	V	V	I	V	V	I	V	
56	~~RUBIGAN 50W TURF & ORNAMENTAL~~	~~Fenarimol~~		X		L	V	L	I	V	L	I	V	
57	~~SENTINEL 40 WG TURF FUNGICIDE~~	~~Cyproconazole~~	X			V	L	V	I	H	V	I	V	
58	~~SEVIN GRUB KILLER GRANULES (2% SEVIN)~~	~~Carbaryl (ANSI)~~		X	X	V	V	V	I	L	L	L	V	
58	~~THIRAM 75WP FUNGICIDE~~	~~Thiram~~		X	X	V	V	I	I	L	X	L	L	
58	~~TRIMEC 1158 BROADLEAF HERBICIDE~~	~~Dicamba (ANSI)~~		X		V	V	V	L	V	V	L	L	
59	~~TRIMEC 1158 BROADLEAF HERBICIDE~~	MCPA				V	V	V	L	L	V	L	V	
59	~~TRIMEC 1158 BROADLEAF HERBICIDE~~	~~Mecoprop~~		X		V	L	V	L	I	V	L	V	
59	~~TRIMEC 13 WEED'N FEED~~	~~Dicamba, dimethlamine salt~~		X		missing	missing	missing	missing	missing	missing	missing	missing	
60	~~TRIMEC 13 WEED'N FEED~~	~~Dimethylamine 2-(2-methyl-4-chlorophenoxy)propionate~~				missing	missing	missing	missing	missing	missing	missing	missing	
60	~~TRIMEC 13 WEED'N FEED~~	Dimethylamine 2,4-dichlorophenoxyacetate				V	V	V	I	L	V	L	V	
60	~~TRIPLET HI-D SELECTIVE HERBICIDE~~	~~Dicamba, dimethlamine salt~~		X		missing	missing	missing	missing	missing	missing	missing	missing	
61	~~TRIPLET HI-D SELECTIVE HERBICIDE~~	Dimethylamine 2,4-dichlorophenoxyacetate				V	V	V	I	L	V	L	V	
61	~~TRIPLET HI-D SELECTIVE HERBICIDE~~	~~Mecoprop-P~~				missing	missing	missing	missing	missing	missing	missing	missing	
62	~~WEEDONE 638 BROADLEAF HERBICIDE~~	~~2,4-Dichlorophenoxyacetate acid~~		X		V	V	V	I	L	V	L	V	
63	~~WEEDONE 638 BROADLEAF HERBICIDE~~	~~Butoxyethyl 2,4-dichlorophenoxyacetate~~				missing	missing	missing	missing	missing	missing	missing	missing	
64		~~Cyfluthrin~~			X									
65		~~Deltamethrin~~			X									
66		~~Halofenozide~~		X	X									
67		~~Paclobutrazole~~		X										
68		~~Thiophanate~~		X	X									

EXHIBIT B

Pesticide and Herbicide Use: Adequacy of the Integrated Pest Management Program

The applicant has submitted to this administrative court, a letter dated October 13, 2004, from Kevin Franke of the LA Group. (Applicant's Supplemental Exhibit 13, Attached as Exhibit B). A detailed response follows:

1. Inert Ingredients (See Franke letter, Items 8 & 9). Citing DEIS page 2-89, Mr. Franke claims that "The DEIS presented a full discussion of the analysis of inert ingredients." As is set forth below, that discussion is far from full and is misleading in several respects.

Franke quotes from the DEIS that Table 2-8 "includes the pesticides that could potentially be used on the golf course, a trade name of a product containing the active ingredient taken from the Cornell Recommends, inert ingredients listed on the product label or Manufacturer [sic - should be "Material"] Safety Data Sheet (MSDS) and USEPA Category of Inert Ingredients taken from EPA's website." While the table includes the trade name of *a product* containing the active ingredient, it certainly does not include the trade names of all products containing the active ingredient. In fact, Franke goes on to specify that "Where more than one alternative product is available for a particular ingredient, *the product with least toxic ingredients was selected.*" (Emphasis added) Finally, on page 9 of his the October 13, 2004 letter Franke confirms that other products may be used. Since those other products would likely contain inert mixtures that differ both qualitatively (chemicals present) and quantitatively (concentration of specific ingredients) from the inerts in the products identified in DEIS Table 2-8, the discussion of inerts is woefully inadequate.

Franke seeks to defend the DEIS claim that the products selected were those with the least toxic inert ingredients by reference to the EPA classification of inert ingredients and reliance upon the inert ingredients identified on product labels. His analysis is grossly oversimplified. In regard to inert ingredients, EPA regulations require only the specific identification of the 8 inerts on their List 1 (Inerts of Toxicological Concern). In addition, product registrants may *voluntarily* list any other inert ingredients they see fit. In practice, registrants sometimes voluntarily reveal the presence of List 4 (Inerts of Minimal Concern) ingredients, but that does not mean that the product does not contain other, unidentified, inert ingredients, which may be classified in Lists 2 (approximately 95 chemicals), 3 (approximately 2000 chemicals) or 4 (approximately 1000 chemicals). Franke's conclusion that no assessment of toxicity was necessary for products other than those on EPA List 1 is unsupported by the facts. For example, see Table 1, below, which identifies several chemicals from Lists 2 and 3, and identifies some of their potential toxic effects as identified by the USEPA and the National Institutes of Health.

Table 1. Some Toxic Effects of Selected EPA List 2 and List 3 Inert Ingredients*

Ingredient	List #	Toxic Effects
Cresols	2	Skin irritation, burns, and inflammation; irritation of eye, permanent damage and blindness; pneumonia; pancreatitis; central nervous system disorders; kidney failure.
Dibutylphthalate	2	Irritation of eyes and throat; photophobia, conjunctivitis, nausea, dizziness.
Dimethylphthalate	2	Irritation of eyes, mouth, nose, throat; dizziness, abdominal pain, nausea, vomiting, diarrhea; central nervous system depression; reduced respiratory rate; paralysis, coma.
Epichlorhydrin	3	Skin irritation and sensitization; eye irritation; liver and kidney damage; inflammation of lungs and asthmatic bronchitis; death by respiratory paralysis. Probable Human Carcinogen**
Naphthalene	3	Nausea, vomiting, diarrhea, blood in urine, dermal sensitivity; hemolytic anemia; convulsions and coma. In newborns: brain damage with uncoordinated movements, disturbances in vision, hearing, feeding and speech.
Toluene	2	Skin, eye and respiratory irritation; abdominal pain, headache, nausea, dizziness, drowsiness, hallucinations; anemia; liver disorders and enlargement; central nervous system dysfunction; coma and death.

* Sources: US Environmental Protection Agency, Integrated Risk Information System at http://www.epa.gov/iris/subst/index.html; US Environmental Protection Agency, Chemical Profiles at http://yosemite.epa.gov/oswer/CeppoEHS.nsf/Profiles/106-89-8?OpenDocument; and US Department of Health & Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry at http://www.atsdr.cdc.gov/toxpro2.html.
** Classified as a Probable Human Carcinogen by EPA. See "Chemicals Evaluated for Carcinogenic Potential" Office of Pesticide Programs, USEPA, April 11, 2003.

In fact, EPA does not characterize even those ingredients on List 4 as non-toxic. For example, peanuts and several peanut derived products (oil, shells) are included on List 4 in spite of the fact that their ability to precipitate potentially fatal anaphylactic shock in allergic individuals is well known. The category titles in EPA's classification, used without further explanation or evaluation, lend themselves to misinterpretation. Franke's reliance on the category titles is a gross oversimplification and unacceptable as an analysis of the toxic effects of inert ingredients in products proposed for use at the Belleayre Resort.

In Item 9 of his October 13, 2004 letter to ALJ Wissler, Franke argues that all of the products are properly registered for use on golf course turf in NYS. The fact that a pesticide product is registered for use, is not an assurance of its safety, but rather a permit to sell the

product for specific uses based on a risk / benefit analysis in which risk and benefit may be apportioned to different entities. The EIS process, on the other hand, provides a site specific means to "...systematically consider significant adverse impacts, alternatives and mitigation." See 6 NYCRR § 617.2(n). The two processes are quite different.

Franke adds, in Item 9, that limiting the products that can be used at Belleayre to those that have been evaluated would limit their options for "... effective pest control with a demonstrated 'non-impacting' pesticide ...." This statement goes well beyond the consideration of the adverse effects of inert ingredients, and implies that the pesticide products, including both active and inert ingredients are somehow safe, harmless, non-toxic and free of risk to human health and the environment. However, he provides no support for the proposition that any specific pesticide product, no less any of the unspecified pesticides that he would reserve the right to apply at the Belleayre Resort, is, in fact, "non-impacting." To the contrary, pesticide labels bear hazard and precautionary statements which warn of the potential for such adverse impacts. In fact, both federal regulations prohibit such claims on pesticide labels (see 40 C.F.R. 162.10(a)(5)), while both federal and New York state law prohibit such claims in the course of the distribution and sale of pesticides. See 7 USC §136j(a)(1)(B) and ECL § 33-1301(1)(a).

DEIS Table 2-8 remains incomplete, with the inerts of many products unidentified. Even where an inert ingredient is identified, the table does not reveal if that is the only inert ingredient in the product. That information is generally apparent on the product label, but is not included in the DEIS. Further effort, such as direct inquiry to EPA and the various product registrants, could reveal the identity of additional inert ingredients. To the extent that the inert ingredients in any product proposed for use at the Belleayre Resort is unknown, or has not been fully assessed for its risks to human health and the environment, that deficiency in the risk assessment should be prominently revealed in the DEIS. Unsupported, and unsupportable, assurances of safety, made in the absence of adequate information, should be removed from the DEIS.

2. Assessing Health Effects (See Franke letter, Item 10). Responding to our comments about the discussion of health effects in the DEIS, Franke cites the utilization of drinking water standards in the Fertilizer and Pesticide Risk Assessment. That risk assessment addresses the potential for contamination of groundwater, but does not address the risks associated with other routes of exposure, such as contact and inhalation, either at the point of application or elsewhere as the pesticides may be distributed by drift, surface runoff or post-application volatilization. Specific inadequacies in the limited assessment of risk associated with groundwater contamination are discussed elsewhere in this brief. The absence of an evaluation of risks arising from other routes of exposure is significant and should be corrected.

Franke's response to our comments on the DEIS is silent on the proposed use of chemicals identified as possible and probable carcinogens or as neurotoxins. Products containing ingredients so classified should not be accepted for use. Also, as discussed at length above, the DEIS does not reflect any meaningful effort to assess the potential of inert ingredients to adversely affect human health or the environment.

As to the potential for chronic effects attributable to either the pesticides applied or their degradation products, Franke seeks to dismiss the matter, baldly claiming that any discharge to surface water would be episodic, and therefore would not cause any chronic effects. Franke's claim fails on at least two counts.

First, Franke confuses chronic exposure with chronic effects. Chronic exposure is simply long-term exposure. Chronic effects, however, are those that are manifested long after the initial exposure. It is not true that chronic effects always arise as the result of chronic exposure, as Franke implies. Chronic effects may arise as the result of acute exposures, as a single exposure to a genotoxic agent may cause cancer, and as brief exposure to a neurotoxin during early development may cause permanent neurological disorders.

Second, Franke concludes that episodic pesticide applications could only result in episodic acute exposures. That would only be the case if all of the pesticides applied and all of their degradation products had extraordinarily short half lives, so that they broke down in a very short time and if they were only transported by surface runoff, which would carry them rapidly to receptors. Failing that, the pesticides and/or their degradation products may persist in the environment and serve as a continuing (chronic) source of exposure. This would be the case whether the pesticides/degradates had rapidly run off to the receptor or if they were transported at a lesser rate via groundwater.

Experimentally derived LC_{50} values, which reflect only the potential of the a specific chemical to kill the specific target organism within a short period of time is unacceptable as the sole metric of environmental risks arising from the use of pesticides at the Belleayre Resort.

3. Risks Associated With Pesticide Use (See Franke letter, Item 13). Notwithstanding the risks discussed above and not addressed in the DEIS, Franke responds that "The Applicant is cognizant of the fact that there are risks, costs, and liabilities associated with golf course maintenance. Like any good business, there is no benefit in increasing risks, costs or liabilities and there are no good reasons to do so."

While there may be no *good* reason to do so, a business could well make the decision to engage in a risky activity, especially when the risks are imposed on others or on the environment. Although the applicant *may* understand the risks, they have certainly not been adequately stated and evaluated in the DEIS, and that is the issue at hand.

4. Biological Controls (See Franke letter, Item 14). The authors of the DEIS chose to use the words of others to characterize the utility of biological controls. They relied upon a statement made by Vittum in 1991 and a statement by McCarty and Elliot published in 1994. (Notwithstanding the fact that the McCarty and Eliot statement is appropriately cited in the DEIS, Franke chose to characterize it in the October 13, 2004 letter only as being from a handbook edited by Anne Leslie. Leslie was at the time, but is not now, an employee of the USEPA.) The cited statements are both dated more than a decade ago. While the science and

technology of pest control has advanced, those words remain fixed in print, reflecting, at best, the opinions of the authors at that time. Their use in the DEIS, however, was a decision of the authors of that document, and thus become their words. They are, today, outdated and unnecessarily argumentative. If they do not represent the views of the authors of the DEIS they should be deleted.

5. Prioritization of Control Options (See Franke letter, Item 15). Franke states that the control options are listed in the order in which they would be implemented. It should be so stated, clearly, in the DEIS. Franke fails to provide any citation to that document to demonstrate that it is indeed the intention to implement controls in any particular order.

6. Record Keeping (See Franke letter, Item 16). Referring to DEIS Appendix 14, section 3.3.3 (p. 24), we previously noted that the proposed record keeping program is inadequate to document efficacy. In response Franke claims that the referenced section contains the following statement:

> "Effectiveness of cultural practices in preventing pest proliferation and chemical practices in reducing pest levels is also documented as part of the scouting and record keeping program."

After careful review of that section of the November 2002 revision of Appendix 14 I cannot locate that statement.

7. Notification (See Franke letter, Item 17). While Franke agrees to the value of notices of pesticide applications posted on the golf course, he does not say if such notices will be posted before or after applications. He also makes no provision for notice to golf course neighbors who do not use the course. Notice should serve both an informational and precautionary function. If neighbors are not notified prior to applications then they cannot take such precautionary actions as they may deem appropriate to prevent exposure to pesticides and to protect their health and welfare. Notice should not be limited only to those who use the course.

8. Modeling and Risk Assessment (See Franke letter, Item 19). Franke concludes by saying that the Attorney General's office did not feel that the modeling and risk assessment was conservative enough to avoid potential impacts. In response, he cites only a series of defaults used in the DEIS groundwater modeling exercise. That exercise is only one element of an overall assessment of risks associated with the pest control program proposed for the Belleayre Resort. It does not reflect a consideration of other mechanisms for dispersion of and exposure to pesticides proposed for use at the Belleayre Resort, nor does it demonstrate a careful evaluation of the adverse effects of the selected active ingredients on human health and the environment. In fact, not only is there no meaningful discussion of pesticide related adverse effects, but there is insufficient information for readers of the DEIS to try to evaluate the potential for such effects on their own. As mentioned in the context of the discussion of inert ingredients above, DEIS Table 2-8 does not identify specific products which will be used. Nor does the list of active ingredients

identified on DEIS pages 2-85 and 2-86 as "pesticide active ingredients ... recommended for use based on the stringent risk assessment" identify such products.

Even without the identification of specific products, it is illuminating to look at the DEIS Table 2-8 list of active ingredients in light of the variety of products containing those ingredients, their registration status[1] and the presence or absence from the list of products recommended by Cornell Cooperative Extension[2] for use on commercial turfgrass. For example:

- DEIS Table 2-8 cites Koban 30 as an etradiazole product. In fact Koban 30 is one of 3 etradiazole products listed by Cornell, but DEC does not list any product with Koban in its name as a product registered for use in New York.

- DEIS Table 2-8 cites Terrachlor (sic) as a quintozene product. In fact, among the 13 quintozene containing products recommended by Cornell, none is branded as Terraclor. There are, however, 10 products registered in New York which have Terraclor in their name. The DEIS fails to adequately identify even the product chosen for inclusion in the Table.

- DEIS Table 2-8 identifies Vorlan as a vinclozolin product. Vorlan DF is listed as one of 3 vinclozolin products recommended by Cornell, but it is not listed by NYSDEC as a product registered for use in New York.

- DEIS Table 2-8 identifies Rubigan as a product which contains the active ingredient Fosetyl-Al. Rubigan is not among the Fosetyl-Al products recommended by Cornell, and for good reason - the active ingredient in Rubigan products is fenarimol. Fenarimol is not identified in the DEIS as an active ingredient proposed for use.

- Similarly, DEIS Table 2-8 identifies "Balan" as a product which contains benefin as the active ingredient and bensulide as the inert ingredient. It is highly unlikely that bensulide is indeed an inert ingredient in that product insofar as bensulide, like benefin, is herbicidal. Bensulide is not listed on any of EPA's lists of inert ingredients. There are 10 different pesticide products registered in New York with "Balan" in the product name, but only one, Balan 2.5G, is recommended by Cornell. The label for Balan 2.5G identifies benefin as the active ingredient and does not identify any of the inert ingredients which make up 97.5% of the product.

- DEIS Table 2-8 identifies Trimec Encore, as an MCPA containing product. Trimec Encore is registered as a Restricted Use Pesticide in New York.

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[1] Registration status in New York State, as reported here, was verified at the New York State Department of Environmental Conservation website. (See http://www.dec.state.ny.us/website/dshm/pesticid/pestprod.pdf) The list consulted was current as of January 10, 2005.

[2] Cornell Cooperative Extension, "2004 Pest Management Guidelines for Commercial Turfgrass," April 2004.

- Cleary's MCPP was chosen as a representative MCPP containing product in DEIS Table 2-8. Cleary's MCPP is not listed as a product registered for use in New York.

- DEIS Table 2-8 identifies Talstar GC Flowable as a bifenthrin product. Talstar GC Flowable is one of 6 different bifenthrin products recommended by Cornell. Four of those six products, including Talstar GC Flowable, are registered as Restricted Use Products in New York.[3]

- Similarly, DEIS Table 2-8 identifies dithiopyr as an active ingredient to be used at Belleayre Resort. All three of the Cornell recommended dithiopyr products (including Dimension) are registered as Restricted Use Pesticides in New York.

- Similarly, Prograss, the ethofumesate product identified in DEIS Table 2-8 and recommended by Cornell is registered as a Restricted Use Pesticide in New York.

- Similarly, DEIS Table 2-8 identifies prodiamine as an active ingredient to be used at Belleayre, and recommended by Cornell. Two of the three prodiamine products listed by Cornell are branded Barricade although the DEIS does not specify which one was referenced. All three of the prodiamine products are registered as Restricted Use Pesticides in New York.

- Similarly, Confront, listed in DEIS Table 2-8 as a triclopyr product, is registered as a Restricted Use Pesticide in New York. Furthermore, Confront actually contains a second active ingredient, clopyralid, which is not identified in Table 2-8 as an active ingredient to be used at Belleayre Resort.

- DEIS Table 2-8 lists propamocarb and DCPA as active ingredient to be used at Belleayre Resort. Cornell does not recommend the use of either propamocarb or DCPA products.

- For several other products named in Table 2-8, as is the case for some products discussed above, the brand name is inadequate for the product to be definitively identified on the

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[3] Pesticide products are classified as Restricted Use Pesticides (RUP) by the USEPA "if the Administrator determines that the pesticide, when applied in accordance with its directions for use, warnings and cautions and for the uses for which it is registered, or for one or more of such uses, or in accordance with a widespread and commonly recognized practice, may generally cause, without additional regulatory restrictions, unreasonable adverse effects on the environment, including injury to the applicator ..." [7 U.S.C. §3(d)(1)(C)]. Similarly, pursuant to Environmental Conservation Law (ECL) §33-0303d, NYSDEC may list as a Restricted Use Pesticide, a pesticide " a. which (1) either (a) persists in the environment or (b) accumulates as either the pesticide per se, a pesticide metabolite, or pesticide degradation product in plant or animal tissue or product, and is not excreted or eliminated within a reasonable period of time, and which may be transferred to other forms of life; and (2) which by virtue of such persistence or accumulation creates a present or future risk of harmful effects on nay organism other than the targt organisms; or b. which the commissioner finds is so hazardous to man or other forms of life that restrictions on its sale, purchase, use, or possession are in the public interest." ECL §33-0101.42 In short, RUPs as a class, are the most dangerous pesticides registered under both federal and state laws.

list of products registered for use in New York. These include 2,4-D and 2,4-DP (each with approximately 2500 products registered in the US), and Roundup.

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION OFFICE OF HEARINGS AND MEDIATION SERVICES

In the Matter of the State Pollutant Discharge Elimination System Application Nos. 0-9999-00096/00005 and 0-9999-00096/00009 for the Belleayre Resort at the Catskill Park Property, Towns of Middletown and Shandaken

CITY OF NEW YORK'S PROPOSED ISSUES FOR ADJUDICATION AND SUPPORTING MEMORANDUM OF LAW

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NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
OFFICE OF HEARINGS AND MEDIATION SERVICES

In the Matter of the State Pollutant Discharge Elimination System Application Nos. 0-9999-00096/00005 and 0-9999-00096/00009 for the Belleayre Resort at the Catskill Park Property, Towns of Middletown and Shandaken.

CITY OF NEW YORK'S PROPOSED ISSUES FOR ADJUDICATION AND SUPPORTING MEMORANDUM OF LAW

Richard R. Wissler,
Administrative Law Judge

PRELIMINARY STATEMENT

The City of New York ("City") hereby supplements its petition for full party status in the proceedings concerning the above-referenced State Pollutant Discharge Elimination System ("SPDES") Applications for the Belleayre Resort at the Catskill Park Property located in the Towns of Middletown and Shandaken. The City has petitioned for full party status to demonstrate that the Applicant does not meet the standards for issuance of the Permits by the New York State Department of Environmental Conservation ("DEC") and to challenge the sufficiency of the Project's Draft Environmental Impact Statement ("DEIS").

In its original petition for party status, submitted on April 23, 2004, the City raised nine issues regarding the Applicant's plan to construct two golf resorts in the mountainous, forested watersheds of the Ashokan and Pepacton reservoirs (the "Project"). A few of these issues were resolved during the course of the Issues Conference. A number of the serious issues raised remain, however, or else have emerged over the past eight months. As set forth below, these issues merit the scrutiny provided by an adjudicatory hearing. The purpose of

this supplemental submission is to explain these remaining issues in light of the extensive exhibits and oral presentations provided by all parties at the Issues Conference.

The remaining issues proposed by the City for adjudication are as follows:

- Issue One: The Applicant's hydrological analysis of pre-development conditions is inaccurate and does not represent the actual pre-development site conditions.

- Issue Two: The Applicant's analysis of pre-existing pollutant loading for Total Suspended Solids (TSS) and Total Phosphorus (TP) fails to consider the impacts on the actual receiving waters and seriously underestimates the pollutant loads emanating from the project site in its pre-existing condition. Consequently, the Applicant has not acknowledged the significance of, or proposed mitigation measures for, the water quality impacts that will occur once the project is complete.

- Issue Three: The Applicant's proposal to expose more than five acres of soil at one time within the watershed of the Esopus Creek, a stream already impaired by excessive sediment, creates a potentially catastrophic risk to water quality and is inconsistent with DEC's obligation under the Clean Water Act to restore the Esopus to its best usage.

- Issue Four: Key aspects of the Applicant's operation phase Storm Water Pollution Prevention Plan ("SWPPP") for Big Indian are infeasible and/or are based on flawed assumptions about site conditions.

- Issue Five: The DEIS fails to assess the impacts of reasonable alternatives and the no action alternative.

- Issue Six: The DEIS does not adequately analyze the potential adverse impacts associated with induced growth on watercourses critical to the New York City Water Supply.

The City's foremost concern in these proceedings remains water quality. Many high quality tributary streams protected under federal, State, and City law are on or near the site of the proposed Belleayre Resort. These tributaries ultimately feed the Ashokan and Pepacton Reservoirs, which together supply half of the City's drinking water.

As discussed in the context of Issues One, Two and Four, the Applicant continues to grossly overestimate the pre-development stormwater flows coming off the project sites,

thereby leading to an underestimate of the water quality impacts that the project will have in its post-development phase. These potentially serious impacts include erosion impacts from increased stormwater flows conveyed down and along valley slopes and within sensitive stream beds, as well as increased loadings of TSS and phosphorus. In addition, as discussed in Issue Three, the Applicant's proposal to expose well over 5 acres of soil at a time in the watershed of the Esopus Creek, which is already impaired from excessive sediment, has potentially severe consequences. Until these issues are fully adjudicated, the record created by the Applicant on water quality impacts remains an inadequate basis for the SPDES permits as drafted.

Moreover, the Applicant's environmental review is seriously flawed because it does not include an analysis of smaller scale project alternatives. The Applicant has attempted to circumvent the legally required discussion of alternatives by contending that smaller scale alternatives are not economically feasible. Such a blatant attempt to avoid the requirements of SEQRA is especially egregious given that the Applicant's proposed project is the largest scale Catskills development in the past 50 years. Therefore, the failure of the DEIS to analyze reasonable alternatives to the project in its entirety merits adjudication on this issue. Similarly, the Applicant's failure to analyze the potential impacts associated with the secondary growth likely to occur as a consequence of the project is a deficiency in the DEIS requiring adjudication.

LEGAL STANDARD

To be granted full party status, a party must raise issues that are both substantive and significant.[1] See 6 NYCRR § 624.4(c)(1)(iii). An issue is substantive "if there is sufficient doubt about the applicant's ability to meet statutory or regulatory criteria applicable to the project." Id. at § 624.5(c)(2). An issue is significant if "it has the potential to result in the denial

[1] The City's statement of environmental interest, which the Applicant is not contesting, is set forth in its original petition and in the presentation of Mike Principe.

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." Id. at 624.4(c)(3). Furthermore, each issue raised must be supported by an appropriate offer of proof either "in the form of proposed testimony, usually that of an expert, or the identification of some defect or omission in the application." In the Matter of the Application of Seven Springs, 2002 N.Y. Env. Lexis 42, at 14-15.

A. Standard for Issuance of SPDES Permits

A petitioner can articulate an issue that is both substantive and significant "by identifying a material defect or omission in the permit application or *its supporting documentation* that may adversely affect permit issuance" Seven Springs at 46 (emphasis added); see also In the Matter of Broome County Department of Public Works, Decision of the Commissioner, June 11, 1984; In the Matter of Halfmoon Water Improvement Area, Decision of Commissioner, April 2, 1982. Indeed, DEC can only issue a SPDES permit after it has made "a determination . . . on the basis of a submitted application, plans, or other available information, that compliance with the specified permit provisions will reasonably protect classified water use and assure compliance with applicable water quality standards." 6 NYCRR § 750-2.1(b). This provision requires DEC to engage in a deliberative process before issuing a SPDES permit. See Seven Springs, at 40. If the information or data provided by the Applicant is inaccurate, contrived, or incomplete, DEC cannot make the requisite rational determination that the SPDES permit provisions will protect water quality.

Here, the issues and corresponding offers of proof set forth below demonstrate that the documentation supplied by the Applicant in support of its SWPPPs does not contribute an adequate basis for concluding that the project as proposed will "reasonably protect classified

water use and assure compliance with applicable water quality standards." 6 NYCRR § 750-2.1(b). Thus, there is not an adequate basis for the issuance of final SPDES Permits. In broad terms, the Applicant has supplied DEC with grossly inaccurate depictions of the stormwater impacts associated with its project, including impacts from erosion and pollutant loading both during and after construction. Similarly, the Applicant has overstated its ability to control or mitigate those impacts post-construction. As a result of its poor analysis of stormwater impacts, the Applicant has submitted stormwater management and erosion control plans that will not protect the quality of surrounding surface waters. Therefore, DEC cannot issue SPDES Permits for the Project based on the stormwater plans as proposed.

B. Standard for Compliance with SEQRA

When DEC, as lead agency under SEQRA, requires a DEIS be prepared, the sufficiency of that DEIS is an appropriate issue for adjudication. 6 NYCRR § 624.4(c)(i)(b). Here, the City has demonstrated through its offers of proof and throughout the course of the Issues Conference that the DEIS is insufficient, and that the adequacy of the DEIS is both a substantive and significant issue. First, each of the deficiencies in the Applicant's stormwater analysis and stormwater management plans reflects a failure to recognize and mitigate the impacts associated with stormwater runoff from the Project. Fundamentally, the DEIS does not address the serious environmental consequences of replacing hundreds of acres of mountainous forest, which currently attenuate and ameliorate storm flows in the headwaters of two of the City's reservoirs, with vast golf courses and associated developments. Second, the DEIS fails to analyze a reasonable range of alternatives to the Project, such as building only one of the two proposed resort complexes, in violation of 6 NYCRR § 617.9(b)(5)(v). This glaring omission undermines the very purposes of environmental review, signifying the failure of the DEIS to

provide a comparative framework in which to assess environmental impacts. Finally, the DEIS fails to provide an adequate analysis of the potential for significant adverse environmental impacts resulting from induced growth associated with the Project, particularly on watercourses critical to the New York City drinking water supply. An appropriate analysis could result in permit conditions requiring mitigation for these impacts. Each of these issues is substantive and significant under 6 NYCRR § 624.4(c).

> ISSUE ONE: THE APPLICANT'S HYDROLOGICAL ANALYSIS OF PRE-DEVELOPMENT CONDITIONS IS INACCURATE AND DOES NOT REPRESENT ACTUAL PRE-DEVELOPMENT SITE CONDITIONS. THEREFORE, THE STORMWATER PROVISIONS IN THE DRAFT SPDES PERMITS, WHICH DERIVE FROM THIS FLAWED ANALYSIS, ARE NEITHER SCIENTIFICALLY SOUND NOR ADEQUATELY PROTECTIVE OF WATER QUALITY.

A. The Applicant's hydrological analysis does not represent existing onsite conditions

A hydrological analysis enables a design professional to understand both the overall proportions of rainfall that ultimately leave a site as stormwater runoff, and also the rate at which that runoff occurs over time, in relation to a storm event. That is, a site's hydrology determines (1) how much rainfall in a given event will be absorbed into the ground and detained by surface cover conditions, or will evaporate, as opposed to leaving the site as surface flow, and (2) when the peak surface flows will occur during and/or after an event, and how those flows will vary over time. See Transcript, Volume 7, at 1579-1588 (DEP stormwater expert Joseph Damrath explaining the basic parameters and functions of a hydrological analysis). A hydrological analysis produces a hydrograph for each point of concentrated runoff leaving the site, charting volume of runoff over time for a particular storm event. See Tr., Vol. 7, at 1580-1582 and City Ex. 10 (explaining the fundamental principles of developing a hydrograph). The area under the curve shown on a hydrograph is the entire volume of stormwater runoff produced

by that storm. See Tr., Vol. 7, at 1581). Developing a hydrograph that accurately represents the pre-development stormwater runoff is a fundamental part of developing a stormwater plan capable of mitigating post-development stormwater impacts. Id.

Indeed, as stated at the Issues Conference by experts from New York City Department of Environmental Conservation ("DEP"), the New York State Department of Environmental Conservation ("DEC"), and the Catskills Preservation Coalition ("CPC"), a thorough assessment of a site's pre-development hydrology is absolutely essential to developing an SWPPP that will prevent severe water quality impacts from occurring in the post-development phase. At the Issues Conference, DEC's stormwater expert, Patrick Ferracane, explained that

> if the modeling for the predevelopment [stormwater] runoff is inaccurate, it throws off everything, and it affects the sizing of the basins. If that degree of accuracy is off significantly, it could affect the rate of discharges from the basins if they have been undersized . . . and the erosive flows from those basins or the velocity of the flows from those basins may increase erosion potential.

See Tr., Vol. 10, at 2391-2392. See also Tr., Vol. 7, at 1605 (Damrath explaining that if the analysis of pre-existing hydrology is performed incorrectly, "the rest of [the model] is built on inaccuracies and imprecise information") and 1690 (CPC expert Dr. Paul Mankiewicz explaining that understanding a site's pre-existing water budget is essential "to be able to really address the question of how much water and sediment is coming down.").

Throughout the course of this Issues Conference, DEP has offered extensive proof that the Applicant's assessments of the pre-development hydrological conditions, at Wildacres and particularly at Big Indian, are riddled with errors in several key areas, including an overestimation of pre-development peak stormwater flows, a deep misunderstanding about the

routes that stormwater travels as it leaves the sites, a miscalculation of the rate at which stormwater leaves the Big Indian site, and an ignorance of sensitive geologic and hydrological features on and adjacent to the site.

1. Overestimation of Predevelopment Flows

The Applicant's entire hydrological analysis is predicated on a gross overestimate of the volume and rate of stormwater that currently leaves the Project site, in its pre-development condition.[2] An accurate characterization of pre-development runoff is critical to predicting hydrological changes associated with the development and thus both to designing stormwater management plans and to assessing environmental impacts associated with the project. The Applicant's overestimation is readily apparent by comparing the pre-development outputs of the Applicant's HydroCAD model, which it used in its assessment of the sites' hydrology, with actual onsite data gathered by DEP. See City Supp. Ex. 1 at § I.a.ii.

A specific example is illustrative of the serious inaccuracies that permeate the Applicant's hydrological analysis. On September 18, 2004, Hurricane Ivan produced 5.25 inches of rain in the Giggle Hollow watershed. This event approximates the 10-year storm event, which is six inches for this region. At DEP monitoring station BELLGIG – which is where runoff from Giggle Hollow concentrates and which the Applicant has identified as Big Indian Design Point 2 DEP monitoring equipment measured a peak flow of 37.0 cubic feet per second (cfs). Id.

In stark contrast, the HydroCAD model submitted with Applicant's Exhibit 160 estimates the peak flow for a 6 inch storm event at this location to be 618.4 cfs. See App. Ex. 160, Computations, Pre-development, 10 Year Storm Event, page 8. That is, the Applicant's

[2] Although the Applicant used a different model, the HSPF model, to estimate the Project's impacts on pollutant loadings, the issue of the overestimation of pre-development peak flows is apparent in that model as well. See Issue Two below

model predicts an order of magnitude more runoff than actually left the site during an actual storm under undeveloped conditions.

The Applicant disregards this vast discrepancy between HydroCAD and actual onsite conditions, claiming that such a discrepancy could be attributed to lack of wetted conditions, as well as the fact that an actual ten year storm is a full 6 inches of rain and not 5.25 inches, as was Hurricane Ivan. See App. Supp. Response 6. It seems highly unlikely, however, that an extra 0.75 inches of rain would have increased the total runoff from the storm by a factor of 16 over runoff from the first 5.25 inches. Moreover, while Carr seems to suggest that DEP's flow measurements were atypically low for a 10-year, 24-hour storm, the LA Group apparently evaluated the impacts of Hurricane Ivan differently, finding that the storm produced higher overland flow conditions on the site than they had ever seen before at the site. See App Supp. Ex. 12, at 2. Thus, Carr's suggestion that the storm produced an unusually small volume of runoff directly contradicts the findings of the Applicant's other experts who visited the site soon after the Hurricane.

More evidence of the overestimation of pre-development flows is apparent at Big Indian Design Point 3, where HydroCAD estimates that pre-development flows from a 10 year storm event of 267.7 cfs. See App. Ex. 160, Computations, Pre-development, 10 Year Storm Event. Flows of this magnitude would result in obvious indications of erosion in the vicinity of this design point. However, DEP performed an onsite assessment of this location and discovered no evidence of conveyance structures, scour or other indicators of high flows and erosive velocities. See City Supp. Ex. 1, § I.a.ii. and the accompanying photographs, annexed thereto as Attachment A.

The vast discrepancies between actual conditions and conditions described in the Applicant's HydroCAD model strongly indicate that the Applicant has not used the model properly, and that the Applicant is not accurately representing the actual rate and volume of flows at the development sites. The Applicant has repeatedly claimed that these overestimations of the pre-development flow rates are, in fact, conservative estimates and represent a "worst case scenario" at the Project site. See App. Supp. Response 6. The Applicant further contends that this overestimation has led create an SWPPP capable of attenuating post-development peak flows from the project site to levels equal to or less than pre-development flows. See Tr., Vol. 9, 2004, at 2187 (Applicant's stormwater expert Carr explaining that, with respect to Big Indian Design Point 1, the designer of an SWPPP is "charged with attenuating flows at the design point," and "if you have 100 cfs going to a design point now and when your project's done, you have 100, the impact downstream is going to be the same.") But, because the Applicant's assumptions about pre-development runoff from the site are so grossly inaccurate, the Applicant's conclusions concerning the potential impacts from the project are unfounded, and the Applicant's design of stormwater management facilities is fundamentally flawed.

That is, while Carr claims that the SWPPP will reduce peak stormwater flows to pre-development conditions, it has been designed to reduce flows to the drastically overestimated flow conditions described in the HydroCAD model rather than to the actual flows reflected in DEP's onsite data. The Applicant has thus ignored the water quality impacts that will occur from the large increase of stormwater flows in the post-development phase.

2. Incorrect Description of Existing Stormwater Routes and Watersheds

In addition to misunderstanding the volume of stormwater leaving the sites in the pre-development condition, the Applicant also misunderstands the routes by which stormwater

currently leaves the sites. At the Issues Conference, DEP experts pointed to the Applicant's incorrect mapping of watersheds and choice of design points, its failure to identify of existing flow paths, and its overlooking of the significant amount of flow that passes through culverts and other conveyance structures along the railroad bed.

The most blatant examples of such flaws are seen in relation to Big Indian Design Point 1. The Applicant maintains that significant amounts of flow currently travels for a distance of 6,600 feet along the railroad bed in a 10 foot wide by 3 foot deep swale before the flow eventually leaves the site at Design Point 1. See App. Ex. 160, Computations, Pre-Development, page 3 and App. Supp. Response 6 (arguing that "[t]his existing swale within the pre-development model was described as 'ten feet wide' because this was the existing condition found in the field.") As is evident from the onsite examination of the railroad bed during the Issues Conference, this enormous swale is the fictional creation of a computer model that needed to invent a hypothetical channel of this size and length to convey the pre-development flows that were theoretically moving to Design Point 1. See City Supp. 1 § I.a.i.

Moreover, flow – even at the current levels – does not travel to Design Point 1 but instead leaves the project site leaves the railroad bed via a series of existing culverts located adjacent to DEP monitoring location at BELLE2. See City Ex. 11 and Tr., Vol. 7, 1614-1622. The Applicant admits that it did not include these culverts in its hydrological model because of what its expert describes as limitations in the HydroCAD model – its inability to "carry over" the excess flow at these culverts. See Tr., Vol. 9, at 2156-2157. The Applicant's omission of these culverts in the HydroCAD model, however, is contrary to the actual existing conditions and renders the Applicant's evaluation of the hydrology in the watershed of Design Point 1 meaningless. See City Supp. 1, at I.a.i.

While Design Point 1 is the most egregious example of incorrectly routed flows, there are other design points and watersheds which the Applicant has delineated incorrectly and which have not been corrected in any of the Applicant's revisions. See, e.g., City Supp. 1, § I.a.iii and Tr., Vol. 7, at 1614 (explaining, with respect to Wildacres, that the Applicant's watershed delineations show areas draining to Design Points 1 and 2 that actually flow to a channel that travels in the direction of Fleishmanns spring house and which is tributary to Emory Brook).

Until the Applicant completely revises the design points, based upon actual onsite hydrological conditions and not on conditions manufactured by the HydroCAD model, the potential water quality impact of post-development stormwater flows cannot be identified. For example, at Big Indian, because the Applicant has not recognized the existing stormwater flows through culverts under the railroad bed, identified on City Exhibit 11, the Applicant has failed to consider the potential impacts associated with such re-routing these flows down the railroad bed in the post-development phase. See City Supp. 1, at § III(d). If the Applicant pursues its plan to re-route that water – and the significantly larger post-construction volumes that have not been correctly analyzed – down an improved swale to Design Point 1, the impacts on sensitive wetlands, erosive soils, and thus on the receiving waters, could be severe.[3] Id. These severe impacts will result from the Applicant conveying stormwater at rates of up to 500 cfs through an area that does not currently receive flows even approaching these levels. Id.

Again, the Applicant's conclusions about impacts from stormwater in the DEIS, which form the basis for the stormwater provisions in the draft SPDES permits, rely on a misconception of the pre-existing conditions and thus should be rejected.

[3] Design Point 1 in the post-development phase is discussed in Issue Four below.

3. The Applicant has Incorrectly Analyzed Time of Concentration at Big Indian

Another important pre-existing hydrological feature misapplied by the Applicant is the Time of Concentration (T_C) at the Big Indian site. As explained by DEP at the Issues Conference, T_C is the amount of time that it takes for one drop of water to travel from the most distant point in a watershed to the corresponding design point. T_C is calculated by analyzing three types of flow separately: laminar or sheet flow; shallow concentrated flow; and channel flow. See Tr., Vol. 7, at 1648. Sheet flow occurs at the uppermost section of the watershed, farthest from the design point and is the slowest component in the T_C. Next is shallow concentrated flow, which occurs when sheet flow begins to break into rivulets. Finally there is channel flow, which is the fastest component in the time of concentration and occurs closest to the design point. See Tr., Vol. 7, at 1648-1649. As indicated above, time of concentration is critical to an accurate hydrological analysis, because it determines the shape of the hydrograph. See Tr. Vol. 7, at 1585-1586.

At the Issues Conference, DEP expert Joe Damrath explained that the Applicant omitted sheet flow from its T_C analysis, thereby artificially increasing the rate of travel time currently on the site. See Tr. Vol. 7, at 1648-1649. Damrath specifically pointed out that Big Indian Plateau is a "unique" topographical feature with significant natural depressions in the topography and covered by a thick humic lawyer. Id. at 1653 (Damrath describing the humic layer and topographical depressions as observed on the site visit). These features "hold a lot of runoff or hold a lot of rainfall before it's transferred to runoff." Id at 1654. Instead of analyzing the effect that this unique topographical feature may have on its hydrological analysis of Big Indian, the Applicant omitted sheet flow entirely from its analysis.[4]

[4] As noted below, in a supplemental submission, the Applicant revised the hydrological analysis for a portion of the Wildacres site, incorporating sheet flow Based on that limited re-calculation, the Applicant asserts that the

The Applicant repeatedly claimed that sheet flow is unnecessary in the hydrological analysis for Big Indian because sheet flow is for "urban type segments," and should not be used in wooded conditions present at that site. See Tr., Vol. 18, at 4539. This statement is not true and directly contradicts statements made by the Applicant's own expert during the Issues Conference. Specifically, Applicant's stormwater expert David Carr explained that that sheet flow could occur in "wooded areas" depending on the "grade and actual condition of the site." See Tr., Vol. 18, 2004, at 4541; City Supp. 1, § I.b.i.

The Applicant has also argued that the steep slopes present on Big Indian site would not produce sheet flow. See Tr., Vol. 18, at 4530. The topography of the plateau and its existing thick, humic cover type, both evident from the site visits, clearly creates conditions that produce sheet flow. The presence of this unique topography is supported by Damrath's presentation at the Issues Conference and by the actual onsite conditions observed during the site visits. See City Supp. 1, at § I(b)(i). Therefore, the Applicant should have incorporated included sheet flow in the HydroCAD model for the Big Indian parcel, and without a consideration of sheet flow, the Applicant's conclusions about the hydrology of the Big Indian site are unfounded.

Moreover, the topographical conditions on Big Indian are so unusual that, although sheet flow generally exists only for limited distances, at Big Indian sheet flow may occur over distances longer than 150 feet. See City Supp. 1, at § I(b)(i). The Applicant rejects this possibility, relying on a statement in the *"New York Guidelines for Urban Erosion and Sediment Control"* for its claim that sheet flow can never exist more than 150 feet. See Response to City Ex. 1, at 4. The Applicant's mechanical reliance on this guidance highlights a lack of understanding of the actual site conditions and of the importance of actual conditions as

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inclusion of sheet flow does not significantly affect the time of concentration. As discussed below, this conclusion is incorrect.

input for computer models. The Applicant's failure to verify the presence of unusual lengths of sheet flow due to the site's unique hydrology is akin to its failure to verify the flow data produced by HydroCAD with actual flow data gathered onsite. These failures have produced an inaccurate depiction of the site's actual hydrology. See Tr., Vol. 10, at 2385 (DEC noting that if the Applicant "artificially rais[ed] peak rate of runoff from the project, they artificially lowered their need to attenuate that.")

The Applicant's expert David Carr responded to DEP's concerns regarding the omission of sheet flow by re-running HydroCAD, using sheet flow, in order to prove that the inclusion of this parameter in the pre-development phase is unimportant. The Applicant's re-run of HydroCAD, however, is simply irrelevant to this issue because the Applicant re-evaluated only one watershed, at Wildacres. See App. Ex. 161. The majority of DEP comments regarding sheet flow concerned the unusual conditions at the Big Indian site. It is at Big Indian where the inclusion of sheet flow in the pre-development phase will reveal how slowly stormwater currently leaves the site, which is essential in understanding the changes to T_C that will occur if the Applicant drastically alters the topography and the cover type to build a golf course. See City Supp. 1, at § I (b)(i).

To construct the golf course on Big Indian, the Applicant will strip the thick humic layer from the plateau. See App. Supp. Response 6 (Carr stating that the golf holes will obviously by finely graded); see also City Supp. 1, at I (b). The existing micro-topography will be evenly graded. Drainage for the entire area will be channelized, as shown on sheets SG-8 and SG-9, in order to drain the golf course and building areas quickly. See Applicant's Plan Sheets SG-8 and 9, part of OHMS Ex. 3. This is a drastic change from the existing conditions. The Applicant, however, has not considered the effect of these changes on stormwater T_C because it

has not based its stormwater analysis on actual existing conditions. This distortion of the pre-development condition allows the Applicant to claim, incorrectly, that it is not significant altering the travel time of stormwater from the Project site. See City Supp. 1, § I(b)(i). Because, as explained above, T_C is critical to an understanding of hydrology, these errors fundamentally call into questions both the design of the Applicant's SWPPPs – particularly the plans for the Big Indian site – and also the conclusions in the DEIS concerning impacts from stormwater.

We note that the Applicant has also omitted channel flow, another key element of T_C analysis, from many watersheds at both project sites. See City Ex. 1, § I(b)(ii). As with sheet flow, channel flow is essential to evaluating hydrology. Id. In order to accurately understand the impacts of construction of the project, all elements of the existing site conditions, including sheet flow and channel flow which are essential components of T_C, must be used in the HydroCAD model, and must be characterized in accordance with the actual existing conditions.

4. Omission of Sensitive Hydrological and Geological Features

In its hydrological analysis, the Applicant has omitted or provided a flawed analysis of pre-existing hydrological features on and off the Project sites. These flaws and omissions are most significant in relation to wetlands and existing channels that will be affected by the Project, groundwater seeps, sensitive streambed features in Birch Creek, and existing soil lobes present along the railroad bed. Until these pre-existing features are analyzed, the impacts from the increased stormwater in the post-development phase cannot properly be evaluated. Again, this affects both the design of the proposed SWPPPs and the Applicant's conclusions in the DEIS.

With respect to wetlands and existing streams, at the Issues Conference, Damrath identified pre-existing flow paths that the Applicant omitted in its hydrological analysis. See

City Ex. 11 and 12; Tr., Vol. 7, at 1606-1616. DEP further explained that these existing flow paths are connected with wetlands on the site that will be impacted by the Project. Id. These flow paths were also observed during the Issues Conference site visits. See Tr., Vol. 7, at 1609-1610 (Damrath explaining hydrological features observed on Big Indian site visit) and 1611 (explaining hydrological feature observed on Wildacres site visit). The Applicant denied the DEP's claims, arguing that these hydrological features did not exist. It sought to disprove the existence of the flow path Damrath identified at Big Indian by showing that the flow path was not included on a USGS map for the project site. See Tr. Vol 9., at 1606. After the Applicant's presentation, however, DEC explained that it did not base its classification of hydrological features on USGS maps. See Tr., Vol. 10, at 2425. Furthermore, as indicated in Applicant's Supplemental Ex. 13, the Army Corps of Engineers revisited both Project sites and made a preliminary determination that these sites were in fact connected to the valley streams, confirming DEP's assessment of these features. The Applicant's failure to accurately assess the existence and importance of significant hydrological features indicates that the Applicant has not adequately evaluated existing flow paths and wetlands on the Project site.

Similarly, the Applicant has failed to acknowledge the exposed clay lenses within Birch Creek. See City Supp. 1, at § III (a). Understanding the existing sensitivity of these areas is essential to assessing the impacts that will result from the Applicant's plan to increase flows in Birch Creek in the post-development phase. The increased stormwater flows that the Applicant intends to discharge to these streams could exacerbate these existing conditions and cause excessive turbidity in a watershed already listed as impaired because of excessive sediment. Id.

Furthermore, there are many areas of sensitive soils off-site, in the area of Birch Creek, which will likely be affected by the proposed development. DEP has found instability in

Birch Creek and on the slopes in this area caused by a combination of anthropogenic impacts within the Birch Creek stream channel and development within the floodplain and on the lower mountainside slopes. See Tr. Vol. 8, at 1830-1831 (Damrath explaining sensitive offsite soil features on Big Indian); City Supp. 1, § III(a); City Ex. 23 and 24; and City Supp. Ex. 6 (describing soils along railroad bed which are subject to mass movement). The situation is exacerbated by the poor stability of the soil in this area and the underlying glacial-lacustrine clay deposits. Id. This combination of factors has created a very sensitive reach of stream at the base of Belleayre Mountain. Since the DEIS does not recognize the existence of these soils, their vulnerability to changes in hydrology, or the spatial and temporal changes in hydrology of the site, it does not correctly evaluate the project's potential impacts. See City Supp. 1, at § III (a).

The Applicant has attempted to contest the existence of these sensitive soils conditions by providing an analysis of a single clay lobe used as an example by Damrath at the Issues Conference. Compare Tr., Vol 8, 1830-1832 (Damrath describing soil lobe to explain "one of the ways you can identify mass movement of soil") with App. Supp. Ex. 4 (describing Roger Case' examination of one "area identified on City [Exhibit] 24."). First of all, it is important to note that the Applicant's expert did observe a "slight bulge" but simply interpreted the significance of this area differently than Damrath did. Thus, this is a classic disagreement between experts which should be resolved through adjudication. Moreover, as pointed out by Damrath in his response to Case's assessment, the soil lobe discussed at the Issues Conference was intended as an example and, in addition to this particular feature, there are "several the active stream bank and bed erosion of these soils and their underlying clays is evident at several locations in the valley." See City Supp. 6. Finally, the Applicant's contention that soils in this area will no longer be affected by the project is simply erroneous, as its current operation phase

SWPPP conveys huge volumes of stormwater down the railroad bed, which is immediately adjacent to these sensitive soils.

All of these hydrological and geological features need to be identified and analyzed in order to assess the actual impacts that stormwater emanating from the Project may have on receiving water quality. Unless and until that occurs, the conclusions in the DEIS are unreliable and the SPDES permits should not be issued.

B. The Applicant's failure to perform an accurate assessment of pre-development conditions is a substantive and significant issue

The adequacy of the background hydrological data underlying the SPDES permit is substantive because it raises significant doubts about the Applicant's ability to achieve the effluent limitations and conditions set forth in the permits. Indeed, DEC agreed at the Issues Conference that if this pre-development hydrological analysis was not performed correctly, "it throws off everything." See Tr., Vol. 10, at 2391-2392. DEC went further and stated that it had concerns that the HydroCAD model is "inaccurate." Id. Because of these inaccuracies, the current SPDES permits will not protect receiving waters from degradation. This is of particular concern at the Big Indian side, because the Esopus Creek is already a 303(d) listed water impaired for its best usage due to excessive sediment. DEC expressed concerns that runoff from the project could impair Birch Creek with excessive sediment, as well. See Tr., Vol. 10, at 2389-2390. As the Applicant has not yet correctly analyzed the effects that the increase of stormwater from its project will have on these surface waters, or correctly identified the locations and rates at which stormwater leaves the site, neither DEC nor anyone else can determine the severity of these impacts. However, in light of the sensitivity of these waters and of the soils above them, DEP has consistently contended that these impacts could be significant. These concerns

expressed by DEC, DEP, and CPC cast doubt on the Applicant's ability to meet current regulatory standards regarding water quality.

This issue is also substantive in relation to SEQRA, which requires project sponsors to not only accurately assess impacts associated with their project but to analyze those impacts against the context of the existing "environmental setting." See Environmental Conservation Law §8-0109(2)(a) and the SEQR Handbook, at B-32 (stating that "each relevant environmental characteristic . . . should be discussed to a degree of detail to provide an understanding of existing environmental conditions."). By presenting a flawed, less conservative picture of the site's current conditions, the Applicant's analysis for stormwater impacts does not fully acknowledge the changes that will result after the site is developed.

This issue is significant because the permits cannot be issued unless they are supported by proper and scientifically sound scientific data regarding the site's pre-existing conditions. Moreover, the Applicant must redesign its hydrological model around an accurate depiction of the site's environmental setting.

Therefore, the Applicant's analysis of the sites' pre-existing hydrological conditions merits the intense scrutiny that adjudication provides.

ISSUE TWO: THE APPLICANT'S ANALYSIS OF PRE-EXISTING POLLUTANT LOADING FOR TSS AND PHOSPHORUS FAILS TO CONSIDER THE IMPACTS ON THE ACTUAL RECEIVING WATERS AND SERIOUSLY UNDERESTIMATES THE POLLUTANT LOADS EMANATING FROM THE PROJECT SITE IN ITS PRE-EXISTING CONDITION. CONSEQUENTLY, THE APPLICANT HAS NOT ACKNOWLEDGED THE SIGNIFICANCE OF, OR PROPOSED MITIGATION MEASURES FOR, THE WATER QUALITY IMPACTS THAT WILL OCCUR ONCE THE PROJECT IS COMPLETE

A. The Applicant's pollutant loading analysis fails to accurately account for impacts to receiving waters

The function of a pollutant loading analysis is to compare the amount of pollutants leaving the site in its pre-developed conditions with the amount of pollutants leaving the site after the land use changes have been made and anthropogenic stormwater controls have been put into place. Therefore, as with the hydrological analysis, the pollutant loading analysis requires the modeler to develop a representative assessment of the pre-development conditions in order to accurately account for the impacts that will occur pre to post-development. See Tr., Vol. 7, at 1595 (DEP expert Timothy Negley explaining basic functions of pollutant loading model. Factors critical to this analysis include (1) an assessment of the peak flows currently leaving the site; (2) the amount and type of pollutants currently leaving the site; and (3) the land use changes (cover type) that will take place in association with the development. Id. at 1590-1596 (describing basic elements of pollutant loading model).

As indicated by DEP and others, an accurate assessment of the pollutant loading impacts is very important because this analysis will likely underlie key conditions set forth in the permit, such as effluent limitation, monitoring requirements, and revisions of the Total Maximum Daily Load. See Tr. Vol. 10, at 2424 (DEC stating that "the limitations in the SPDES permits and the proposed revision to the TMDL are based on the outcome" of the Applicant's

pollutant loading model). The applicant's undertaking of this extremely important analysis is inaccurate in several important respects.

1. *The Applicant has analyzed impacts from increased pollutant loadings on too large a scale, thereby overlooking impacts that occur in sensitive upstream tributaries*

Both Draft SPDES permits contain outfalls for direct discharges of stormwater to local streams. The Wildacres SPDES permit provides for twelve direct stormwater discharges to several unnamed tributaries of Emory Brook. See Draft Wildacres SPDES Permit, at 3. The Big Indian SPDES permit provides for four direct stormwater discharges, one each to Woodchuck Hollow and Lost Clove Brook, and two to Birch Creek. See Big Indian Draft SPDES Permit, at 3. However, despite the direct discharges to these surface waters, and despite the high quality of the water currently draining from the site into these tributaries, the Applicant completely overlooks the potential for significant impacts in these waters, instead focusing its pollutant loading impact analysis on large watersheds where local impacts appear negligible.

The Applicant's HSPF model assesses potential pollutant loading impacts on a scale of 27,000 acres for the Big Indian site and approximately 21,000 acres for the Wildacres site. See Tr., Col. 18, at 4608. By using these enormous study areas, the Applicant concludes that, while there will be some pollutant loading impacts on local stream bodies, these impacts will be diluted in the context of the larger watersheds. As explained by the Applicant's expert Scott Lowe, the results of the HSPF model showed that "[w]hen you go up to the upper reaches where you are at the real small watershed, then you see a change . . . But then as you go down, the change is very hard to detect [as it is] getting lost in the volume of material coming from elsewhere." Tr., Vol. 18, 4633-4634. Lowe went on to state that the impacts to these waters will result from increased loads of TSS in the post-development. See Tr., Vol. 18, at 4626 (Lowe stating that the HSPF model projects "more TSS loadings. . . in the upper reaches of the

watershed where the effect is going to be most felt.") In its full report on the HSPF model, Lowe again acknowledged that there will be water quality impacts to the local receiving waters, but vaguely dismissed such impacts because "in most cases the differences are not large." See App. Supp. Ex. 1.

The Applicant's macro-watershed approach to analyzing impacts to water quality fails to account for or take seriously the importance of analyzing impacts of pollutant loads to local upper stream water bodies. Because impacts from land use changes are cumulative, "local impacts must be evaluated carefully in order to properly review their overall environmental impacts." See City Supp. Ex. 3. For the Applicant to conclude that water quality impacts from its Project could only be considered significant if the change would result in perceptible pollutant loadings in the ultimate receiving water bodies would lead to the manifestly incorrect conclusion that most land use changes do not significantly affect water quality at all. Id. The Applicant's analysis is even more inappropriate considering its plans to directly discharge stormwater to these upstream waters. Indeed, the Applicant even acknowledges that these discharges will cause water quality impacts, which in some cases may be large. See App. Supp. Ex. 1 (Lowe stating that there will be impacts to upstream receiving waters, but in "most cases the difference will not be large") (emphasis added).

The Applicant has openly refuted DEP's assertion that it must analyze the localized impacts, stating that "DEP's focus on water quality should be on the ultimate receiving waters, that is, the reservoirs that they operate as their water supply system, as well as upstream impacts where they are significant." See App. Supp. Response 9. However, the Applicant's current pollutant loading model makes it impossible for DEP or any other regulatory agency to analyze the impacts to upstream waters as the Applicant has focused its impact analysis on

enormous watersheds and ignored or summarily dismissed the impacts to the smaller upstream water bodies. See City Supp. Ex. 3. It is the Applicant's responsibility in this process to provide such an assessment of receiving waters, not DEP's, and until it does so, its pollutant loading analysis does not provide an adequate basis for the Draft SPDES permits.

The macro-watershed approach taken by the HSPF model is also unacceptable from a regulatory perspective. The SPDES permit regulations require applicants for individual stormwater SPDES permits to provide DEC with a "description of the outfall configuration for each outfall [with] sufficient information so that the Department can analyze the effect of the discharge on the receiving waters." 6 NYCRR § 750-1.7. Thus far, however, the Applicant has not presented a sufficient analysis of the pollutant loading impacts that will occur at the location of the outfalls in the Draft SPDES permit. The Applicant has provided no indication of where and at what level the these significant pollutant impacts will occur, thus it has it provided no information that can be used to develop numerical effluent limitations for the proposed stormwater outfalls that can be assured to protect the quality of the receiving waters. Perhaps as a result of this lack of information, there are no effluent limitations for the outfalls in the Big Indian SPDES permit. See e.g., Big Indian Draft SPDES Permit (containing no effluent limitations for TSS despite being located in the watershed of water bodies impaired for sediment). Again, instead of providing such useful information, the Applicant simply contends that these local impacts do not matter.

The Applicant's failure to provide this information is especially alarming given the high quality of the stormwater currently draining into these receiving streams. DEP expert Charles Cutietta-Olson has provided a thorough and fact-based accounting with respect to the existing quality of the water draining into the small water bodies that will be impacted by the

Project. See City Supp. 2 and 3. DEP flow data indicates that existing TSS and TP loads in these receiving waters are incredibly low. See City Supp. 2, Tbls. 5 and 6. In addition, DEP's analysis of water collected at its monitoring stations indicated that "sample turbidities were among the lowest they had ever analyzed, even lower than turbidities from the microfiltered wastewater treatment effluents at the City-owned wastewater treatment plants in the area." See City Supp. 3. The high quality of this water is particularly evident at the Big Indian Project site and is perhaps a result of that sites unique plateau topography and thick humic layer. See, e.g., City Supp. 2, Tbl. 6 (indicating existing TSS concentrations from the Project site are currently between 0.28 and 13.35 milligram per liter).

In response to DEP's assessment of the high quality of water currently draining from the Project sites, particularly at Big Indian, the Applicant's makes unsupported and unspecific allegations that the quality of these waters is not actually as high as DEP maintains. See App. Supp. Response 9. For example, without any supporting citation or data, the Applicant blankly contends that DEP data indicates "rapid responses" in water quality and that there have been spikes of turbidity in the waters on the Wildacres portion of the project site. As DEP made clear, however, the pollutant loadings in both base flow and storm flows leaving the project site are unusually low for the area. See City Supp. 2 and 3. The Applicant also engages in unsupported hypothesis when it discounts DEP's discussion of interflow on the Big Indian site, however the Applicant again provides no proof of its theory other than a one sentence assertion. The weakness of this response is an indication that the Applicant has not made an actual assessment on the impacts that will occur to the receiving waters.

Furthermore, in addition to ignoring the high quality of the water coming off the Project site, the Applicant's HSPF model also makes no mention of the sensitivity or water

quality standards in the receiving waters themselves. See City Supp. 1, at § III(a). For instance, the Applicant does not provide any analysis of how increased loads of TSS to Birch Creek could exacerbate the turbidity problems which are currently a result of sensitive stream bed features in that water body. This is a serious consideration which must be analyzed, especially because it takes place within the watershed of a stream impaired for sediment. See Tr., Vol. 2311, at 2390 (DEC stating that, "Introducing artificial or man-induced erosion potentials into those watersheds for [the Ashokan and Esopus] [which are impaired because of stream bank erosion] significantly could affect our ability to now restore it to what it should be or to maintain what it already is.").

Until the Applicant revises its analysis to provide an indication of what impacts will occur in these receiving streams, it should not be permitted to discharge its stormwater into them. Moreover, as discussed further below, it is very likely that the increase of TSS and phosphorus loads to these waters will be far greater than the Applicant has calculated using its HSPF model.

2. *The Applicant has overestimated pre-development TSS loadings emanating from the Project sites*

The accurate assessment of TSS impacts is of special concern at the Big Indian side, as the Esopus Creek is listed as a water body that is impaired for its best usage due to excessive sediment on New York State's 303(d) list. In addition, there are highly erodible soils and sensitive stream bank features in or above Birch Creek which are vulnerable to increases in peak flows that will result in additional sediment export and further impairment of the Esopus. See City Supp. 1, at § III(a).

If a water body is included on a state's 303(d) list, the state is required to develop a Total Maximum Daily Load (TMDL) for the pollutant of concern. See 33 U.S.C. § 1313(d),

Clean Water Act § 303(d).[5] If a TSS TMDL were already in place for the Esopus Creek, it would necessarily include a mechanism for appropriately analyzing and regulating the sediment contributions from the Project in the context of the overall water quality issues in the basin. In the absence of a TMDL, however, the Applicant and DEC bear the burden of carefully evaluating the potential erosion and sedimentation impacts from the Project, during and after construction. See Tr., Vol. 10, at 2389-2390 (discussing the absence of TMDL for sediment).

However, although an accurate assessment of TSS loads are essential to ensure the protection of surface waters form the pre to post-development phase, the Applicant significantly overestimates the volumes of pre-development stormwater flows and, correspondingly, TSS loads in the pre-development phase.[6] By overestimating these loads in the pre-development phase, the Applicant has been able to deny that significant impacts to surface

[5] In particular, Section 303(d) of the Clean Water Act requires each state "to identify those waters in its boundaries for which . . . effluent limitations . . . are not stringent enough to implement any water quality standard applicable to those waters." See 33 U.S.C. § 1313(d)(1). After a waterway is identified under Section 303(d), the state must then determine a Total Maximum Daily Load of the pollutants that can be discharged in order to achieve "the applicable water quality standards with seasonal variations and a margin of safety which takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality." Thus, when a water body is classified as impaired under State 303(d), a state must adopt a TMDL that not only ensures that the water body will not degrade further, but a TMDL that is strict enough to restore the water to its classified use. See id. § 1313(d)(1)(A) (stating that state must establish TMDL "at a level to implement the applicable water quality standards"); see also Tr., Vol. 10, at 2390 (DEC stating "it is our mandate to not only maintain the best use of a water body but restore it."). This mandate applies whether DEC is issuing an individual SPDES permit or authorizing a discharge under the SPDES General Permit for stormwater from construction activities. See GP-02-01, Part 1.A (stating that no discharge will be authorized under the general permit if it violates water quality standards, including the standard that "[t]here shall be no increase in suspended, colloidal and settleable solids that will cause deposition of impair the waters for their best usage.")

The Ashokan Reservoir, classified by DEC as a AA(T) water body, and its tributary the Esopus Creek, classified as an A(T) water body, are both identified on the State's 2004 303(d) list of impaired waters for silt and sediment. The current source of this pollutant is stream bank erosion. Birch Creek, the stream directly adjacent to the Big Indian Project site and a major tributary of the Esopus, is currently classified as a B stream and is not listed on the 303(d), although DEP has observed numerous erosive features in Birch Creek's stream bed. The Big Indian project site is within the drainage areas for these three water bodies and will directly affect their water quality, especially with respect to Birch Creek and the Esopus. For instance, the Applicant's current Draft SPDES permit for Big Indian contains direct outfalls of stormwater into Birch Creek and one of these outfalls, pond 100, is in the vicinity of the location where Birch Creek flows into the Esopus.

[6] This peak flow issue, while similar to the one raised regarding HydroCAD, relates here to pollutant loading and not to the impacts caused by high volumes of flows, as was discussed in Issue 1 above.

waters will occur when the site is developed.[7] In the section entitled "Verification," the Applicant's expert compares what is supposed to be a calibrated version of the HSPS model against actual onsite data gathered by DEP. See App. Supp. Ex. 1. The verification results displayed in the graphs, however, reveal that the HSPF model consistently overestimates the flow and TSS concentrations at both the DEP monitoring stations (see e.g., graphs for BELLELOST), and at Birch Creek, which is a USGS monitoring station. The Applicant then used the overestimated results to compare the pre to post development pollutant loads. Had the Applicant used the onsite pollutant loading for this comparison, the impacts between pre and post development impacts would have been much greater. Because the Applicant has used unrepresentative pre-development pollutant loads, the actual impacts to the Project have not yet been identified in this model.

3. *The Applicant has overestimated pre-development phosphorus loadings emanating from the Project sites*

Similarly, the Applicant's calculations of phosphorus loadings from the Project site are incorrect and must be revised. Although neither the Ashokan nor the Pepacton is currently impaired by phosphorus, the Applicant's analysis of phosphorus is critical for setting not only the effluent limitations in the SPDES permits, but also the proposed revisions of the TMDLs for both reservoirs. See Tr. Vol. 10, at 2424. The Applicant concludes that current, pre-development annual phosphorus loads from the pre-development project site are in excess of 500 kilograms per year for the Delaware side and over 1100 kilograms per year from the Big Indian side. In contrast, had this load been calculated using DEP's flow data rather than flow data derived from its model, the annual phosphorus load from both sites would have been more than

[7] This issue is analogous to Issue 1, as both issues involve the Applicant's mischaracterization of existing stormwater conditions at the site, resulting in an underestimate of the water quality impacts of the Project.

approximately an order of magnitude less the figure derived by the Applicant. See City Supp. 2, at Table 5. Thus, as with TSS, the Applicant overestimation of phosphorus in the pre-development phase conceals the impacts that will actually result from the increase of phosphorus in the post-development phase.

4. The Applicant has not used all available DEP data in calibrating and verifying the HSPF model

The issue of model calibration was widely discussed this summer in relation to the Applicant's modeling of pollutant loads. While the Applicant is now using a different pollutant loading model, this issue remains relevant, as the Applicant has not used all available DEP onsite data to calibrate its HSPF model to represent actual site conditions.

The Applicant denies this, stating that the HSPF model "used all sampling data collected . . . that were provided by DEP through the LA Group." See App. Supp. Response 9, at 1 ("DEP used all sampling data collected during the model calibration period (April 2001 – March 2002) that were provided by DEP through the LA Group."). The Applicant has only, however, used sampling data collected from April 2001 to March 2002. DEP provided the Applicant with sampling data extending through 2003. Therefore, the Applicant should have used this onsite information to calibrate and verify the results of its HSPF model.

B. The Applicant's failure to accurately assess pre-development pollutant loads from the project site is a substantive and significant issue[8]

The Applicant's failure to accurately analyze the potential pollutant loading impacts emanating from the Project site is a substantive and significant issue.

First, the Applicant's reliance on a model that does not fully and accurately assess impacts to the receiving waters is contrary to the requirements of both SEQRA and 6 NYCRR

[8] Although phosphorus and TSS are presented as a single issue for briefing purposes, the issues are not dependent on each other. Thus, the court may find an adjudicable issue for one pollutant and not the other.

§ 750-2.1(b) as the Applicant has failed to assess the water quality impacts that the Project will have at the location of the permitted outfalls. Both SEQRA and the SPDES permit regulations require the Applicant to assess the discharge's water quality impacts in the receiving water into which there will be an outfall. As stated in subpart A above, the SPDES permit regulations require applicants for individual stormwater SPDES permits to provide DEC with a "description of the outfall configuration for each outfall [with] sufficient information so that the Department can analyze the effect of the discharge on the receiving waters." 6 NYCRR § 750-1.7.

Similarly, SEQRA requires a description of the "environmental setting" of the project "sufficient to understand the effects of the proposed action." 6 NYCRR § 617 9(b)(5)(ii). In other words, SEQRA requires project sponsors to develop appropriate study areas when analyzing their project's impacts. Some key consideration in establishing an appropriate environmental setting for analyzing the impacts caused by a point source discharge are "the baseline concentrations of those [pollutants] in the water [and] the assimilative capacity of the receiving waters." See *Gerard, Ruzow, and Weinburg, Environmental Impact Review in New York*, § 5.07[2].

The Applicant's HSPF model falls far short of either regulatory requirement because it analyzes the water quality impacts on enormous scales, thereby ignoring the impacts that will be felt in the upstream water bodies. The Applicant must redirect the focus of its analysis on these smaller, impacted streams.

The issue of inaccurately assessed pollutant loads is also substantive because it directly relates to the Applicant's ability to comply with existing water quality standards. The Applicant's proposal to discharge stormwater from point sources at Big Indian will, by its own admission increase TSS loads in waters entering the Esopus. Some of these points sources, such

as Big Indian pond 100, will discharge directly to the surface waters—however the Applicant has not yet provided a detailed assessment of impacts to these surface waters. In addition, the Applicant's incorrect assessment of phosphorus is substantive because it affects the Phase II TMDL for the New York City Watershed. The Applicant's overestimation of the pre-development loads leads to an underestimation in the additional load allocated for the Project. While the Applicant will undoubtedly contend that such impacts do not matter, DEC, the agency responsible for revising the TMDL, made clear at the Issues Conference that model accuracy is essential to the revision of the TMDL and to the effluent limitations in the Draft SPDES permit. See Tr. Vol. 10, at 2424 (DEC stating that it is not acceptable to base effluent limitations and TMDL revisions on flawed or inaccurate models). The revised TMDL is still based upon a pollutant loading model that overestimates pre-development phosphorus loadings which in turn conceals the actual increase in phosphorus that will occur from pre to post development.

These issues are significant because they would require modifications of the Draft SPDES Permit and of the TMDL Revisions. They also require the Applicant to re-perform its analysis of pollutant loadings.

ISSUE THREE: THE APPLICANT'S PROPOSAL TO EXPOSE MORE THAN FIVE ACRES OF SOIL AT ONE TIME WITHIN THE WATERSHED OF THE ESOPUS CREEK, A STREAM ALREADY IMPAIRED BY EXCESSIVE SEDIMENT, CREATES A POTENTIALLY CATASTROPHIC RISK TO WATER QUALITY AND IS INCONSISTENT WITH DEC'S OBLIGATION UNDER THE CLEAN WATER ACT TO RESTORE THE ESOPUS TO ITS BEST USAGE

A. Overview of the Regulatory Framework

DEC's "SPDES General Permit For Stormwater Discharges from Construction Activity," or GP-02-01, which is incorporated by reference into both the Wildacres and Big Indian Draft Individual SPDES Permits, provides that "there shall not be more than five (5) acres

of disturbed soil at any one time without prior written approval by the Department." GP-02-01 Part III.D 2(4). Despite this limitation, both the Draft Big Indian SPDES Permit and the Draft Wildacres SPDES Permit contain Special Conditions for Construction Phasing which would allow the Applicant to expose far more than 5 acres at one time during construction. These Special Conditions incorporate by reference construction phasing plans set forth in specified drawings submitted by the Applicant, which in turn designate areas substantially larger than 5 acres to be exposed at any given time during the construction process. See e.g., Big Indian Draft SPDES Permit, at 17-18 and Wildacres Draft SPDES Permits 22-23.

The phasing would allow the Applicant to expose between at least 12 and 16.4 acres of soil at one time on Big Indian, although the Applicant's expert admitted that there is a distinct possibility that 25 acres of soil will be exposed during Phase 3 at the Big Indian side and during the construction of Wildacres. See Tr., Vol. 9, at 2094-2100 and 1215 (regarding the amount of exposed soils, Applicant's expert Kevin Franke stating, "It's not to say it couldn't possible be higher [than 16.4 acres] for either Phase 3 or one of the phases in Wildacres.")

Notably, in its presentation at the Issues Conference, DEC explained that, despite the inclusion of these Special Conditions in the Draft SPDES Permits, it had not yet made a determination as to the environmental feasibility of exposing more than 5 acres on this Project site. DEC expressly stated that "[w]e still have to agree that environmentally it's feasible that they can do this." See Tr., Vol. 10, at 2357. Instead of environmental considerations, DEC based its inclusion of the Special Conditions for Construction Phasing on the Applicant's concerns about of the "technical and economic feasibility of constructing the Project[]" Id. DEC indicated that it would make its determination regarding the environmental feasibility of the Applicant's proposal after the Applicant had submitted more detailed design plans,

presumably 60 days before construction is to begin in accordance with the general permit. See Tr., Vol 10, at 2378 (DEC expert Patrick Ferracane stating DEC's intention to make its environmental determination regarding the phasing plans as soon as 60 days before the start of construction). Thus, it appears from DEC's statements that it does not intend the Special Conditions for Construction Phasing to constitute as the formal written waiver which would allow the Applicant to expose more than 5-acres at one time.

While it is unclear when DEC intends to make its final determination about whether the construction phasing proposed by the Applicant is environmentally feasible, the water quality impacts that could result from such a waiver are appropriately part of this Issues Conference and any subsequent adjudicatory proceedings because the Special Conditions for Construction Phasing are included in the Draft SPDES Permits. See Tr., Vol. 10, at 2354 (stating, in reference to the 5-acre standard, "there are a number of [design standards] incorporated into the individual permit."). Moreover, DEC cannot issue a SPDES permit containing the Special Conditions for Construction Phasing until it makes a determination regarding the environmental feasibility of the Applicant's proposal to expose more than 5-acres at one time in the watershed.[9]

B. The issue of the waiver from the 5-Acre standard in the construction of Big Indian is substantive because construction as proposed could contribute to further violations of water quality standards in Birch Creek, Esopus Creek, and the Ashokan Reservoir

The Applicant's proposal to expose over 5 acres of soil on the Big Indian site is "substantive" because such extensive exposures threaten to further impair a water body listed on New York State's 303(d) as impaired because of silt and sediment caused by erosion.

[9] At a minimum, DEC must revised the SPDES permits to make clear that they do not, in advance of specific authorizations based on detailed construction drawings, constitute waivers of the 5-acre limitation

As discussed in connection with Issue 2 above, although DEC has not yet established a TMDL for sediment to restore these water bodies to their best uses, DEC is obligated to ensure that these impaired surface waters do not suffer further degradation from sediment and must take measures necessary to restore these waters to their water quality classification. At a minimum, given that the Big Indian Site drains into the Esopus Creek, and that it is characterized by steep slopes and highly erosive soils, DEC should not issue a SPDES permit authorizing substantial land disturbance without first making a carefully considered and well-supported determination that the project as proposed will not further impair the Esopus. See Tr., Vol. 10, at 2362 (DEC stating that its main concern on the Project site are the "severity of the slopes" and the "clay soils.")

The Applicant's proposal to far exceed the 5-acre standard within the drainage areas of these impaired waters clearly creates a distinct risk that these waters will suffer additional significant sediment loads during the Big Indian construction phase. The erosivity of the soils affected by the project and the steep topography of the project site create a situation where severe erosion impacts could occur if such large areas of soil are exposed. Furthermore, the feasibility of installing effective erosion controls over such a wide swath of land and on such difficult terrain is questionable. See Tr., Vol. 8, at 1860 (explaining inherent difficulties of installing advanced erosion controls on steep 25 acres terrain). In addition, the Applicant's failure to address the sensitivity of offsite soil features and streambed features, and how they might be affected during the construction phase, leaves many critical erosion impacts of the project unaddressed. See City Supp. Ex. 1, § III(a); and Tr., Vol. 8, at 1822-1831 (explaining the Applicant's failure to identify soil lobes and highly erosive soil types which will be affected by the project).

Concerns about the Applicant's proposal to deviate from the 5-acre standard have been raised by a number of parties. Indeed, DEC, the agency obligated by the Clean Water Act to identify and protect 303(d) listed waters, stated that "this amount of disturbance certainly increases the potential for water quality impacts and increases the risk . . . particularly in this area because of the environmental [sic] sensitive issues." See Tr., Vol. 10, at 2388. In addition, DEC stated that potential impacts that could result from the exceeding the 5-acre standard included impacts to the New York City water supply and impacts to the trout spawning streams, each part of the best uses set forth in the AA(T) and A(T) water quality standards. Id.

DEC also expressed significant concerns that the Applicant's proposal to exceed the 5-acre standard could interfere DEC's regulatory obligations under section 303(d) when its expert stated, "Introducing artificial or man-induced erosion potentials into those watersheds for those [Birch Creek and Esopus Creek] could affect our ability to now restore it to what it should be or to maintain what it already is." See Tr., Vol. 10, at 2390. Identical concerns regarding the Applicant's proposal to exceed the 5-acre standard have been raised in DEP's offer of proof, as well as in both EPA and the Watershed Inspector General's comments on the DEIS and Draft SPDES Permits. See Tr., Vol. 10, at 1859-1864; see also OHMS Ex. 5 (EPA Comments on Draft Environmental Impact Statement) and CPC Ex. 56.

Thus, as the regulators and other concerned parties have noted, the Applicant's proposal to disturb large areas of soil in a naturally fragile and already impaired watershed threatens to further degrade water quality in Birch Creek at a minimum, if not also Esopus Creek and the Ashokan Reservoir. Furthermore, the specific doubts expressed by DEC, the agency responsible for administering the 303(d) program, would clearly suggest the need to take a close

look at the efficacy of the Applicant's plans in relation to the sensitivity of the 303(d) listed waters affected by the Project.

C. The issue of the waiver from the 5-Acre standard in the construction of Big Indian is significant because it may require a substantial modification of the Applicant's construction phasing plans

The issue of the 5-acre standard is "significant." As discussed above, DEP and other concerned parties have demonstrated that the waiver of the 5-acre rule poses significant environmental risks, particularly at the Big Indian site, and thus that the waiver included in the draft permits should be removed. This would constitute a significant additional condition. Indeed, the Applicant represented at the Issues Conference that it would be unable to proceed with the project as planned if it were required to comply with the 5-acre standard because construction of the golf courses would be too expensive and too technically difficult in such small increments. See Tr., Vo. 9, at 2075 (Applicant's attorney Terresa Bakner stating that "the amount of soils we are disturbing at any one time are the absolute minimum that anyone should disturb and still build a golf course"). Accordingly, the resolution of this issue could result either in substantial additional permit conditions or in a substantial modification of the project as proposed. The issue is therefore significant. 6 NYCRR § 624.4(3).

ISSUE FOUR: KEY ASPECTS OF THE APPLICANT'S OPERATION PHASE SWPPP ARE INFEASIBLE AND/OR ARE BASED ON FLAWED ASSUMPTIONS ABOUT SITE CONDITIONS[10]

A. Certain critical aspects of the Applicant's operation phase SWPPP are infeasible, inaccurate, and could lead to water quality degradations in 303(d) listed waters, additional outfalls, and/or changes to the Draft SPDES Permits

A key aspect of the Applicant's stormwater plan for Big Indian is its conveyance of large quantities of stormwater down the railroad bed to large pond located in the vicinity of Design Point 1. There are three fundamental problems related to this conveyance that could result in adverse impacts to water quality which the Applicant failed to address in the DEIS or its Application for a SPDES Permit.

The first problem is the Applicant's inability to safely convey stormwater down this conveyance in the 100 year storm event without creating significant adverse erosion impacts to sensitive receiving waters. The Applicant is required to prove safe conveyance under GP-02-01, which is incorporated by reference into the Big Indian Draft SPDES permit. Applicant Ex. 160 lists HydroCAD model output predictions for the 100 year, 24 hour storm event along the railroad bed as 419.4, 574.3 and 555 cubic feet per second through reaches 97, 98 and 99, respectively. See App. 160, Computations, Post-Development, Big Indian Resort and Country Club, page 82 and City Supp. 1, at § III(b). This huge volume of flow then discharges to pond 100, located at Design Point 1, which is shown to discharge at 700.4 cfs. Such large and fast moving conveyances of stormwater in an area with sensitive soils and geological features, which

[10] As a result of the presentations made by DEP and DEC at the Issues Conference, the Applicant substantially revised its operation phase SWPPP for the Big Indian Project. In particular, the Applicant revised its original plans showing discharges from several stormwater ponds as overland flow to acknowledge and provide design details for several point source outfalls These improvements, however, fail to resolve certain inherent flaws in the operation phase SWPPP, discussed below.

the Applicant has yet to acknowledge in its environmental review, could certainly cause large loads of sediment to be deposited in Birch Creek, and then into the 303(d) listed Esopus. See City Supp. 1, at § III(b).

Despite this sensitive area and this large volume of stormwater, the Applicant has admittedly not provided any details or plans for this swale. In response to questioning by the ALJ about the railroad conveyance, the Applicant's expert stated, "the design along the railroad track needs to be completed." Such vagueness about this extremely difficult conveyance reflects a failure to recognize the potential for, let alone mitigate, significant adverse impacts to water quality. This is not merely a question of timing. The Applicant has indicated on a number of occasions that it will prepare detailed plans in the future. See e.g., App. Supp. Response 6 (Carr stating "Again, the Applicant plans to repair the washouts and improve the existing swale, pursuant to detailed design drawings, which would be approved by DEC, and by pass the existing culverts, many of which are undersized to carry the existing flows.") As the City and others have explained, however, while detailed construction drawings are not required at this stage for all aspects of the Project, where a proposed structure, such as this conveyance, poses an inherent threat to water quality, the Applicant has an obligation to take a hard look at its feasibility. See Tr. Vol. 8, at 1809-1812; City Supp. 1, at § III(b).

The second problem related to this conveyance is Pond 100 itself. This 5000 foot^2 terminal pond for the railroad swale, which would convey up to 700 cfs of stormwater into Birch Creek and which has not yet been designed by the Applicant, is listed as an outfall on the revised Big Indian SPDES Permit. When specifically asked at the Issues Conference where the stormwater goes after it leaves pond 100, the Applicant's expert David Carr gave vague answers such as "it does go somewhere" and "[I]t moves as it does today. We're not changing any of

that." See Tr., Vol 9, at 2187-2188. As with the conveyance itself, the Applicant has an obligation to undertake a detailed study of such an inherently problematic structure in connection with the environmental review of the project, not merely at the construction stage. Moreover, as discussed in Issue 1 above, the stormwater does not flow to Design Point 1 in the existing conditions, but leaves the site via culverts along the railroad bed. See City Supp. Ex. 1. Thus, as a result of these significant changes, the Applicant should be required to provide details of not only the swale, but of this terminal pond. See City Supp. 1, at § III.b.

The third problem related to this swale is that the Applicant proposes to use it only for treated stormwater from the upstream micro-detention ponds and not for the untreated, sediment-laden stormwater which will be coming from the mountainside. The DEIS suggests that any small ephemeral streams, intermittent drainage ditches, or washouts of the railroad ditch will be intercepted and bypassed in order to maintain separation of stormwater runoff and any existing streams. See DEIS, App. 9A, at 61 and Tr. Vol. 8, at 1810-1812. Given the huge volume and velocity of this discharge, this separation of clean flow from sediment-laden flow is infeasible. In addition, due to the sensitivity and erodability of the soils above the railroad track, there is a distinct possibility that large movements of soil will block the railroad bed conveyance, causing the conveyance to fail entirely. See Tr., Vol 8, at 1810-1812. Again, the impacts from sediment to the sensitive receiving waters could be extreme.

Before an outfall is permitted for this swale and pond, the Applicant must provide detailed schematics to prove the feasibility of its plan in light of the sensitivity of the surrounding area. Until that occurs, an outfall in the vicinity of pond 100 is inappropriate.

B. The issue of the railroad bed conveyance is substantive and significant

The impacts from large volumes of stormwater traveling at erosive velocities through a sensitive area in a swale that has not yet been designed are substantive because such discharges could contribute to violations of water quality standards in the receiving waters. This questionable conveyance could result in discharges of large amounts of sediment to these waters. Moreover, pond 100, which is proposed to receive stormwater from the swale and discharge it at erosive velocities into Birch Creek, is listed as an outfall in the revised SPDES Permit. These discharges must be evaluated before the SPDES permit is issued. This conveyance is questionable due to the extreme difficulty of constructing a swale that would separate clean water from stormwater. See Seven Springs, at 58 (ruling that likelihood of stormwater control to fail is a substantive and significant issue). Therefore as this issue relates to the Project's impacts on existing water quality standards is substantive. This issue is also significant because it may require the Applicant to re-design a substantial part of its design plan, i.e. the railroad bed conveyance. If the Applicant performs this analysis and determines this conveyance is not feasible, it will have to find an alternative method of safely conveying these large amounts of stormwater from the Project site.

Therefore, the environmental impacts and feasibility of this railroad bed conveyance are appropriate for adjudication.

ISSUE FIVE: THE DEIS FAILS TO ASSESS THE IMPACTS OF REASONABLE ALTERNATIVES AND THE NO ACTION ALTERNATIVE

Pursuant to SEQRA, the Applicant must provide a "description and evaluation of the range of reasonable alternatives to the action that are feasible, considering the objectives and capabilities of the project sponsor. The description and evaluation of each alternative should be at a level of detail sufficient to permit a comparative assessment of the alternatives discussed." 6

NYCRR § 617.9(b)(5)(v). The Applicant, however, has failed to provide DEC with a reasonable range of alternatives to consider in evaluating the environmental impacts of the Project. See OHMS Ex. 7 (the "City Petition"), pp. 38 – 44. Rather, the DEIS improperly relies on an Economic Evaluation Study to conclude that elimination of either of the two central components of the proposed development (Big Indian Plateau or Wildacres Resort), or any of the other major components contained therein, is unfeasible. See OHMS Ex. 3 (the "DEIS"), Section 5.3.4; Appendix 27. Therefore, the DEIS is inadequate and must be revised to include an environmental assessment of reasonable alternatives, including, but not limited to, elimination of the Big Indian component of the Project and the no action scenario. See Sun Company v. City of Syracuse Industrial Development Agency, 209 A.D.2d 34, 50, 625 N.Y.S.2d 371 (4th Dep't 1995), *app. dism'd*, 86 N.Y.2d 236 (1995) (EIS failed to comply with SEQRA where there was no meaningful consideration of alternatives).[11]

The review of alternatives has been characterized as the "heart of the SEQRA process." Shawangunk Mountain Environmental Ass'n v. Planning Board of the Town of Gardiner, 157 A.D.2d 273, 275-276, 557 N.Y.S.2d 495 (3d Dep't 1990) (subdivision approval failed to comply with SEQRA where there was no consideration of alternatives). The Applicant's attempt to evade an environmental assessment of alternatives undermines the very purposes of the statute. See ECL 8-0109. As the Court of Appeals has explained,

> The purpose of requiring inclusion of reasonable alternatives to a proposed project is to aid the public

[11] The Final Scoping Document requires such an analysis. Section 5.3 of the Final Scoping Document requires that the DEIS "include a discussion of a different mix of resort components..." Beyond the feasibility analysis employed to dismiss the potential of eliminating either Wildacres or Big Indian, or one of the golf courses, the DEIS attempts no assessment of a mix of components. For example, the DEIS does not consider the elimination of detached lodging units at either Wildacres or Big Indian, or the elimination of Belleayre Highlands and/or Highmount Estates. Other mixtures of project components could also be assessed. In light of the Applicant's flawed position that none of the handful of development alternatives identified in the DEIS is financially feasible, as explained below, the DEIS fails to fulfill the required scope.

> and the governmental bodies in assessing the relative costs and benefits of the proposal. To be meaningful, such an assessment must be based on an awareness of all reasonable options other than the proposed action.

Webster Associates v. Town of Webster, 59 N.Y.2d 220, 228, 464 N.Y.S.2d 431 (1983); see also Town of Dryden v. Tompkins County Board of Representatives, 78 N.Y.2d 331, 333-334, 574 N.Y.S.2d 930 (1991) (requirement that lead agency describe and evaluate range of reasonable alternatives to proposed action is substantive and not procedural requirement). Here, the DEIS dismisses reasonable alternatives in order to reach a predetermined outcome, in clear violation of the letter and spirit of SEQRA. See Sun Company, 209 A.D.2d at 50. On a fundamental level, the DEIS deprives the public and DEC of information that will help them assess the environmental impacts of the Project. See Shawangunk Mountain Environmental Ass'n, 157 A.D.2d at 275 ("a lead agency must act and choose among alternatives so as to minimize adverse environmental consequences, consistent with other social, economic and policy considerations").

The Applicant has attempted to divert attention from the feasibility analysis toward other "objectives of the Project sponsor," including improving the local economy and realizing various goals set forth in a number of draft and final planning documents. See Tr., Vol. 13, at 3133 – 3137. The Applicant's other purported objectives, however, do not excuse the Applicant from the requirements of SEQRA. While the Applicant may represent that the Project conforms to planning goals outlined in the Route 28 Corridor Study, the Tourist Development Plan for the Central Catskill Planning Alliance and the West of Hudson Economic Development Study, see, e.g., Tr., Vol. 13 at 3138 – 3139, by foregoing an environmental assessment of reasonable alternatives the Applicant has deprived DEC and the public of the information necessary to make their own informed evaluations. The purpose to SEQRA is to ensure a public

review of environmental impacts, not to allow an applicant to define a project's objectives so as to avoid public review.

The range of alternatives that should be considered includes, among other things, the scale or magnitude of the Project. 6 NYCRR § 617.9(b)(5)(v); see also In re Dalrymple Contracting Company, Inc., DEC Comm'r Interim Decision, Sept. 24, 2002; Sutton Area Community v. Board of Estimate, No. 10147/89, at 6 (Sup. Ct. N.Y. Co Apr. 18, 1990) (court noted that, as a direct result of the environmental review process, the approved project reflected a lower density alternative to that originally proposed), aff'd, 165 A.D.2d 456, 568 N.Y.S.2d 35 (1st Dep't), rev'd on other grounds, 78 N.Y.2d 945, 573 N.Y.S.2d 638 (1991); Grape Hollow Residents' Ass'n v. Beekman Planning Bd., No. 1986/284 (Sup. Ct. Dutchess Co. Oct. 16, 1986) (EIS failed to consider reasonable smaller-sized project where opponents of a subdivision preferred a smaller number of units). Here, the DEIS provides no environmental assessment of project alternatives of a lesser magnitude; such as the Wildacres only alternative; no environmental assessment of project alternatives of a smaller scale, such as one involving all components, but with fewer hotel rooms, fewer detached lodgings, fewer amenities, etc.; and no environmental assessment of the no action alternative.

A. The DEIS fails to analyze a project of a different scale or magnitude

The Applicant's decision to forgo an environmental assessment of alternatives of a lesser magnitude or scale is based solely on an Economic Evaluation Study that concludes that the Project as proposed is the only economically feasible development option. See DEIS, Appendix 27, HVS International Report, p. 1-6. This conclusion, in turn, is based on a comparison of the Internal Rates of Return ("IRRs") for five different scenarios: the Project as proposed, including both Big Indian and Wildacres; elimination of the golf club at Big Indian; elimination of the golf club at Wildacres; development of the Big Indian resort only; and

development of the Wildacres resort only. In each of these scenarios, however, the Applicant's expert HVS International calculated the IRR for the resort component separately from the detached housing component. The decision to so limit the IRRs fundamentally distorts the comparative feasibility of the alternatives, as shown below.

The DEIS calculates that the IRR would be 14.7% for the Project as proposed, 8.4% for Big Indian, and 10.7% for Wildacres. According to HVS International, "hotel and resort IRRs generally enter into feasible territory once they exceed approximately 14%," and therefore only the Project in its entirety meets the standard. DEIS, Appendix 27, HVS International Report, p. 1-9. Yet, the DEIS and the subsequent statements of the Applicant's own experts make clear that the success of the Project depends not only on the hotels and resorts but also, and to a far greater degree, on the profitability of the detached housing component. See, e.g., DEIS, Appendix 27, HVS International Report, p. 1-4, Tables 1-2, 1-3, 5-3, 6-18; Tr., Vol. 5, at 1065 – 1066; Tr., Vol. 13, at 3161 – 3161, 3166 – 3166, 3185 – 3186. This makes sense, since the IRRs for the detached housing components are markedly higher than the hotel and resort components: 41.6% for the detached housing at Big Indian, and 33.5% for the detached housing at Wildacres. See DEIS, Appendix 27, HVS International Report, Table 1-3. Accordingly, RKG Associates, consultants for the City, used the same methodologies and source data as HVS International to calculate a combined IRR for three potential alternatives, in each case aggregating the proposed detached housing with the hotel and resort facilities: the Project as proposed, Big Indian only, and Wildacres only. The calculation shows that the combined IRRs are comparable to each other: 23.2% for the Project as proposed, 22.2% for Big Indian, and 19% for Wildacres. See City Ex. 6, Tr., Vol. 5, at 920 – 926.[12]

[12] Although RKG Associates adopted the Applicant's assumptions for the purposes of calculating the combined IRR, the DEIS analysis remains flawed in that it relies on insufficient data and, as a result, underestimates the

The Applicant's decision not to analyze reasonable and obvious alternatives is unjustified. The Applicant has not rebutted the City's offer of proof on this issue. Rather, at the Issues Conference, Erich Baum of HVS International stated that he did not know what the threshold would be for a combined IRR, such as that calculated by RKG Associates. See Tr., Vol. 5, at 1059 – 1060. HVS International's failure to investigate this potential threshold is insufficient to justify the DEIS' failure to perform an environmental assessment of alternatives. Indeed, the DEIS does not provide a source for the 14% number it relies on as the threshold for resort IRRs; rather, by Baum's own admission this number is merely their "opinion." Tr., Vol.5, at 1044. The Applicant has not explained why HVS International did not formulate an "opinion" as to the appropriate threshold for a combined IRR, and has not shown that the alternatives are unfeasible.

Moreover, in response to direct questions from the ALJ regarding why two hotels are necessary, Steven Rushmore, president and founder of HVS International, resorted to vague, narrative descriptions of why the Project may succeed or fail. See Tr., Vol. 13, at 3204 – 3207; see also Tr., Vol. 5, at 1051 – 1052 (Baum's narrative regarding need for two golf courses). This response does not change the fact that the Applicant relied solely on the IRR calculation in reaching the determination on economic feasibility that forms the basis of the decision to forgo any analysis of alternatives.

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feasibility of the proposed alternatives, most particularly by projecting unrealistically high wages for workers who will operate the Belleayre Resort. See OHMS Ex. 5, DEP SEQRA Comments, § VIII; City Petition, Appendix B.1, Table 18. According to the DEIS, workers will earn wages ranging from about 16% - 165% more than workers with comparable jobs in the Tri-County Area. City Petition, Appendix B.1, Table 18. It is unreasonable, and inconsistent with standard economic analysis, to assume that the company that eventually builds and operates the Resort will volunteer to pay wages so drastically out of proportion to what the market demands. Assuming that the Resort pays its workers something closer to market wages, the costs of each alternative would decrease and the potential yield of each would necessarily increase. Thus, each alternative – including the Project as proposed – would appear more feasible

In addition, although Baum stated that an investor would require that the resort component generate a sufficient IRR to stand on its own, see Tr., Vol. 5, at 1048, both he and Rushmore characterized the resort component of the Project as only "marginally feasible." Tr., Vol. 13, at 3185; Tr., Vol. 5, at 1059. Indeed, Baum stated that "[i]t's entirely possible" that the Applicant would build both resorts, only to discover that the market does not support the detached housing. Tr., Vol. 5, at 1062. The Applicant has left no doubt that the detached housing component is integral to the success of the Project. This emphasis only underscores the need to look at alternatives, as some alternatives may have a lesser impact in the event of the resort's failure.

Given the central importance of the detached housing to the success of the development, the Applicant must provide an environmental assessment of alternatives. As DEC Staff stated, if "the proffers regarding economic feasibility...allow lesser alternatives, then the environmental assessment of such alternatives would have to be further developed in the record." Tr., Vol. 13, at 3213.[13]

B. The DEIS fails to analyze the environmental impacts of the No Action scenario

A DEIS must analyze the "No Action" alternative. 6 NYCRR § 617.9(b)(5)(v). While the DEIS does include a partial analysis of the No Action alternative – including interpretations of its impacts on land use, local and regional planning goals, and socioeconomic benefits – the DEIS does not address the environmental benefits that would result from it. See DEIS, Section 5.10. In particular the City has identified a number of significant environmental benefits that would result from the No Action scenario, based on the extraordinary water quality

[13] SEQRA, of course, does not provide that only the most profitable alternative formulation of a proposed project need be considered, especially where, as here, the very scale of the proposed project creates impacts that could be mitigated by reducing the scale. Thus, the ALJ should direct the Applicant to analyze less profitable alternatives that are nonetheless feasible.

protection and improvement provided by the site in its undeveloped condition. See generally discussion at Issue Two above. It is incumbent upon the Applicant to examine just such environmental benefits in comparison with the impacts of the proposed development. "The EIS preparer must consider the capability of a site to environmentally improve, recover, or allow for restoration and remediation in the absence of the proposed project. This change goes beyond the characterization of the site as it appears today, which may preclude opportunities for site enhancement and increased value, and requires a balancing of the future no action alternative against the project proposal." *Gerrard, Ruzow and Weinberg, Environmental Impact Review in New York*, § 5.14 at 2-5; see also, In the Matter of the Application of Glen Lake Protective Association, Issues Ruling, 12/30/97 (where project posed potential threat to environment, petitioners raised a substantive and significant issue where it offered proof that the environmental benefits of the no action alternative had not been adequately analyzed).[14]

Although counsel for the Applicant has attempted to characterize the issue regarding the DEIS's failure to provide an adequate alternatives analysis as "comments" requiring nothing more than "perhaps some additional narrative or clarifications of the considerations that have occurred without resorting to adjudication," Tr., Vol. 5, at 1023 – 1024, the issue is both substantive and significant, and requires adjudication. Case law makes clear that the complete omission of the alternatives analysis from the DEIS would not be cured by including an adequate analysis in the final EIS. See Webster Associates, 59 N.Y.2d at 22. Therefore, the Applicant's critical omissions cannot simply be remedied in the FEIS. Here, the City has offered unrebutted proof that reveals serious problems with the Applicant's decision not to consider reasonable alternatives in the DEIS. As a matter of law, then, the DEIS is inadequate

[14] As with the analysis of alternatives, the scope specifically directed the Applicant to balance the environmental benefits of the no action scenario against the impacts of the Project. *See* City Ex. 7, Section 5 9

and SPDES permits cannot be issued. The Applicant should be directed to provide the required environmental assessment of project alternatives.

ISSUE SIX: THE DEIS DOES NOT ADEQUATELY ANALYZE THE POTENTIAL ADVERSE IMPACTS ASSOCIATED WITH INDUCED GROWTH ON WATERCOURSES CRITICAL TO THE NEW YORK CITY WATER SUPPLY

The DEIS and subsequent analyses offered by the Applicant unreasonably conclude that there is no potential for the development of the Belleayre Resort to induce secondary growth that will adversely impact New York City's drinking water supply and the local environment. See, e.g., DEIS, Section 7, p. 7-15; Tr. Vol. 12, at 2800 – 3100; App. Ex. 84. To correct this deficiency, the DEIS must analyze the potential for this Project to induce population growth and housing development in the Project's economic impact areas, and commercial development along the Route 28 corridor. These accelerations will spur increases in, among other things, impervious surfaces and stormwater flows, which have the potential to affect watercourses critical to the City's water supply, such as Birch Creek, Emory Brook, the Esopus Creek, and the East Branch of the Delaware River. See OHMS Ex. 5, DEP SEQRA Comments, Sections VI and VII; Tr. Vol. 4, at 776. These potentially significant adverse impacts must be analyzed prior to the issuance of a SPDES permit. See Segal v. Town of Thompson, 182 A.D.2d 1043, 1046, 583 N.Y.S.2d 50 (3d Dep't 1992) (annulling negative declaration in which town failed to address future residential developments that would follow newly created water and sewer districts); see also 6 NYCRR § 750-2.1(b) (DEC may not issue a SPDES permit if that permit is based on insufficient or flawed factual data).

A. The DEIS case studies are insufficient to provide a qualitative background for induced growth analysis

The DEIS' conclusion that there are no potential significant adverse impacts expected from induced growth associated with the Project rests, in part, on three case studies

which are intended to provide an indication of what kind of potential for such impacts actually exists. However, the case studies are only tangentially analogous to the Belleayre Resort, involving developments comprised of different components, offering different product types, and constructed on entirely different scales than the proposed Project. See Tr., Vol. 4, at 802 – 803; OHMS Ex. 5, SEQRA Comment Report, § III.i. Two of the case studies presented analyze secondary growth associated with ski resorts, rather than golf resorts in proximity to ski mountains. See DEIS, Appendix 26, Ch. 6. The third, Greylock Glen in Massachusetts, see id., is not even an active project, had not yet hired its first employee when the case study was undertaken, and, by the Applicant's consultant's own admission, sheds no light whatsoever on what kind of growth might result from the Project. See Tr., Vol. 12, at 2886.

A number of far more comparable developments could and should have been used in the Applicant's analysis. See, e.g., City Ex. 5; Tr., Vol. 4, at 803 – 806. Two of these developments – Snowshoe in West Virginia and Mount Vernon in New Jersey – illustrate the potential for impacts from, among other things improvement of roadway access during the early stages of development; capitalization by other developers speculating on the increased tourism associated with the project; the conversion of residential property to non-residential uses; the creation of housing communities to compete with the development; rapid increases in housing and land pricing; and development in and/or near host communities with sewer service. See OHMS Ex 5, DEP SEQRA Comments § V; City Petition, Appendix A.5; see also Tr., Vol. 4, p. 807 – 808. As noted above, such impacts would include localized increases in, among other things, impervious surfaces, lawns, phosphorus loads, fertilizer and pesticide use, stormwater flows, wastewater flows and water usage.

The DEIS' reliance on its case studies is misplaced and misleading, resulting in an inadequate review of the Project's potential induced growth impacts. Indeed, the U.S. Environmental Protection Agency has expressed that it shares the City's concern that the irrelevance of the case studies gives reason to "question the basis for conclusion drawn in the DEIS (Appendix 26, page 6-23) that 'it is unlikely that the Belleayre Resort would create a particularly large secondary growth in terms of new development.'" App. Ex. 59, p 5.[15]

B. The RIMS II Model is inappropriate for the Project

The DEIS also based its conclusion on a model inappropriate for analysis of the Project's induced growth impacts. See, e.g., Tr., Vol. 4, at 778 – 799. The Applicant used the RIMS II economic impact methodology to analyze the "multiplier" effect of increases in employment and spending that will result from project. This methodology is static, and provides a "snapshot" in time of how expenditures or employment in one industry ripples through the economy in multiple spending cycles. However, only a generalized perspective is provided. See City Petition, Appendix B.2, pp.1-2. The REMI model utilized by RKG Associates is dynamic, and offers a more precise rendering of local and regional impacts. OHMS Ex. 5, DEP SEQRA Comments at § VI.1; Tr. Vol. 4, at 782 – 786, 798 – 799. This model more accurately predicts that the economic "shock" of the Belleayre Resort will lead to higher wages and a population increase, which will in turn create more demand for housing and services that may result in adverse environmental impacts. City Petition, Appendix B.2, pp. 8 – 12.

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[15] AKRF, author of the case studies, has indicated that these three comparables were required by the Scoping Document, and that they are "inherently qualitative, they provide add-on information, they aren't the basis of decision-making." Tr., Vol 12, at 2897. The Scoping Document does in fact require that Windham, Gore Mountain and Greylock be included, but it no way limits the Applicant to reviewing only those three, and in fact requires that the Applicant look beyond those three case studies for others that would shed light on the kinds of impacts that can be expected to result from this development. See City Ex. 7, Section 7.0. Moreover, although the case studies are not the basis of DEC's decision-making, they are an integral part of the analysis of induced growth, and inform the conclusions drawn by AKRF.

C. The DEIS fails to analyze impacts from new residences

As a consequence of its inappropriate case studies and econometric modeling, the DEIS fails to adequately account for impacts arising from the demand for new residential housing. Indeed, the DEIS states that, despite the new employment and recreational opportunities the proposed development would provide, there will be no new residential units constructed in the primary market area, other than those proposed by the developer. See DEIS, Section 7, pp. 7-14 – 7-15.[16] The conclusion is unsupported, and flies in the face of common sense. The REMI model, on the other hand, employed by RKG Associates, predicts that residential capital stock in the primary market area will increase by approximately $15.75 million in its first decade, resulting in 158 new residences and increasing by 50% the rate of housing growth recorded in the 1990s. See OHMS Ex. 5, DEP SEQRA Comments, § VI.3; City Petition, Appendix B.2, Table 6. An additional 155 residences will be built outside the primary market area. See OHMS Ex. 5, DEP SEQRA Comments, § III.i; City Petition, Appendix B.4, p. 2. The impacts associated with such development were not identified or analyzed in the DEIS. See OHMS Ex. 5, DEP SEQRA Comments § III.i; City Petition, Appendix C.5.

The Applicant has not rebutted this offer of proof. Rather, AKRF accepts that RKG Associates' predicted increase in residential capital stock is "reasonable." Tr., Vol. 12, at 2955. AKRF counters that RKG Associates' assumptions regarding development cost and unit size are flawed, and attempts to lower the number of estimated new residences by increasing both. See Tr., Vol 12, at 2957 – 2958; App. Ex. 84, Slides 41-45. The result is that AKRF now predicts that 58 – 78 new residences will be built in the first decade. App. Ex. 84, Slide 43.

[16] John Feingold stated that AKRF drew its conclusions based not solely on the model, but also on a "hands-on experiential approach. using both on the ground experience and knowledge of the area as well as the model itself." Tr, Vol 12, at 2941 – 2942. It is unclear what kind of experience and knowledge predicts no new residences will be constructed as a result of the largest resort development in the Catskills in over 50 years.

RKG's assumptions, however, were entirely reasonable. See Tr., Vol. 16, pp. 4009 – 4013. In any event, the Applicant has yet to analyze the potential impacts of the new residences the Applicant now concedes are likely to result from the Project.

D. The DEIS fails to analyze impacts from new commercial development

The analysis in the DEIS of new commercial development in the NYS Route 28 corridor is similarly flawed. The DEIS indicates that the Project will induce a demand for an additional 76,600 square feet of commercial space. See DEIS, Appendix 26, p. 7-6. However, the DEIS dismisses the likelihood that new commercial development would occur along NYS Route 28, and suggests instead that all, or almost all, commercial development will funnel into existing spaces in nearby villages. In contrast, the City has shown that, due to a typical business's desire for enhanced access, parking and visibility not available in villages and hamlets, there would be significant development pressure to accommodate much, if not all, of this induced demand along NYS Route 28. See, e.g., OHMS Ex. 5, DEP SEQRA Comments, § VI.4; Tr. Vol. 4, at 809. Such pressure may lead to the conversion of existing residential spaces into commercial spaces, as well as new developments.

Indeed, contrary to the findings in the DEIS and the Applicant's subsequent statements at the Issues Conference, development pressure will be most intense along the Route 28 corridor. The DEIS itself predicted that, given reasonable development constraints, approximately 3,900 acres would be available for development along the corridor. See App. Ex. 84, Slide 17.[17] Consequently, developers will have a range of site selections along Route 28, which will prove among the most attractive option available to developers given their access,

[17] Despite the fact that the estimate of developable acreage in the DEIS has not been challenged, the Applicant has ratcheted that number significantly down. See App Supp. Ex. 24. As demonstrated by RKG Associates, the revised estimate is misleading and unreasonable. See City Supp. Reply #3.

visibility and parking availability. See Tr., Vol. 4, at 815. More particularly, sites closest to the Project with access to public sewers will experience the most intense pressure. See Tr., Vol. 16, at 4003. These pressures and trends are already being observed, with the proposed expansion of the Margaretville Motel, a new proposed hotel outside Pine Hill, and residential development in close proximity to Route 28. See Tr., Vol. 4, at 809; OHMS Ex. 5, DEP SEQRA Comments, § VII.6; City Petition, Appendix B.4, p. 3; App. Ex. 84 Slide 5. The villages – which variably suffer from lack of parking, as in Pine Hill and Arkville, and significant disinvestment, as in Fleischmanns, or have low vacancy, as in Margaretville and Phoenicia – are unlikely to absorb the in-fill development predicted by the DEIS. See Tr., Vol. 4, at 810 – 813.

These new developments will result in impacts on important streams in the vicinity of project, such as stream temperature alterations and contamination from stormwater runoff. See City Petition, Appendix C.4, pp. 3, 5. In particular, developments on the Big Indian side of the corridor will likely drain into Birch Creek; developments on the Wildacres side will likely drain into Emory Brook. Both are major tributaries to City reservoirs. Thus, increases in impervious surfaces and natural resources modifications resulting from new residential and commercial development have not been adequately considered in either the DEIS.

The DEIS' failure to analyze the potentially significant adverse impacts associated with secondary residential and commercial development is similar to the insufficiency found in the Negative Declaration overturned in Segal v. Town of Thompson. In that case, private companies had provided sewage service to about 600 homes. Due to financial difficulties, new sewer and water districts were created with the capacity to serve more users. Opponents to the creation of the districts produced evidence that there were approximately 1300 lots in the area, and the potential for 800 new homes to be built. The court found that the new

districts would have more than doubled the number of homes that could be served in the area, and that the environmental review failed to address the effect the new capacity would have on the rate of development of the vacant lots within the districts. See Segal v. Town of Thompson, supra; see also Schulz v. New York State Dep't of Envt'l Conservation, 200 A.D.2d 793, 606 N.Y.S.2d 459 (3rd Dep't 1994) (negative declaration failed to take "hard look" at potential adverse effects of construction of sewer system, or creation of material demand for sewer system). Similarly, here the applicant fails to adequately identify and analyze the potential for new housing and commercial development that will follow on the heels of the resort. In particular, the Project has been predicted to induce 323 housing units and the conversion of between 975 and 1,625 acres of land for residential uses, in addition to commercial development along Route 28. In addition, while the DEIS predicts that impervious areas could increase by only 12 acres as a result of total induced growth, the REMI analysis predicts that induced growth could lead to more than 55 acres of impervious surfaces. See OHMS Ex. 5, DEP SEQRA Comments, § VII.3. This induced growth could result in significant adverse impacts not identified or analyzed in the DEIS. Therefore, the SPDES permits cannot be issued, and the issue is fit for adjudication.[18]

[18] The City notes that both the Coalition of Watershed Towns and the Applicant have, in the context of the Issues Conference sessions on secondary growth and community character, made a series of statements alleging that the City's regulation of subsurface sewage treatment systems, the City's Land Acquisition Program, and the City's ownership of sewage treatment plants have brought small-scale development to a standstill, and will prohibit secondary growth along the Route 28 corridor, leaving projects the size and scale of the Project as the only viable means of accomplishing economic development in the region. See, e.g., Tr., Vol. 4, at 823 – 862, 907 –910; Tr. Vol. 12, at 2812, 3025 – 3026; Tr. Vol. 16, 4122 – 4124, 4154 – 4155, 4159 – 4160. As the City believes it is important to focus on matters appropriately at issue in this proceeding (namely, whether the deficiencies in the DEIS and draft SPDES permits identified above are adjudicable), rather than on the irrelevancies represented by these and other false attacks (the substance of which was not included in even a qualitative manner in the DEIS), we will not respond to the allegations in any detail in this submission. The City simply notes for the record that these allegations are without basis in law or in fact. The City has always supported reasonable and responsible economic development, as witnessed by, among other things, the City' affirmative support for economic development loans and grants made by the Catskill Watershed Corporation over the past 5 years, the vast majority of which have targeted small businesses. See City Supp. Ex. 4. According to the CWC's own annual reports, these loans and grants (which are funded by City dollars) have created or retained thousands of jobs in the Catskill region. See id.

CONCLUSION

For the reasons stated above, the City respectfully requests that its petition for full party status be granted and that the issues outlined above be determined adjudicable.

Dated: New York, New York
December 23, 2004

Respectfully submitted,

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In addition, the City works effectively to assist property owners and project developers in advancing projects while at the same time complying with regulatory requirements, as witnessed by the fact the vast majority of applications to DEP for regulatory approvals are, in fact, approved.

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION OFFICE OF HEARINGS AND MEDIATION SERVICES

In the Matter of the State Pollutant Discharge Elimination System Application Nos. 0-9999-00096/00005 and 0-9999-00096/00009 for the Belleayre Resort at the Catskill Park Property, Towns of Middletown and Shandaken

CITY OF NEW YORK'S REPLY BRIEF

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NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
OFFICE OF HEARINGS AND MEDIATION SERVICES

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CITY OF NEW YORK'S REPLY BRIEF

Richard R. Wissler,
Administrative Law Judge

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PRELIMINARY STATEMENT

The City of New York ("City") hereby replies to the briefs filed by the Applicant, the Department of Environmental Conservation Staff ("DEC"), and the Coalition of Watershed Towns, Delaware County, Town of Middletown and Town of Shandaken (collectively referred to as the "Watershed Communities")[1] concerning the above-referenced draft State Pollutant Discharge Elimination System ("SPDES") permits for the proposed Belleayre Resort. As set forth in detail in the City's initial brief, the City has demonstrated through oral presentations and documentary submissions during the Issues Conference that there are a number substantive and significant issues concerning the draft permits as well as the environmental review for the Project that merit adjudicatory hearings. The submissions by the Applicant, the Watershed Communities, and DEC underscore the need for full adjudication; indeed, DEC's recommendation of an adjudicatory hearing on the issue of the Applicant's flawed hydrological analysis should be dispositive at least on that issue.

[1] These briefs are cited herein as App. Brief, DEC Brief, and Watershed Communities Brief, respectively.

THE ISSUES RAISED BY THE CITY ARE SUBSTANTIVE AND SIGNIFICANT AND THEREFORE REQUIRE FULL ADJUDICATION

The City's December 23, 2004 brief proposes six issues for adjudication, each of which relates to the Draft SPDES Permits and/or the Applicant's review of the Project's environmental impacts under the State Environmental Quality Review Act ("SEQRA"). In brief, the issues are as follows:

- Issue One: The Applicant's hydrological analysis of pre-development conditions is inaccurate and does not represent the actual pre-development site conditions.
- Issue Two: The Applicant's analysis of post-development pollutant loading for Total Suspended Solids (TSS) and Total Phosphorus (TP) is inaccurate.
- Issue Three: The Applicant should not be allowed to expose more than five acres of soil at one time within the watershed of the Esopus Creek.
- Issue Four: The Applicant's operation phase Storm Water Pollution Prevention Plan ("SWPPP") for Big Indian is inadequate because it is based on the Applicant's flawed hydrological analysis (see Issue One).
- Issue Five: The DEIS fails to assess the impacts of reasonable alternatives and the no action alternative.
- Issue Six: The DEIS does not adequately analyze the potential adverse impacts associated with induced growth on watercourses critical to the New York City Water Supply.

Nothing raised by DEC, the Applicant, or the Watershed Communities in their briefs negates the validity of any of these issues and, in fact, DEC's brief makes clear that at least three of the issues raised by the City require full adjudication.[2]

[2] In the interest of brevity, the City will not respond to each factual dispute raised by the Applicant, except to note that the continuing existence of these disputes highlights the need for a full adjudicatory process that will allow for cross-examination and ultimate resolution of the issues. The City reaffirms its offers of proof on all issues discussed in its December 23, 2004 brief.

A. DEC Staff should be granted deference on its recommendation that the Applicant's flawed hydrological analysis be fully adjudicated

The Applicant attempts to characterize DEP's criticism of its hydrological analysis as merely an "alternative view on how the analysis might have been conducted." App. Brief, at 34. The Applicant supports this argument by repeatedly stating that "NYCDEC staff's determination to prepare and issue draft SPDES permits for the discharge of stormwater during construction and operation is a determination that the Resort, as designed, can meet [the applicable] standards." Id. (emphasis added). The Applicant goes on to argue that the Administrative Law Judge (ALJ) must give deference to DEC's determination when deciding whether the hydrological issues are substantive and significant. App. Brief, at 19. The City agrees; thus, in accordance with the recommendation made by DEC in its brief, the issues regarding the Applicant's flawed hydrological analysis should proceed to full adjudication. DEC Brief, at 15.

In its brief, DEC determined that the issues discussed in City Supplemental Exhibit 1 raise "credible concerns" about the Applicant's hydrological assessment of the Project sites. Id. The issues raised in City Supplemental Exhibit 1 are labeled City Issues One and Four in the City's December 23, 2004 brief. In essence, City Supplemental Exhibit 1 focuses on the technical deficiencies in the Applicant's modeling of pre-development site conditions, concluding that the Applicant's understanding of the site as it currently exists is deeply flawed. As a result of the Applicant's flawed hydrological analysis the Applicant has mischaracterized pre-development conditions – the foundation for analyzing the impacts of the proposed development. Thus, in Issue Four, the City demonstrates that these flaws undermine the Applicant's design of post-construction stormwater management facilities.

DEC's decision to support the hydrological issues for adjudication is important in several respects. First, DEC's recommendation serves as peer validation of the scientific and engineering analysis performed by DEP experts, and therefore rebuffs the Applicant's argument that the City has merely provided an "alternative" way to perform the hydrological analysis. Clearly, as indicated in the City's offer of proof, the analysis performed by DEP experts presents a dramatically different, more conservative depiction of the Project sites in their pre-development condition which dramatically contrasts with the results of the Applicant's hydrological analysis.[3] By acknowledging that the City has raised "credible concerns" with respect to the Applicant's hydrological analysis, DEC has confirmed that the issues raised by the City cannot merely be disregarded as a disagreements in expert opinion, but are, in actuality, real and substantive issues absolutely crucial to understanding the potential water quality impacts associated with the Project.

Second, the Applicant can no longer rely on the presumption against substantive and significant issues suggested in Part 624 of the Permit Hearing Procedures. The regulation states that when DEC staff has reviewed a permit application and finds that it "conforms to all applicable requirements of statute and regulation, the burden of persuasion is on the potential party proposing any issue related to that component to demonstrate that it is both substantive and significant." 6 NYCRR § 624.4(c)(4). In its brief, the Applicant makes repeated reference to this presumption to support its argument that its Stormwater Pollution Prevention Plan (SWPPP) meets all applicable rules and regulations. See App. Brief, at 22. However, in light of DEC's recommendation for full adjudication on the issue of hydrology — a subject that is absolutely

[3] Indeed, as discussed in detail in the City's December 23, 2004 brief, actual data collected at the site during and after Hurricane Ivan demonstrate that rather than merely reflecting a difference of opinion, the Applicant's analysis is wrong. See generally City Brief at 8-10.

fundamental to the Applicant's individual stormwater SPDES permits — the Applicant can no longer claim that it is entitled to this presumption. Indeed, rather than granting deference to DEC's prior decision to draft the SPDES permits, the ALJ should instead grant deference to the recommendation made by DEC in its brief, which comes after months further analysis of these issues. See 6 NYCRR § 624.4(c)(2) (stating that ALJ must determine whether there is a substantive issue on the "basis of the record of the issues conference and any subsequent written arguments authorized by the ALJ."); see also App. Brief, at 22 (stating, with respect to hydrological issues, "the judgment of the agency involves factual evaluations in the area of the agencies' expertise and is supported by the record, such judgment must be accorded great weight and judicial deference") (citing In the Matter of Adirondack Fish Culture, Interim Decision of the Commissioner, August 19, 1999, at 9). Because the regulatory presumption in favor of the Applicant and the initial draft permits is no longer applicable, the burden has effectively shifted back to the Applicant to prove that its hydrological assessment of the Project sites is sufficient for the issuance of the SPDES permits.

Finally, DEC's recommendation for "further inquiry" demonstrates that it does not yet possess enough information on which to base its determination that the stormwater provisions in the Draft SPDES permits will "reasonably protect classified water use and assure compliance with applicable water quality standards." See 6 NYCRR § 750-2.1(b). DEP experts have demonstrated that the hydrological information underlying the current Draft SPDES permits is defective in several important respects, including drastically underestimating pre-development peak flows and failing to adequately describe key stormwater conveyance structures. See generally City Supp. 1. DEC's request for further inquiry on these and other

important issues signifies that it needs additional information before it can determine that the final SPDES permits will comply with the applicable requirements.

Therefore, based on the foregoing, City Issues One, Four, and any related concerns, must proceed to full adjudication.

B. The issue of the 5-acre standard requires adjudication

The Applicant mischaracterizes the City's issue regarding the 5-acre standard, designated as Issue Three in the City's Brief, by suggesting that the City claims that the 5-acre standard "is inviolable." Applicants Brief, at 41. To the contrary, the City has never argued that it is illegal for DEC to allow for more than 5 acres of exposed soil at one time. Rather, the City has argued that, in accordance with the applicable requirements, DEC should not include a condition in the Draft SPDES permits that amounts to a waiver of the 5-acre standard before DEC determines that such a waiver will "reasonably protect classified water use and assure compliance with applicable water quality standards." See 6 NYCRR § 750-2.1(b).

As discussed at length in the City's brief, DEC Staff stated at the Issues Conference that it had not yet determined whether it could grant the Applicant a waiver from the 5-acre standard and also comply with its obligations under section 303(d) of the Clean Water Act. DEC's expert further stated that DEC had thus far limited its consideration of this issue to the Applicant's economic concerns and had not yet considered the environmental ramifications of granting the waiver. Because the "Special Conditions for Construction Phasing" in the Draft SPDES Permits incorporate by reference a construction phasing plan that would allow the Applicant to expose well over 5 acres at one time — and this phasing plan will serve as the template for the construction of both resorts —DEC must make this environmental determination prior to issuing permits containing this condition. The Applicant's argument in its brief misconstrues the City's legal position on this matter and should therefore be disregarded.

Rather, because the City has demonstrated that there is a substantive and significant issue concerning whether the provisions in the draft permits that would allow for disturbance of more than five acres are lawful, the issue should be adjudicated.

C. The post-development pollutant loading impacts analysis remains deficient as the Applicant has failed qualitatively and quantitatively assess the impacts on receiving waters

The Applicant and DEC have focused their discussion of issues raised concerning the pollutant loading analysis exclusively on the prospective revision of the Total Maximum Daily Loads (TMDLs) for phosphorus in the Ashokan and Pepacton reservoirs.[4] See App. Brief, at 58-60 and DEC Brief, at 18-20. However, the need for accurate revisions of the TMDLs is only one reason that the Applicant must provide a thorough and quantitative assessment of the pollutant loading from its individual stormwater outfalls. In order to justify either the issuance of SPDES permits under 6 NYCRR § 750-2.1(b) or the conclusions in the DEIS concerning potential significant impacts from stormwater, the Applicant must also assess the impacts of the pollutants in its stormwater discharges on their receiving waters. As discussed in City Issue Two, the Applicant's analysis of these impacts is patently deficient.[5]

There was much discussion during the Issues Conference concerning the appropriateness and execution of the WinSLAMM model, which the Applicant initially used for this analysis. See, e.g., Transcript, Vol. 8, at 1864 (proffered testimony of Dr. Robert Pitt which criticized the Applicant's use and application of the WinSLAMM pollutant loading model). As a

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[4] As set forth in its Brief and exhibits cited therein, the City continues to maintain that the Applicant has overestimated the amount of phosphorus and TSS currently leaving the Project site and that this analysis needs to be improved before the SPDES permits are issued or the TMDL is revised.

[5] In addition, the Applicant has never made an attempt to reconcile or explain how it seeks to attain the pollutant loading limits set forth in the Draft SPDES permits (allegedly derived from on DEP onsite flow data), given the fact that its flawed hydrological model—which DEC agrees remains shadowed by "credible concerns"— has produced a SWPPP which will result in a net increase of stormwater volume in the post-development phase.

result of the questions raised over the summer, the Applicant performed a new analysis, using the HSPF model. See generally Tr. Vol. 18, at 4591-4633 (proffered testimony of Applicant expert Dr. Scott Lowe) and Applicant Supplement Exhibit 1. Even assuming that this new analysis is more accurate, it was not intended to, and does not, serve as the thorough pollutant loading analysis required for both the SPDES permits and SEQRA. Indeed, both the Applicant and DEC have noted the limited usefulness of the HSPF Model. See App. Brief, at 63 (stating that the HSPF modeling "is offered only to supplement the record of the issues conference."); DEC Brief, at 19 (stating that "the Department has terminated review of the HSPF modeling results"). Based on these statements, and on the renunciation of the Applicant's earlier modeling efforts, it appears that there is currently no comprehensive assessment of impacts to receiving waters from priority pollutants, such as TSS, underlying the draft SPDES permits or the DEIS. This is unacceptable at both sites, but particularly problematic at Big Indian where stormwater discharges into the watershed of water bodies which are already impaired from excessive sediment.

As pointed out in the City's brief, it is imperative that the Applicant undertake a thorough analysis of the impacts that increased loads of TSS will have on the small tributaries designated as receiving waters in the Draft SPDES Permits. Thus far, the Applicant has performed such an analysis only on a macro-watershed scale, asserting that the City should care only about the impacts on the reservoirs themselves, and not impacts on their headwaters. These headwaters, however, are currently of extraordinarily high quality, and the Applicant cannot ignore potentially significant impacts to tributaries whether or not they will result in recognizable impacts to the downstream reservoirs themselves. Indeed, the health of these upstream

tributaries is an essential factor to maintaining status of the Ashokan and Pepacton as unfiltered drinking water supplies. See City Brief, at 24-25 and exhibits cited therein.

As impacts from the individual outfalls to these small receiving waters have not yet been assessed by the Applicant, and as DEC has apparently not used even the flawed HSPF model to examine the extent of the impacts caused by the outfalls in drafting the permits, a substantive and significant issue remains regarding the impacts to water quality. See 6 NYCRR § 750-1.7(b)(12) (requiring Applicant's for individual permits to "provide a description of the outfall configuration for each outfall [which provides] sufficient information so that the Department can analyze the effect of the discharge on the receiving waters").

D. Alternatives

The Applicant has attempted to avoid the requirement that it prepare an environmental assessment of projects of an alternative scale or magnitude by creating an economic analysis that concludes that only the Project as proposed is feasible. The City has demonstrated that the development of Wildacres alone, taking into account both the hotel and timeshare components, offers a comparable internal rate of return ("IRR") for the Applicant, calling into question the sole justification the DEIS offers for neglecting to undertake an alternatives analysis. See City Ex. 6.[6] As the Applicant readily admits, the Applicant's own consultants "developed a threshold [IRR] as a feasibility litmus test" that examines only the hotel component. See App. Brief at 166. The Applicant emphasizes unsubstantiated statements offered at the Issues Conference that indicate that investors will only invest in a project where the hotel meets that threshold, see App. Brief at 166-168, yet, according to the Applicant's consultant, the hotel components, as proposed, are only "marginally feasible." See Tr., Vol. 13,

[6] The Applicant claims that its consultants explained away the combined IRR at the Issues Conference. See App. Brief at 168 (citing to Tr. 3157). That page contains no such explanation.

at 3185; Tr., Vol. 5, at 1059. Given the critical importance of the timeshare component to the Project's success, the Applicant's consultants should, at the very least, be subject to cross-examination regarding, among other things, the basis for its IRR, why no IRR was developed for the entire project, and whether a combined IRR provides a sufficient incentive to attract investors.

Moreover, the Applicant has offered no factual evidence or legal support for the proposition that its vision for the future of the region as a four-season tourist destination excuses it from compliance with SEQRA. See App. Brief at 160-161. Nor, for that matter, does the Applicant offer any evidence that development of Wildacres or Big Indian alone is inconsistent with this broad goal. Rather, the Applicant simply asserts that the Project is consistent with regional and local plans, and that this consistency is critical to understanding the Applicant's objectives.[7]

Importantly, DEC has abandoned its support of the alternatives analysis contained in the DEIS, and left it for the ALJ to decide whether the alternatives analysis meets statutory and regulatory requirements. See DEC Brief at 8. Thus, the Applicant's string citation of case law upholding the deference courts afford administrative agencies is entirely unavailing. See App. Brief at 160. Moreover, none of the cases cited by the Applicant stand for the proposition that the Applicant may forgo an alternatives analysis on the untenable premise that the Project as proposed is the only economically feasible option. Rather, all of the cases cited by the Applicant

[7] These plans can, of course, be read in any number of ways. See, e.g., Tourism Development Plan for the Central Catskills, App. Ex. 8, at v ("Development of one or more destination resorts should be encouraged *on an environmentally compatible site*") (emphasis supplied), 24 – 26 (describing broad range of regional goals), and 33 (stating that potential resort should be capable of supporting 100-150 rooms); see also West of Hudson Economic Development Study, App. Ex. 72 at 31 (stating that recoverable grants should be offered for large-scale resort development only where it can be demonstrated that the Project will not result in secondary growth that would adversely affect water quality). While it is reasonable to conclude that potential development of a resort in the Catskills has been contemplated by these plans as a means of stimulating year-round tourism, there is no basis for the conclusion that the Project as proposed is the only resort that can accomplish this goal.

that directly addressed the alternatives issue held that an alternatives analysis was adequate only where one had actually been performed. See, e.g., Neville v. Koch, 79 N.Y.2d 416, 422-428 (1992) (agency took a "hard look" where, in addition to four hypothetical full-build projects, agencies analyzed no build hypothetical and five alternatives, showing particular impacts). The circumstances here are clearly distinguishable from each of the cases the Applicant cites, in that here, the Applicant has not analyzed the environmental impacts of even a single alternative.

Similarly, the Applicant's reliance on In Re: Dalrymple Gravel & Contracting Company, Inc., Decision of the Commissioner, June 24, 2003 is misplaced. That decision, in fact, supports holding an adjudicatory hearing on the issue of alternatives. In Dalrymple, the ALJ found an adjudicable issue existed where the Applicant had failed to provide an analysis of alternative sites for the proposed project, and thus offered no comparable basis on which to determine whether the project would result in significant adverse impacts. The DEC Commissioner affirmed this decision. Only after the Applicant prepared and submitted an alternative site analysis, and an adjudicatory hearing was held, did the ALJ and Commissioner decide that the analysis was adequate. It is important to note that, contrary to the Applicant's representations, and in contrast to the determination in Dalrymple, DEC Staff here has found that there may be environmental effects for which no mitigation has been identified. See infra pp. 3-6, above.

Finally, the Applicant mentions several other factors that are irrelevant to the issue. Thus, for instance, the DEIS' recollection of the preliminary design phases of the Project does not fulfill SEQRA's alternatives analysis requirement. See App. Brief at 161. Similarly, the calculation of the economic benefits the Project may, or may not, generate for the Catskills region does not constitute an analysis of alternatives that satisfies this requirement. See App.

Brief at 162. That the Applicant has compiled an impressive design team is simply irrelevant to the question of whether the feasibility analysis provided may substitute for an analysis of alternatives. See App. Brief at 162.

Even under the standards that would apply if DEC Staff maintained that the alternatives analysis is adequate, which it does not, the City has met its burden of persuasion and raised an issue that is both substantive and significant. The City has identified omissions in the application, proffered expert testimony that runs counter to the Applicant's assertions, and identified where it may further demonstrate the DEIS' defects through cross-examination of the Applicant's witnesses. See In re: The Halfmoon Water Improvement District #1, Interim Dec'n, April 2, 1982.

E. Secondary Growth

Contrary to the Applicant's apparent misunderstanding, see App. Brief at 153, the City maintains as its Issue Six that, pursuant to 6 NYCRR § 624.4(c)(i)(b), the DEIS' insufficient analysis of the potential for secondary residential and commercial growth to result in potentially significant environmental impacts is an appropriate issue for adjudication.[8] The issue is clear: the Applicant relied on inappropriate case studies[9] and econometric modeling to reach the conclusion that the Project will result in *no* new commercial development along the Route 28

[8] In their Brief, the Watershed Communities state that "DEP's limited jurisdiction regarding water quality protection does not confer standing to adjudicate community character." Watershed Communities Brief, at 39. There is no support for this position. Indeed, as an involved agency, DEP "has the responsibility to provide the lead agency with information it may have that may assist the lead agency in making its determination of significance, to identify potentially significant adverse impacts in the scoping process, to comment in a timely manner on the EIS if it has concerns which need to be addressed and to participate as may be needed, in any public hearing." 6 NYCRR § 617.3(e). Nothing in SEQRA, its implementing regulations, or case law suggests that an involved agency's role is limited by its regulatory jurisdiction.

[9] The Applicant has admitted that its case studies are not comparable to the proposed Belleayre Resort. See App. Brief, at 161.

corridor (where development is, for obvious reasons, most likely to occur) and *zero* new residences in the economic impact area. In so doing, the Applicant has simply ignored the potential secondary impacts of the largest development proposed in recent memory for the Catskills. This insufficiency must be corrected, and an analysis of secondary growth impacts prepared, before DEC can issue the SPDES permits.

F. The issues raised by the Watershed Communities concerning the Public Health Law are not relevant to this proceeding and should be disregarded

The Watershed Communities, both through an oral presentation and in their brief, describe at length their views of the City's obligations under the Public Heath Law (PHL) to provide compensation to owners of property in the watershed under certain circumstances. Watershed Communities Brief at 29-37, Tr., Vol. 10, at 2427-38. The City respectfully urges that the Administrative Law Judge ignore this entire discussion. The Applicant has not made a claim in this proceeding for compensation under the PHL, and indeed such a claim could not properly be asserted before DEC. We note that the City vigorously disagrees with the Watershed Communities' analysis of PHL Section 1105, and has briefed the issue fully in matters where it has properly been raised.

CONCLUSION

For the reasons stated above, the City respectfully requests that its petition for full party status be granted and that the issues identified in it December 23, 2004 submission be deemed adjudicable.

Dated: New York, New York
January 21, 2005

Respectfully submitted,

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NEW YORK STATE DEPARTMENT
OF ENVIRONMENTAL CONSERVATION

In the Matter of the Application of

Application Numbers
0-9999-00096/00005
0-9999-00096/00009

BELLEAYRE RESORT at the
CATSKILL PARK PROPERTY

POST ISSUE CONFERENCE MEMORANDUM OF LAW FOR THE COALITION OF WATERSHED TOWNS, DELAWARE COUNTY, TOWN OF MIDDLETOWN AND TOWN OF SHANDAKEN

Dated: December 23, 2004

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I. Introduction

This Memorandum of Law is submitted on behalf of the Coalition of Watershed Towns ("Coalition"), Delaware County ("Delaware"), the Town of Middletown ("Middletown") and the Town of Shandaken ("Shandaken") collectively known as the Watershed Communities. The Watershed Communities have intervened in this proceeding to address specific issues raised by the City of New York Department of Environmental Protection ("City" or "DEP") in its petition and in its comments on the DEIS. Many of those issues concern matters of law and policy that have implications far beyond the instant application and, if affirmed by Commissioner Crotty in the course of this adjudicatory proceeding, will have profound impacts on all activities in the West-of-Hudson Watershed. With the exception of Delaware County, the Watershed Communities are not taking a position in this proceeding on many of the substantive issues concerning this project. The Watershed Communities have, however, already expressed their support for the economic benefits provided by the project assuming it is able to meet applicable regulatory standards. This memorandum of law requests a ruling by Administrative Law Judge ("ALJ") Richard W. Wissler that no substantive and significant issues have been raised by petitioning interveners under the provisions of the Department Permit Hearing regulations set forth in 6 NYCRR Part 624 ("Part 624") relating to: (1) stormwater and (2) community impacts.

II. Background

The public review of this project started in 2000 with a dispute over lead agency status. Initially, with the approval of the Town of Middletown, the Town of Shandaken sought lead agency status. Shortly thereafter, DEP also sought lead agency status. DEC Commissioner Cahill resolved the issue by determining that DEC is the appropriate lead agency for this project. The DEC staff

conducted a public scoping on this project. Approximately three years and after submitting an early draft of the DEIS to the other involved agencies for comment and responding to those comments, DEC accepted the DEIS as complete and started the public review process. DEC conducted an extensive public comment period on the DEIS including four legislative hearings.

The issue conference consisted of 18 days of hearing and testimony, seven site and hamlet visits and/or hikes and the submission of several hundred exhibits. Based upon issues raised during the issue conference and at the request of the DEC staff, additional information was provided by the Applicant relating to stormwater. DEC staff reviewed that information and issued an updated draft SPDES permit for Wild Acres and Big Indian Projects. Neither the Applicant nor DEC staff are seeking an adjudicatory hearing. CPC and the City are the only parties seeking an adjudicatory hearing.

III. The Watershed Communities Interest in this Proceeding

A. Home Rule

The Watershed Communities have intervened in this proceeding because they believe that the positions taken by DEP in this proceeding are contrary to the agreements reached in the 1997 New York City Watershed Memorandum of Agreement ("MOA"). More important, the Watershed Communities believe that the positions taken by DEP, if adopted by Commissioner Crotty in this proceeding, could be the beginning of the end for their communities. The Watershed Communities want to ensure that the other parties to this proceeding comprehend the severe restrictions placed on both existing and new development by the Watershed Regulations. In the West-of-Hudson Watershed (and, in particular, the western portion of the Ulster County and all of Delaware County), the burden of the Watershed Regulations relative to the type of development that exists and is likely

to occur is overwhelming. The Watershed Communities agreed to these severe restrictions with the understanding that consistent with those restrictions, existing development would be allowed to continue and new development would be allowed to occur. Issues regarding the type (i.e., whether new development would be commercial, institutional, recreational or residential) or size (i.e., a major hotel complex versus a small hotel, lot size, bulk restrictions, density) would not be the prerogative of DEP; rather, DEC as lead agency must consider and give deference to the adopted land use plans of the local communities.

Under the MOA and through the New York Department of State ("DOS"), grant funds were made available to the Watershed Communities to improve their planning resources. Under Section 151 of the MOA, New York State agreed to assist in economic development by (i) the establishment and maintenance of a "one-stop shopping" permit program to assist the regulated community in identifying the governmental permits required to implement a regulated activity in the Watershed; (ii) to support responsible, environmentally sensitive economic development project by using existing NYCDEP economic development information centers; (iii) to support regional development programs to promote regional economic development interest; (iv) to provide a public relations and tourism development program to target special programs and resources in the Watershed; (v) to make available existing industrial productivity programs to help increase efficiency of new and existing Watershed businesses; and (vi) to enhance existing worker training and skill development programs by providing training courses to build the skills of the Watershed region's labor markets. In order to ensure that there were funds available for economic development, the MOA created the Catskill Fund for the Future. Section 135 of the MOA requires the City to provide $59,745,241.65 as an economic development fund to support qualified economic development projects which is defined

as projects which encourage environmentally sound development and which encourages the goals of Watershed protection and job growth in the Watershed Communities located West-of-Hudson.

The MOA intended to strike a balance between the need for Home Rule and the City's need to protect its water supply. It states as follows:

> Whereas, the parties recognize that the goals of drinking water protection and economic vitality within the Watershed Communities are not inconsistent and it is the intention of the parties to enter into a new era of partnership to cooperate in development and implementation of watershed protection program that maintains and enhance..... the economic vitality and social character of the Watershed Communities;
>
> * * *
>
> Whereas, the parties agree that the City's land acquisition program, the City's Watershed Regulations, and the other programs and conditions contained in this agreement, when implemented in conjunction with one another would allow existing development to continue and future growth to occur in a manner that is consistent with the existing community character and planning goals of each of the Watershed Communities; and that the City's land acquisition goals ensure that the availability of developer land in the watershed will remain sufficient to accommodate projected growth without anticipated adverse effects on water quality and without substantially changing future population patterns in the Watershed Communities;
>
> * * *
>
> Whereas, the parties have agreed to act in good faith and to take all the necessary and appropriate actions, in cooperation with one another, to effect the purposes of this agreement.

The State and DEP, as parties to the MOA, realized that the West of Hudson Watershed Communities were on the decline; the backbone of their economy (farming, logging, manufacturing and tourism) was leaving. The population that remained was struggling, had below average income and was aging. There was insufficient economic activity and population to support restaurants, retail, health care and other basic necessities. As Alan Rosa (former Supervisor of the Town of

Middletown), Len Utter (current Supervisor of the Town of Middletown) and Robert Cross (current Supervisor of the Town of Shandaken) testified, the Towns of Middletown and Shandaken were once thriving communities with active Main Streets. (Trans. 4101-4104, 855-863, 864-875.) As Alan Rosa testified, the communities need a base population to support the basic services (e.g, little league, doctors, churches, funeral parlors, Girl Scouts, dentists, insurance agents, lawyers, restaurants, movie theater). Local governments need a base population to pay for basic local services (e.g., highway maintenance, snowplowing, street lighting, water, sewer, police protection, criminal justice, public health, stormwater). (Trans. 4103.) The State and federal government mandates on local governments (e.g., water supply filtration, road improvements, handicap accessibility, new prisons, new courthouse, additional requirements for police protection and fire protection, education mandates, solid waste management, prevailing wage) generally do not differentiate between rural and urban areas. As a result, despite a fiscally conservative Board of Supervisors, counties like Delaware County have some of the highest per capita property tax rates in the State. In the end, the Watershed Communities agreed to the MOA because it was the best deal that they could negotiate. The Watershed Communities were able to obtain protections in the MOA because the State of New York Department of Health (under Governor George Pataki's leadership) leveraged its approval authority over the Watershed Regulations to force the City to negotiate a partnership that, according to the MOA, would "allow existing development to continue and future growth to occur in a manner that is consistent with the existing community character and planning goals of each of the Watershed Communities."

B. Watershed Regulation Severely Limit the Opportunities for Future Development

Because of the restrictions on sewage disposal and impervious surfaces, the Watershed Regulations significantly influence or effect the size of development and its location within the Watershed. Under the Watershed Regulations, the City controls all forms of sewage disposal. Under the Watershed Regulations, a nonresidential applicant or an existing commercial facility has two options for sewage disposal: (1) an intermediate size subsurface sewage disposal system under Section 18-38; and/or (2) a wastewater treatment plant under Section 18-36. An "intermediate size subsurface sewage disposal system is a subsurface sewage disposal system utilizing a septic tank for subsurface disposal, treating sewage or other liquid waste for discharge to the ground waters of the state and where a SPDES permit is required for such system." (Section 18 –16 (a) (55)). While an intermediate size subsurface disposal system may be practical outside the Watershed, the restrictions imposed on such systems under the Watershed Regulations makes such systems impossible on most commercial lots within the Watershed (Section 18–38(a) and (b)). Outside the Watershed, if you do not have adequate soil to install a conventional trench system, an applicant can install a variety of other system such as intermittent sand filters, galley systems, seepage pits, wide chamber gravelless systems, mounds systems, evaporation-transpiration systems, evaporation-transpiration absorption systems or add some form of pretreatment. (See DOH, Part 75, Appendix 75-A.8, A.9 and A.10.) None of the above options are allowed within the Watershed. Within the Watershed, if you add some form of pretreatment, the system is regulated as a waste water treatment system under Section 18-36 and, thus, becomes cost prohibitive. Intermittent sand filters, galley systems, seepage pits, wide chamber gravelless systems, mounds systems, evaporation-transpiration systems and evaporation-transpiration absorption systems are prohibited within the Watershed Regulations (Section 18-38(b)). Within the Watershed, the soil percolation rates must be faster than three minutes per inch

(Section 18-38(b)); outside Watershed, soil percolation rates only need to be faster than one minute per inch (Part 75-A.4(a)(3)). Within the Watershed, an additional area of at least 100% of the primary absorption field shall be set aside as a reserve absorption field; outside the Watershed, it is recommended that an additional area of 50% be set aside for future expansion or replacement, if possible. (Part 75-A.4(a)(5)). While intermediate size subsurface sewage disposal systems that existed as of May, 1997 are grandfathered, the City takes the position that upon any alteration, modification or failure, the regulations applicable to new system apply. (Section 18-38(a)(8)). Under the Watershed Regulations, the City also takes a position that if the system is not used for a year, the system loses its grandfathered status and the facility cannot reopen without complying with the regulations applicable to new systems. (Section 18-38(a)(9) and 18-27(a)(4)). Since most of the existing commercial lots do not meet the requirements for an intermediate size subsurface to sewage disposal system under the Watershed Regulations (i.e., depth to groundwater, set back from a watercourse, depth to bedrock, maximum slopes, area, soil permeability, percolation rate), many existing businesses are precluded from making any alteration, modifications or changes to their existing facility or business. An alteration or modification includes a change in tenant, an increase in intensity of use or change in the nature of the wastewater. For most property owners of commercial lots, the only technologically feasible alternative is a wastewater treatment system.

Under the Watershed Regulations, a wastewater treatment system is essentially any treatment system that requires a SPDES permit (Section 18-16(a) (110)). The Watershed Regulations define a new wastewater treatment plant in Section 18–16 (a) (110) as "any facility which treats sewage or discharges treated effluent in the Watershed, and which requires a permit under Titles 7 or 8 of Article 17 of the Environmental Conservation Law, installed for the purpose of treating, neutralizing, stabilizing or disposing of sewage by removal of contaminants accomplished by unit operations or

processes or by a combination of such operations and processes, including any combination of the following: preliminary treatment, flow equalization, primary settling, biological treatment, chemical treatment, secondary settlement, filtration, aeration, disinfection, sludge processing, or any other processes as may be applicable to a given design for wastewater treatment plant." Wastewater treatment plants include plants that discharge subsurface and/or to a water course. Section 18-36 of the Watershed Regulations regulates the design and operation of all wastewater treatment plants in the New York City Watershed. With a few minor exceptions, Section 18-36 of the Watershed Regulations subjects the design and operation of all wastewater treatment plants to the same stringent requirements regardless of the flow rate. As a result, any wastewater treatment plant built to meet the requirements of the Watershed Regulations (no matter whether it is serving 10 or 20 homes, a small restaurant, a 30 room hotel or 300 homes) will cost easily in excess of $1 million. (See Exhibit A for a listing from EFC of the costs of the upgrades to existing WWTPs.) Section 18-36(a) (10) requires all existing waste water treatment plants to be upgraded to meet the requirements of Section 18-36 by May 1, 2002 (five years from the effective date of the regulations). The regulatory upgrades are listed in Section 18-36 and, in part, in Section 141 of the MOA. In addition to mandatory effluent limitations, the regulatory upgrades include the following: phosphorus removal, sand filtration, disinfection, microfiltration or an equivalent technology, stand-by power, power alarm, automatic start-up capability, disinfection back-up, back-up sand filtration, recording flow meters, and alarm telemetering. Under DEC regulations, the more equipment, the greater the staffing requirements. Also, under the Watershed Regulations, DEP must review and approve of the design of each new or modified wastewater treatment plant. The cost to design and construct an upgrade to the existing wastewater treatment plant within the Watershed to meet the City Watershed Regulations for the existing facilities is shown on Exhibit A. The cost for a typical household range from a low of approximately $10,000 per residential unit (for a large development with over 300

units) to approximately $125,000 per residential unit (for a small development with approximately 20 units). The operating cost after the upgrade typically increase between 100% to 500%. The cost for small commercial operations (i.e., restaurants, small hotels, small resorts, not-for-profit organizations) is generally much worse. An upgrade for a typical restaurant or small hotel would generally cost in excess of one million dollars. Moreover, under the upgrade program, it has taken, on average, over seven years to design, permit and construct an upgrade for a typical facility.

While Section 141 of the MOA requires the City to fund the cost of the upgrade for facilities that existed in 1997, according to the City, it does not require the City to fund the upgrade (either capital or operating cost) for any modifications, expansions or alterations to an existing private facility or for a new private facility. For example, if an existing facility were to increase its permitted flow, DEP takes the position that the facility has to pay the upgrade portion of the cost associated with the increase in flow including any incremental operating cost.

The net effect of the Watershed Regulations is that small or medium-sized commercial development can take place only where there is an existing publicly owned wastewater treatment plant that has adequate capacity to accept its waste. In the Watershed, there are a few publicly owned wastewater treatment plants (i.e., Pine Hill, Tannersville, Grand Gorge, Margaretville, Village of Hobart ($2,897,407), Village of Stamford ($4,322,699), Village of Delhi ($6,918,000), and Village of Walton ($8,785,996)). The first four are City-owned plants and the City maintains that it decides who may connect to those plants. The last four plants are in Delaware County and, according to Exhibit A, the upgrade costs for those facilities ranged from a low of $2,897,407 to a high of $8,785,996. While the MOA provides funding for the construction of some new wastewater treatment plants in existing hamlets/villages, those wastewater treatment plants are designed to

handle only the existing flow plus 10% and are specifically not funded to address future development. In order to have a development outside an area that is served by an existing publicly owned wastewater plant, the size of the development needs to be on the order of the size of this project in order to overcome the cost to construct and operate a wastewater treatment system that conforms with the Watershed Regulations.

So why do the Watershed Communities believe that the positions taken by DEP, if adopted by Commissioner Crotty in this proceeding, could be the beginning of the end for their communities? First, the City maintains that a project of this size is inconsistent with the community character and the project size should be reduced on that basis. During the issue conference, the experts disagreed on whether the project needs to be of this size in order to be economically feasible and attract a sufficient number of visitors. CPC's expert testified that the communities could survive with small hotels depending on passive tourism (i.e., tourist that come up to the mountains to hike, fish and hunt). The past 30 years of experience suggest that passive tourism is not enough. Moreover, such hotels are not possible unless they are sited in a hamlet served by an existing publicly owned wastewater treatment plant. Very few sites remain to be developed within the hamlet areas. Moreover, visitors to the Catskills want views of the mountains – not Main Street. Second, in this proceeding, the City is demanding a level of analysis for storm water that is cost prohibitive, unprecedented and not necessary to make the requisite regulatory determinations. By demanding this extreme level of analysis, the City is conveying the message to other potential project developers not to come to the Watershed (i.e., the uncertainties about the cost, the approvals and delay will make similar project either cost prohibitive or infeasible). In this proceeding, the positions taken by the DEP with respect to storm water and project alternatives/community character demonstrate that the DEP is not an objective, independent regulatory agency, but rather DEP is an interested party

opposed to the project with the intent of stopping the project in order to protect and enhance the value of its resource (i.e., the water supply). Inconsistent with being an opponent of the project, DEP is also an approving agency/regulator that must issue two approvals for the project including an approval over the storm water pollution prevention plan. In either case, the City is depriving the local communities the opportunity to make their own decision whether a destination resort of this size is consistent with the community character, local zoning and in the best interest of the long-term survival of these communities.

C. Neither the MOA Nor the Watershed Regulations Prohibited Development on Steep Slopes and/or Large Tracts of Undeveloped Land

The Watershed Communities wish to reiterate the point made in their initial Petition for Party Status regarding DEP's comment that in the 1997 MOA:

> Development was to be encouraged in town centers with supporting infrastructure. Growth was not envisioned as appropriate on steep slopes or at locations outside of population centers on large tracts of undeveloped land with mature forests.

DEP DEIS Comments, p.4

As stated in the Petition for Party Status, there is no factual or legal basis for that position. The Watershed Communities understand that DEP has not pressed that position in the Issues Conference nor presented it as an issue for adjudication. Nevertheless it provides the underlying basis for much of DEP's arguments. The Watershed Communities feel very strongly that such a position must be clearly rejected as unfounded and ask for such a ruling from the ALJ in the context of the ruling on issues for adjudication.

The Watershed Communities' position is thoroughly presented in the Petition for Party Status and will not be repeated here. It is sufficient to note that nowhere in the MOA, its attachments, the Watershed Rules and Regulation or the Water Supply Permit can any reference be found which either explicitly or implicitly supports DEP's position. The Watershed Regulations do provide exemptions from the general prohibition of impervious surfaces within 100' of a watercourse for villages and hamlets. 15 RCNY §18-39(a)(3). However, that exemption is a recognition of the existing patterns of development in villages and hamlets which immediately border rivers and streams would, without an exemption, be severely limited.

There are no regulatory restrictions on steep slopes or forested areas. DEP's regulatory authority regarding impervious surfaces and stormwater pollution prevention plans makes absolutely no distinction for the location of the project or the nature of the terrain other than creating thresholds for DEP's jurisdiction. 15 RCNY §18-39. Once DEP's jurisdiction is determined, the standards for approval are not altered by the nature of the project, only by the nature of the watershed basin and whether it is phosphorus or coliform restricted or within the basin of a terminal reservoir. 15 RCNY §18-39(c).

The fact that the MOA and its associated regulations and programs are silent on the issue presented by DEP, is not a mistake. The Watershed Communities were adamant that DEP's authority was limited to water quality protection and could not be used as stealth means of land use controls. Had the intention of the parties been otherwise, there would have been specific statements and provisions to that effect. There are not. Instead all projects, regardless of location are required to meet the same standards for water quality protection, regardless of location on steep slopes or mature forests. Those conditions are accounted for in the design of the stormwater pollution prevention

plans - there are no additional requirements or presumptions presented by the character of the property.

The Watershed Communities respectfully request that the ALJ and the Commissioner soundly reject DEP's attempt to infer an additional regulatory presumption which is contrary to the MOA.

IV. Burden on City/CPC to Meet the Threshold for an Adjudicatory Hearing

The City/CPC (collectively "the Interveners") are seeking an adjudicatory hearing on, among other issues, stormwater and community character impacts. The Interveners are asserting that there is insufficient information in the record for DEC to make findings required by Section 8-0109 of the ECL.

Subdivision 1of ECL Section 8-0109 provides that:

> Agencies shall act and choose alternatives which, consistent with social, economic and other essential considerations, to the maximum extent practicable, minimize or avoid adverse environmental effects
> ...

Subdivision 8 provides that

> When an agency decides to carry out or approve an action which has been subject to an environmental impact statement, it shall make an explicit finding that the requirements of this section have been met and that consistent with social, economic and other essential considerations, to the maximum extent practicable, adverse environmental effects revealed in the environmental impact statement process will be minimized or avoided.

The role of SEQRA in a Part 624 adjudicatory hearing is described in the Interim Decision issued by DEC Commissioner Flack in In re Wilmorite, Inc., Rotterdam Square, 1981 WL 142250 (N.Y.Dept.Env.Conserv.). In that decision, the Commissioner stated as follows:

> In accordance with ECL §70-0119 and [SAPA] Articles 3 and 4, DEC must conduct an adjudicatory hearing on permit applications where issues have been raised by the Department staff or the public, which if resolved, may result in permit denial or the imposition of significant permit conditions. The prospect of permit denial or imposition of significant permit conditions primarily affects the Applicant for a permit. A fair reading of these statutes leads to the conclusion that the opportunity for an adjudicatory public hearing is principally designed to give an Applicant a measure of statutory due process in the consideration of its applications by the Department. It is not intended for a forum for the adjudication of rights between the Applicant and intervening parties.
>
> The scope of the adjudicatory hearing should be limited to the resolution of only contested issues. Where the Department's staff or other parties to the proceeding do not affirmatively raise substantive and significant issues concerning the permit applications, including, where applicable, the [DEIS], there is no need for formal adjudication of the remaining contents of the application.
>
> Where the Department is lead agency under the [SEQRA], it must also, in addition to deciding on issuance of permits, seek comments on the DEIS, and insure that responses to those comments are contained in its [FEIS] regarding the project. Nothing in ECL Article 8 or the SEQR regulations . . . requires the Department [or any other agency] to utilize the adjudicatory hearing forum for purposes of resolving or responding to comments on the DEIS. In fact, at both the State agency and local government levels, most SEQRA hearings are legislative in form.
>
> However, because SEQR is also a substantive statute requiring the Department to make the findings required by ECL §8-0109.8 and 6 NYCRR 617.9 [now 617.11], issues arising under SEQR which may lead to permit denial or the imposition of significant conditions must be subject to actual adjudication if SAPA's due process requirements are to be met . . .

As stated above, SEQRA is integrated into the Part 624 Adjudicatory hearing only to the extent that mitigation conditions may be imposed (or the permit denied) as part of the findings required by ECL §8-0109.8. Under 6 NYCRR §624.4(b), issues to be adjudicated are limited to those identified as "substantive and significant." Section 624.4(c)(6)(i) provides that

> In determining issues to be adjudicated, the sufficiency of the DEIS and the DEC's commensurate ability to make findings required by §617.11 are appropriate subjects for the adjudicatory hearing. In situations where the Department staff has reviewed an application and find that a component of the applicant's project, as proposed or as conditioned by the draft permit conforms to all applicable requirements of the statute and regulation, the burden of persuasion is on the potential party proposing any issue related to that component to demonstrate that it is both substantive and significant.

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. In determining whether such a demonstration has been made, the ALJ must consider the proposed issue in light of the application and related documents, the draft permit, the content of any petitions filed for party status, the record of the issues conference and any subsequent written arguments authorized by the ALJ." See 624.4(c)(2). To determine whether an issue is significant, the Intervener must demonstrate that the issue in dispute "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."

As a result, the issue in this proceeding is whether, in light of the Application and related documents, the draft permit, the petitions for party status, the issue conference record and any subsequent written arguments authorized by ALJ Wissler, the DEC Commissioner has sufficient

information to make the required findings, if any, that the significant adverse impacts to community character and/or that significant adverse impacts from stormwater have been mitigated to the extent practicable consistent with social, economic and other essential considerations.

In making this determination, there are a number of Black Letter Principles that define the DEC's obligation with regard to mitigation findings. The Black Letter Principles can be found in the treatise: Environmental Impact Review in New York, Gerrard, Ruzow, Weinberg, Chapter 6.

1. The adjudicatory hearing is a due process right to protect the Applicant's and Intervener's rights under SAPA. The adjudicatory hearing process should not be used as a means by project opponents to stop a project by causing undue delay and expense.

2. SEQRA does not change the existing jurisdiction of agencies nor the jurisdiction between or among State and local agencies (6 NYCRR §617.3(d)).

3. SEQRA requires that any conditions that mitigate adverse environmental impacts to the extent practicable consistent with social, economic and other essential consideration must also be "practicable and reasonably related to the impacts identified in the EIS." (6 NYCRR §617 3(b)).

4. Only significant impacts need to be considered in an EIS and thus only significant impacts are subject to mitigation. Merson v. McNally, 90 N.Y.2d 742, 751 (1997) ("the purpose of an EIS is to examine the identified potentially significant environmental impacts which may result from a project"; West Village Comm. Inc. v. Zagata, 242 A.D.2d 91 (3d Dep't), lv. to

appeal denied, 92 N.Y.2d 802 (1998) (the purpose of an EIS is to examine the identified potentially significant environmental impacts which may result from a project, not every conceivable impact").

5. Courts will give great deference to an agencies exercise and discretion in determining the need for and the appropriate mitigation measures. Lucas v. Planning Bd. of Town of LaGrange, 7 F.Supp.2d 310, 322 (S.D.N.Y. 1998) (agencies have "considerable latitude in the exercise or discretion for substantive environmental decisions"); Town of Henrietta v. Department of Envtl. Conservation, 76 A.D.2d 215, 222 (4th Dep't 1980) ("thus, a general substantive policy of the act is a flexible one. It leaves room for responsible exercise of discretion . . .)."

6. Mitigation measures must relate to the particular project under consideration. (City of Rye v. Planning Comm'n, Village of Port Chester, N.Y.L.J., Dec. 6, 2000 at p.36, col. 3 (Sup. Ct. Westchester County).

7. It is up to the lead agency to decide, subject to the rule of reason, which mitigation measures to impose. The agency must employ a rule of reason, taking a hard look at and consider potential mitigation measures. Jackson v. New York State Urban Dev't Corp., 67 N.Y.2d 400, 422 (1986) (the agency must, "employing a rule of reason, take a hard look at and consider potential mitigation measures"); West Branch Conservation Ass'n, Inc. v. Planning Bd. of Town of Clarkstown, 207 A.D.2d 837 (2d Dep't 1994), lv. to appeal dismissed, 84 N.Y.2d 1019 (1995) (Town Planning Board "studies the EIS, hears the public commentary and works with the developer and the community to determine which method would most

successfully mitigation each environmental impact in question"); Save the Pine Bush, Inc. v. Planning Bd. of City of Albany, 298 A.D.2d 806, 808 (3d Dep't 2002).

8. Not every conceivable mitigation measure must be identified and addressed before an FEIS will satisfy the substantive requirements of SEQRA. Aldrich Pattison, 107 A.D.2d 258, 266 (2d Dep't 1985); Fornial v. Town of New Hartford, No. 97-2634, slip op. at 9 (Sup. Ct. Oneida County Jan. 7, 1998) ("there is nothing in SEQRA which mandates perfect mitigation . . .").

9. With respect to mitigation, SEQRA does not compel particular outcomes. Fornial, No. 97-2634, slip op. at 7 (upholding zoning changes in EIS for commercial development as against claims that traffic and other mitigation measures were inadequate).

10. Dissatisfaction with an agencies proposed mitigation measures is not redressable by the courts so long as those measures have a rationale basis in the record." Jackson v. New York State Urban Dev't Corp., 67 N.Y.2d at 421; Space v. Hurley, No. 6549/00, slip op. at 4 (Sup. Ct. Rockland Co. Nov. 17, 2000) ("although the Rockland County drainage agency would have preferred to see final plans before the respondents determination [permitting a golf course], the court finds sufficient basis for the negative declaration in respondents plan to use retention basins and to use buffers around existing ponds in order to minimize erosion and siltation").

11. "It is not the role of the courts to weigh the desirability of any action or chose among alternatives. Dissatisfaction with an agencies choice is not redressable by the courts, where

. . . those choices have a rationale basis in the record." Residents for a More Beautiful Port Washington v. Town of North Hempstead, N.Y.L.J. Sept. 1, 1988, at p.21, col. 4 (Sup. Ct. Nassau Co), aff'd, 149 A.D.2d 266 (2d Dep't 1989) (citations omitted).

12. Whether an action comports for local zoning law is not an issue to be resolved under SEQRA review. SEQRA states that its provisions do not change jurisdiction between and among state agencies and public corporations. In re Dutchess Sanitation Service, Inc., 1980 WL 103092 at 1 (N.Y.Dept.Env.Conserv.); Town of Poughkeepsie v. Flacke, 84 A.D.2d 1, 5 (2d Dep't 1981), appeal denied, 57 N.Y.2d 602 (1982) ("SEQRA was not intended to and did not pre-empt nor in any way interfere with the zoning ordinance").

13. DEC has consistently expressed the view that its "policy is not to interfere with local land use decisions. [I]n the context of a DEC hearing including SEQRA issues, it is the responsibility of local government officials to see the record is developed which adequately reflects zoning policies and practices in the effected locality." In re Pyramid Crossgates Co., 1980 WL 103087 at 1 (N.Y.Dept.Env.Conserv.).

V. DEP/CPC Have Not Met Their Burden of Persuasion with Respect to the Issue of Stormwater.

CPC and DEP both assert that adverse impacts from stormwater are significant and have not been adequately mitigated by the draft permit and the mitigation measures proposed by the Applicant. In order for stormwater impacts to become an adjudicable issue, CPC and DEP must present sufficient evidence to raise a disputed factual issue as to whether the record, as supplemented during the issue conference, fails to contain sufficient information for the DEC Commissioner to

issue a finding that the project, as proposed by the applicant and restricted by the draft permit prepared by the Department's staff, mitigates any significant adverse impact from stormwater, to the extent practicable, consistent with social, economic and other essential considerations and, as a result, additional significant and substantive conditions (or permit denial) may have to be added to the draft permit.

There are two types of stormwater impacts regulated by the Department: (1) Stormwater impacts during construction; and (2) stormwater impacts post construction. The Department now has a comprehensive and established regulatory structure for regulating both types of stormwater impacts. Currently, stormwater is regulated by the department under General Permit 02 01 (hereinafter referred to as "Phase II General Permit"). (App. Ex.40.)

Stormwater impacts during construction are regulated by requiring that the Applicant and/or the Applicant's engineer prepares an erosion control plan to prevent stormwater containing soil to impact surface water during the construction process. The erosion control plan must be developed in accordance with the guidance documents incorporated in to the Phase II General Permit. (App. Ex.37). The guidance document sets forth the best management measures that can be implemented during construction to minimize stormwater runoff containing soil. Different engineers will select different control measures; no one control measure is required. Under Phase II General Permit, the Applicant is required to certify to the Department that the Applicant has an erosion control plan developed in accordance with the applicable guidance. The Department reviews the submission to determine whether the plan was developed in accordance with the applicable guidance. If the Department is not satisfied with the information submitted, the Department may require additional

information and/or may subject the project to an individual SPDES permit. In the overwhelming majority of projects, the Department relies on the professional judgment on the Applicant engineer.

Stormwater impacts post construction are regulated under Phase II General Permit by the requirement of a storm water pollution prevention plan (hereinafter referred to as "SPPP"). The objective of the SPPP is to mitigate the post construction of stormwater consistent with generally accepted best management practices. The best management practices are intended to reduce the phosphorus loading in the stormwater by 40% and to reduce the TSS concentration by 80%. The SPPP also contains measures to ensure that the stormwater from a severe storm does not pose a threat to surface waters or downgradient facilities. The SPPP must be prepared in accordance with the referenced guidance documents. The guidance documents identify the available control measures and provide the details for the design and sizing of those measures. Different engineers will select different control measures; no one control measure is required or specified. Under Phase II General Permit, the Applicant is required to certify to the department that the Applicant has an SPPP developed in accordance with the applicable guidance. The Department reviews the submission to determine whether the plan was developed in accordance with the applicable guidance. If the Department is not satisfied with the information submitted, the Department may require additional information and/or may subject the project to an individual SPDES permit. In the overwhelming majority of projects, the Department relies on the professional judgment on the Applicant engineer.

Under the Phase II General Permit, the Applicant submits a notification with details regarding its SPPP and erosion control plan. The Applicant must wait a specified time period (ranging from 5 to 60 business days) before commencement of construction. If by the end of the waiting period, the Applicant does not receive notification from the Department that additional information is

required, the Applicant may proceed with the project. If the project does not require any other Department permit, the Applicant's participation under the Phase II General Permit is considered the Type II Action under SEQRA and does not require any SEQRA review.

Under Phase II General Permit, there are generally no monitoring requirements or post construction testing requirements to confirm the adequacy of the measures. Under Phase II General Permit, the Applicant's obligation is to implement the SPPP in accordance with its terms and conditions and not to cause a contravention of the water quality.

In this proceeding, the Department staff elected not to allow the Applicant to proceed under Phase II General Permit and required the Applicant to obtain an individual SPDES permit for both projects. The draft individual permit regulates all aspects of the storm water management. It requires a best management practice plan to prevent the spill and/or release of any chemical to groundwater or surface water. It specifically requires the highest standards for the application of pesticides and fertilizers. It requires monitoring the water quality in the stormwater detention ponds for pesticides on a regular basis. It requires monitoring of water quality in the groundwater and monitoring of surface water quality both upgradient and downgradient on a regular basis. It regulates the types of pesticides that may be used on the golf course. It also regulates the types of chemicals that may be used to enhance the settlement in the detention ponds. In addition, it requires effluent toxicity test on the water from the stormwater detention basins three times each year within two weeks of the seasonal application of pesticides. It specifies a maximum annual phosphorus load from stormwater and requires sampling to confirm that the limit is not exceeded. It requires the Applicant to prepare and submit to the Department for approval at the appropriate time the SPPP. It regulates the

Applicant use of the effluent from the wastewater treatment plant as irrigation water for the golf course.

CPC and DEP offered the testimony of several experts on the stormwater issues. In general, their objections and/or comments can be summarized as follows: (i) the Applicant has not properly evaluated the potential stormwater impacts; (ii) nor has the Applicant proposed appropriate stormwater pollution control measures; (iii) the Applicant has underestimated the pollutant loading; (iv) the Applicant has used the incorrect models to evaluate stormwater impacts; (v) the Applicant must demonstrate that there will be no net increase of phosphorus between preconstruction conditions and post construction conditions; (vi) the Applicant must provide detailed plans of the stormwater pollution control measures at this stage in the process in order to make the requisite findings under SEQRA; (vii) the potential erosion impacts of this project are catastrophic; and (viii) the stormwater retention basins are undersized. As indicated below, none of these positions meet the evidentiary threshold for triggering an adjudicatory issue. Below, this memorandum addresses each of the comments identified above and explains why the comment fails to meet the threshold trigger adjudication.

CPC and DEP's position: **The Applicant has not properly evaluated the potential stormwater impacts.** SEQRA does not require perfection in quantifying the stormwater impacts. Rather, SEQRA requires that the stormwater impacts be identified sufficient to make a determination whether there are significant adverse impacts and, if so, to make a reasoned determination of the appropriate mitigation measures. Additional evaluation of potential stormwater impacts is not necessary to select the appropriate mitigation measures.

CPC and DEP's position: **The Applicant has not proposed appropriate stormwater pollution control measures.** SEQRA does not mandate the selection on specified mitigation measures and SEQRA allows the Department to use its discretion in selecting an appropriate mitigation measure. A court will sustain a selected mitigation measure provided there is a rational basis for the selection. While different engineers may select different control measures, SEQRA does not require academic debate regarding which measure will be more effective.

CPC and DEP's position: **The Applicant has underestimated the pollutant loading.** The Applicant and DEP have provided numerous estimates as to the pollutant loading. Regardless of the estimates selected, the pollutant loading from this project is not significant and the mitigation measures selected to mitigate the pollutant loading would not be altered. An estimate of the pollutant loading is necessary for the department to modify the TMDL for phosphorus for both the Ashokan and in Pepacton Reservoirs. The draft permit requires the applicant to conduct sampling in the receiving stream to confirm that the pollutant loading has not been exceeded. If the Applicant has underestimated the pollutant loading and that underestimation is incorporated in to the draft SPDES permit, the Applicant is at risk of exceeding the mass loading limitation in the draft SPDES permit. As a result, the Applicant took a very conservative approach to the estimates for phosphorus loadings. DEC staff was satisfied with the accuracy of the estimates for purposes of this proceeding.

CPC and DEP's position: **The Applicant has used the incorrect models to evaluate stormwater impacts.** At the present time, the hearing record is complete with numerous evaluations and modeling of the stormwater impacts. Modeling was performed both by or on behalf of DEP and the Applicant. Regardless of which modeling results are used, the draft permit conditions remain unaffected.

CPC and DEP's position: **The Applicant must demonstrate that there will be no net increase of phosphorus between preconstruction conditions and post construction conditions.** DEP admits that this is not a requirement of the Phase II General Permit. DEP asserts that this is a requirement of their own regulations because their regulations incorporate DEC Phase I General Permit. Neither EPA nor DEC take the position that this is a requirement of Phase I General Permit. In fact, DEC made it absolutely clear that the "no net increase" is not a requirement of the Phase I General Permit (Trans. 4643). Neither CPC and DEP have provided any evidence that "no net increase" is either practical or necessary.

CPC and DEP's position: **The Applicant must provide detailed plans of the stormwater pollution control measures at this stage in the process in order to make the requisite findings under SEQRA**. The SEQRA statute and the SEQRA regulations make clear that compliance with SEQRA is to be done at the earliest possible time in the application process. SEQRA compliance is the critical first step in the permitting process. Once SEQRA is addressed, the Applicant and the involved agency can proceed with the local permit approvals. During the local permit approvals, the application may be denied or significantly modified. To the extent that the project is modified based upon local requirements imposed by the Town Board and/or Planning Board of Middletown and/or Shandaken, the details on the SPPP may change. As result, a conceptual plan for the SPPP measures is necessary at this stage to ensure that the SPPP is feasible; the final actual design details must wait until the local approvals have been obtained. DEC staff has testified that there is sufficient information now to confirm that the project can meet applicable standards and that detailed design documents can wait to later in the permit process.

CPC and DEP's position: **The potential erosion impacts of this project are catastrophic.** The draft permit contains a variety of requirements to reduce the potential for a catastrophic failure. Neither CPC nor DEP have identified additional reasonable and practical measures consistent with social, economic and other essential considerations that could be implemented to reduce the potential for a catastrophic failure.

CPC and DEP's position: **The stormwater retention basins are undersized.** The department staff now has access to all the information relating to whether the stormwater retention basin is properly sized. The Department staff has made an informed decision that it has sufficient information at this point in time to evaluate the sizing of the detention basin sufficient for SEQRA purposes. In other words, there is sufficient information to know that stormwater detention basins can be designed and be of adequate size to manage the stormwater from this project.

In making a determination whether to identify stormwater as an adjudicable issue, the Watershed Communities requests that the Department consider the following:

A. Upon information and belief, the level of stormwater protection required under the draft permit exceeds the level required for any other golf course or hotel establishment in New York State. Scott Clark of Burton F. Clark, Inc., the contractor that will be installing the golf course, testified that the cost of the stormwater controls on this project exceeds the cost for constructing an entirely new golf course elsewhere (Trans. 1735-1736.)

B. Obtaining approval to operate under Phase II General Permit, by itself, is not considered a discretionary approval under SEQRA.

C. Under the Phase II General Permit, DEC does not require approval over each individual SPPP, rather Applicants submit notification with a description to its plan and the Department reviews the submittal with the option of requiring more information or a site specific approval. In the overwhelming majority of cases, DEC does not provide comments to the submissions.

D. DEP requires under the Watershed Regulation, a separate stormwater pollution prevention plan drafted in accordance with GP-93-06. DEP retains individual site specific approval over the SPPP as part of its permit process. DEP is free, as part of its permit process, to require significant additional measures to mitigate stormwater impacts; the applicant should, however, qualify for future stormwater funding from CWC for any measures required by DEP that were not otherwise required under state law.

E. Neither the Pepacton nor the Ashokan exceed a TMDL for phosphorus. In both cases, the TMDL analysis performed by DEP for DEC and approved by EPA indicates that there is adequate expansion capacity for phosphorus (Ashokan 8,000 kg) and (Pepacton 33,000 kg) (Watershed Communities Ex. 4 and 5, Trans. 3263). Nonetheless, both these watersheds have a TMDL for phosphorus even though they are not impaired for phosphorus. In the draft permit, DEC has provided a specific limit for phosphorus loading from stormwater and will require the Applicant to

conduct periodic surface water monitoring upstream and downstream of the project to ensure that the allocation is not exceeded.

F. The permit specifically restricts the pesticides that can be used, requires monitoring for pesticides in the stormwater basins and groundwater and requires a BMP for pesticides, herbicides, fungicides and fertilizers that incorporates industry practices such as Integrated Turf Management Plan and Fertilizer and Pesticide Risk Assessment (FPRA), both as Appendices 14 and 15, respectively, of the DEIS, accepted by the Department on November 26, 2003, chemical application rates and methods, use of non-synthetic or "organic" fertilizers and pesticides, employee training, inspections and records, preventative maintenance, good housekeeping, materials compatibility and security, and structural measures such as storm water retention ponds, constructed wetlands, and erosion/sediment control devices and practices, where appropriate. The permittee shall make every attempt to meet the substantive operational requirements of the Gold Signature Certification Program under the Audubon Cooperative Sanctuary Program for Golf Courses (ACSP, administered by The Audubon Society of New York State, Inc.)

G. The draft permit requires effluent toxicity testing requirements in the stormwater detention ponds three times per calendar year, with each sampling occurring within two weeks of the application periods.

H. The turbidity and phosphorus loadings from this project are minuscule in comparison to a typical dairy farm (six healthy cows (Trans.3260)) and the turbidity and

phosphorus load to the Ashokan from the City's Shandaken Tunnel. (Watershed Community Ex. 17 and 18.) Dean Frazier testified that DCAP anticipates a 7,000kg/yr. reduction in phosphorus loadings from two programs being initiated by Delaware County to reduce phosphorus from cow manure. (Watershed Communities Exh. 8, 9, Trans. 3241-3265.) The draft permit for the Shandaken Tunnel will allow DEP to add 10,400 kg/yr of phosphorus to the Ashokan. Yet DEP has to date, refused to install an intake in the Schoharie Reservoir that would substantially reduce the phosphorus loading.

I. The MOA provides a comprehensive plan for water quality protection in the West-of-Hudson Watershed sufficient to demonstrate to EPA that the unfiltered water supply will meet applicable drinking water standards for filtered water. Nothing in the MOA prohibited this project or projects of this type. Nothing in the MOA or DEC regulations requires existing golf courses (that are not being modified) to implement the stormwater mitigation measures for pesticides, herbicides and fertilizer.

VI. The MOA, Article 11 of the Public Health Law and this Proceeding.

At the issue conference on June 25, 2004, the Watershed Communities' attorney Kevin Young explained the history of Public Health Law Article 11 and its relationship to this proceeding. (Trans. pg 2427-2439.) Administrative Law Judge Richard Wissler requested that Mr. Young supplement his offer of proof with a written summary providing documentary support for his oral testimony. That written summary is provided below.

Article 11 of the Public Health Law is an city's statutory authority for its Watershed Regulations. Article 11 allows the City to promulgate *extraterritorial* regulations to protect its water supply provided those regulations are promulgated in accordance with certain procedures and approved by the New York State Department of Health.

As consideration for that *extraterritorial* authority, Public Health Law §1105 (1) provides, in relevant part, as follows:

> [A]ll persons whose rights of property are *injuriously affected* by the enforcement of any ... rule or regulation [of NYCDEP made under the provisions of Article 11 of the Public Health Law], shall have a cause of action against the municipality or corporation ... for *all damages* occasioned or sustained by such ... enforcement, including *all injuries caused to the legitimate use or operation of such property*.

When the Legislature granted the City the power to exercise *extraterritorial* authority over the Watershed (PHL §1100), it did so on the condition that the City pay for any injury caused to property rights (PHL §§1104 - 1105). See, e.g., Loft Corp. v. City of New York, 218 N.Y.L.J. 22 (Putnam County Sup Ct.), rev'd on other grounds, 260 A.D.2d 549 (2d Dep't), lv. to appeal denied, 94 N.Y.2d 757 (1999). In fact, "[t]he obligation to compensate for all damage or injury has historically always been a part of the Watershed enabling acts." Id. at p.8 (and legislative history summarized therein). The New York Court of Appeals long ago held that the City cannot ignore its obligation to pay for damages to affected property in the Watershed, because the City's exercise of power over the watershed was specifically conditioned on this Legislatively imposed duty to pay. See Burhans v. City of New York, 198 N.Y. 439, 446 (1910).

The Legislature's determination to expose the City to damage payment obligations was well-founded. More specifically, PHL §1105 serves as an intended and important check on the exercise

of the City's power over the watershed, which lies outside its territorial limits. Absent full enforcement of PHL §1105, the City has no reason to take genuine account of private property interests in its enforcement of the Watershed Regulations, particularly since most, if not all, of those property interests are held by non-residents of the City and to whom the City has no accountability.

Because PHL §1105(1) gives holders of property rights a remedy for injury caused by the City's extraterritorial enforcement of the 1953 and 1997 Watershed Regulations, a remedy that goes beyond what was available at common law or under the U.S. Constitution, it is a remedial statute. See, e.g., McKinney's Cons. Laws of N.Y., Book 1, Statutes §§35 and 321. See also In re Commitment of Marino S., 293 A.D.2d 223 (1st Dep't 2002), lv. to appeal granted, 99 N.Y.2d 505, aff'd, 100 N.Y.2d 361, cert. denied, 540 U.S. 1059 (2003) (holding that a statute is remedial if it provides a new remedy); and Mendler v. Federal Ins. Co., 159 Misc.2d 1099 (New York County Sup. Ct. 1993) ("Remedial statutes are designed to correct imperfections in prior law, give relief to aggrieved parties and to promote justice").

As a remedial statute, PHL §1105(1) must be "liberally construed, to spread [its] beneficial result as widely as possible" and "to promote justice." McKinney's Cons. Laws of N.Y., Book 1, Statutes §321, p. 490 (quoted with approval in Weingarten v. Board of Educ. of the City School Dist. of the City of New York, 3 Misc.3d 418, 426 (2004)). Such a liberal construction "is one which is in the interest of those whose rights are to be protected" McKinney's Statutes §321, p. 491.

In order to bring a claim under PHL §1105(1), therefore, a claimant need only show that (1) they are persons with "rights of property," (2) that those property rights were "injuriously affected," and (3) that this injury was caused by the City's enforcement of rules or regulations promulgated

under Article 11 of the Public Health Law. Once a claimant satisfies these three factors, they are entitled to recover "all damages occasioned or sustained by such ... enforcement." PHL §1105(1). Such damages may include, but are not limited to, "all injuries caused to the legitimate use or operation of such property." PHL §1105(1). To understand Section 1105, one needs to know its legislative history. The statutory history is attached in a separately bound Appendix.

In 1885, the New York State Legislature adopted Chapter 543, the predecessor to what eventually became PHL §§1100-1105. Chapter 543 was "AN ACT to confer upon the state board of health power to protect from contamination, by suitable regulations, the water supplies of the state and their sources." Appendix A.

By this original enactment, the State Board of Health was "empowered to make rules and regulations for protecting from contamination any and all public supplies of potable waters and their sources within this state." (Sec. 1) Provision was also made for a determination of violations and the imposition of penalties (Sec. 4-6). Most notably, however, Section 7 of the Act provided that whenever execution of the regulations of the State Board of Health "required the providing of some public means of removal or purification of sewage, the municipality or corporation owning the water-works benefitted thereby" was required to "construct or maintain such works or means for sewage disposal." This is the genesis of PHL §1104 as it currently exists today.

Five years later, in 1890, Section 7 of Chapter 543 was amended to expand its scope; these amendments provided, in relevant part, that whenever execution of the regulations of the state board of health (1) required or made necessary "the construction or maintenance of any system of sewerage, or a change thereof" the municipality or corporation owning the water-works benefitted

thereby had to incur the expense of constructing and maintaining such system of sewerage; or (2) occasioned or required the removal of any buildings, the municipality or corporation owning the water-works benefitted thereby had to pay for such removal and also had to "pay to the owner thereof all damages occasioned by such removal"; or (3) "will injuriously affect any manufacturing or industrial enterprise which is not a public nuisance," the municipality or corporation "shall pay all damages occasioned by the enforcement thereof." Appendix B.

The 1890 Amendments contained an additional provision, however, that extended the relief available to all parties injuriously affected by any of the regulations adopted thereunder. That provision was appropriately subtitled: Right of Action for Damages. More specifically, the 1890 Amendments added the following provision:

> And the owner or owners of any building, the removal of which is occasioned or required or has been removed by *any rule or regulation of the state board of health made under the provisions of this act, and all persons whose rights of property are injuriously affected by the enforcement of any such rule or regulation*, shall have a right of action against the municipality or corporation owning the water-works benefitted by the enforcement of such rule or regulation, for *all damages occasioned or sustained by such removal and enforcement of the said rule or regulation or either*...

(emphasis added).

The 1890 statute specifically provided for the recovery of damages occasioned by *either* the removal of a building *or* enforcement of a rule or regulation made under the provisions of the act. The Act was amended yet again in 1893, at which time it was broken down into Sections 70-74 of the PHL. (Appendix C). The new Section 72 essentially contained the Right of Action for Damages provision quoted above with one notable exception. The damages provision was amended to provide for the recovery of "all damages occasioned or sustained by such removal *or* enforcement" rather than for the recovery of "all damages occasioned or sustained by such removal *and* enforcement of

the said rule or regulation *or either*." This change, therefore, made it clearer that damages occasioned by enforcement of a rule or regulation were recoverable based solely on enforcement.

The next amendment to §72 came in 1904, but simply changed "state board of health" to "state department of health." (Appendix D). Then, in 1906, §72 was amended to omit the language referring to the payment of damages whenever enforcement of the regulations "will injuriously affect any manufacturing or industrial enterprise which is not a public nuisance" and substituted in its place language requiring the payment of "just and adequate compensation" for property "taken or injured" if the execution of the state's rules or regulations requiring construction or maintenance of a sewerage system "injuriously affect any property." (Appendix E at p. 1524). Section 72 continued to contain the Right of Action for Damages provision – that provision was not altered in 1906.

In 1909, Section 72 became Section 73 of the PHL but otherwise its language remained the same. (Appendix F at p. 3044). Then, in 1911, the PHL was amended yet again, this time to empower the City – for the first time - to "make such rules and regulations subject to the approval of the state department of health for the protection from contamination of any or all public supplies of potable waters and their sources within the state where the same constitute a part of the source of the public water supply of said city." (Appendix G (Section 70)). This amendment necessitated that Section 73 also be amended to make reference to the execution of the City's rules and regulations and the recovery of damages in connection therewith. Although other changes were made to the statutory language, most notable is the Legislature's expansion of recoverable damages under the Right of Action for Damages provision to specifically include "all injuries caused to the legitimate use or operation of such property." (Appendix G at p. 1831).

The next major amendment occurred in 1953, when the Legislature finally separated Section 73 into two sections, PHL §§1104 and 1105. Section 1104 was drafted to address the consequences and ramifications from "orders or regulations the execution of which will require or make necessary the construction and maintenance of any system of sewerage, or a change thereof" or "which will require the providing of some public means of removal or purification of sewage." (Appendix H). Section 1105, on the other hand, encompassed the Right of Action for Damages provision and provided a claim for injuries arising from the enforcement of "any rule or regulation of the department, or the commissioner of water supply, gas and electricity of the city of New York, or the board of water supply of the city of New York, *made under the provisions of this article*."

In the negotiations of the MOA, the Coalition attempted to require the City to comply with its obligations under Public Health Law Sections 1104 and 1105. In a September 27, 1993 Declaratory Ruling issued in response from a petition from the Coalition, the New York State Department of Health issued a declaratory ruling interpreting Public Health Law Section 1104 to include as part of the City's payment obligation any and all costs incurred by a public entity to comply with the city's regulations relating to sewage. That Declaratory Ruling was upheld by the Albany County Supreme Court in City of New York v. New York State Dep't of Health, 164 Misc.2d 247 (Albany County Sup. Ct. 1995). The 1993 Declaratory Ruling was incorporated into the MOA as Exhibit UUU and pursuant to section 172 of the MOA, City agreed not to pursue any further appeals with respect to the 1993 Declaratory Ruling. Under the MOA, the City of New York provided CWC (the Catskill Watershed Corporation) with funds to reimburse property owners for the cost of compliance with the stormwater regulations (section 128 and 145), the restrictions for sand and salt storage facilities (section 126), septic systems (section 124), alternative designs septic systems (Section 129) and wastewater treatment plant upgrades (sections 141, 142, 143). In order

to be eligible for stormwater funds or wastewater treatment of grant funds, a property owner must demonstrate that the additional requirements were due solely to the Watershed Regulations and were not otherwise required under state and federal law.

How does all this relate to this proceeding? In this proceeding, through its comments and positions on the stormwater impacts from this project, the City is attempting to establish an impossible standard for stormwater management under State law - not the Watershed Regulations. To the extent that these repetitive stormwater investigation and measures are required under state law, the Applicant will not be eligible for funding under Section 128 of the MOA "West of Hudson Future Stormwater Controls Fund") nor will the Applicant be eligible for funding under Section 1105 of the Public Health Law. In this proceeding, under the mantra "the drinking water supply for 9 million people," the City is demanding cost prohibitive and unnecessary level of the stormwater investigation and mitigation (or complete denial) under the vague authority of SEQRA and, thus avoiding the legislative purpose of Article 11 of the Public Health Law (i.e., extraterritorial regulatory protections can only be done through a rule making under Section 1101 and with the compensation required under Sections 1104 and 1105). This is not the first time that the City has attempted to use State law as a basis to escape its obligation to pay for treatment.

In 1924, the City, Town of Hunter and Village of Tannersville entered into an agreement for the construction and operation of sewer lines and sewage treatment plant to serve the Village of Tannersville and parts of the Town of Hunter. In the 1970s, a dispute arose over the duration of the agreement and the City's obligation to continue to operate the plant. The City argued that it no longer had an obligation to operate the plant because, at that time (in comparison to 1924), state law

prohibited the disposal of raw sewage into the stream. In its papers to the Court of Appeals, City's Corporate Counsel for the City W. Bernard Richard argued as follows:

> In 1924, the City, acting through the Commissioner of the Board of Water Supply,[1] signed the instant agreement with the Town and the Village. The purpose of the agreement was 'to provide for the sanitary protection of the water supply system of the City of New York' (preamble to the enabling legislation, Laws of 1923, C. 630). The agreement was necessary to effect this purpose because it was executed at a time when there was no enforceable restraints on polluters of state waters. This situation has been altered by state statutes and regulations which now require polluters of state waters to assure (and pay for) water purity (see p.9, supra). Thus, if the City now were to cease its operation of the sewage system, the Town and the Village would have to assume the responsibility of assuring that their sewage does not reach Gooseberry Creek. For this reason, as well as because the initial system is now insufficient to meet Town and Village sewage treatment needs, the City seeks to abandon the sewage system. It is the City's contention that the agreement permits such abandonment.

(A copy of the City's Memorandum of Law to the Court of Appeals is attached to the Appendix at I.). The Court of Appeals disagreed with the City's interpretation of the agreement and held that the City had an obligation to operate the plant as long as the City was withdrawing water from the Schoharie Reservoir. Haines v. Town of Hunter, City of New York, 41 N.Y.2d 769, 773 (1977). The Coalition has intervened in this proceeding to prevent the City from escaping its responsibility to pay the incremental costs arising from the implementation of its stormwater regulations.

VII. Community Impacts

In the definition of the term environment, SEQRA includes "existing patters of population concentration, distribution or growth, and existing community or neighborhood character." ECL §8-

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[1] The Board of Water Supply was established pursuant to Chapter 724 of the Laws of 1905

0105(6). In Section 8-0103(7), the statue identifies as an part of the intent of SEQRA the"protection and enhancement of the environment, human and community resources shall be given appropriate weight with social and economic considerations in public policy. Social, economic and environmental factors shall be considered together in reaching decisions of proposed activities."

In determining whether there is a significant impact on community character, Sections 617.7(c)(1)(iv) and (v) identifies the significance criteria as: (1) the creation of material conflict with the communities current plans [and goals] as officially approved or adopted;" and (2) "the impairment of the character or the quality of . . . existing community or neighborhood character." In other words, in order for there to be a significant impact on community character, it must either be a material conflict with an existing community plan or the proposed project must impair the character or quality of the community character. Only significant adverse impacts must be mitigated under SEQRA.

In making decisions on community character, DEC gives deference to local land use plans. In re St. Lawrence Cement Company, LLC (DEC Comm'r Decision, Sept. 8, 2004); In In re Miracle Mile Associates, 1979 WL 33483 at 3 (N.Y.Dept.Env.Conserv.), the Commissioner stated: The Department will not intrude its judgment . . in matters which have been properly been the subject of definitive local government determinations of pattern of land use through comprehensive planning and resulting in implementation of local development goals." See also In re Onondaga Valley Farms, Inc., 1982 WL 25862 at 2 (N.Y.Dept.Env.Conserv.); In re Palumbo Block Co., 2001 WL 651613 (N.Y Dept.Env.Conserv.) (identifying community character as an issue for adjudication in connection with a permit for a proposed sand and gravel mine, the Commissioner stated "as local entities are most impacted by physical changes in land use, this Department must necessarily give

great weight to their adopted plans when performing SEQRA as required balancing tests particularly in the absence of state-wide concerns or interests."

As was determined by the Commissioner as most recently in the St. Lawrence Cement case, community character should not be a separately adjudicable issue, but should be considered in the context of other issues which may be adjudicated (i.e., visual, open space and the impacts to the forest preserve). Clearly DEP's limited jurisdiction regarding water quality protection does not confer standing to adjudicate community character. While CPC may have standing to raise the issue, it is not amenable to separate adjudication and will be considered by DEC in the final determination after giving due deference to Middletown and Shandaken's local land use plans.

Dated: December 23, 2004
Albany, New York

Respectfully submitted,

YOUNG, SOMMER, WARD, RITZENBERG,
BAKER & MOORE, LLC
5 Palisades Drive
Albany, NY 12205
(518) 438-9907

By: _____
Jeffrey S. Baker, Esq.

By: _____
Kevin M. Young, Esq.

wpdata\coalition of watershed towns\crossroads\041222 FINAL MOL kmy

Exhibit A

New York State
ENVIRONMENTAL FACILITIES CORPORATION

Thomas J Kelly, *President*

September 10, 2004

Kevin Young, Esq.
Young, Sommer, LLC
Counselors At Law
Executive Woods
Five Palisades Drive
Albany, NY 12207-2997

RECEIVED
SEP 13 2004
YOUNG, SOMMER...LLC

Dear Mr. Young:

In response to receipt of your check for $1.50 received on September 9, 2004, enclosed please find copies of records responsive to your FOIL request dated June 4, 2004 and modified on August 4, 2004.

The New York State Environmental Facilities Corporation expressly reserves all its rights and remedies under FOIL.

Sincerely,

Susan Mayer
Records Access Officer

SM:PER

[handwritten notes on the attached report are from Kevin Young]

625 Broadway, Albany, New York 12207-2997
518 402 6924 • 800 882 9721
www.nysefc.org

Capital and O&M Cost Estimates

Facility Name	Cost Category	Estimated Cost	Year
Bedford Hills Correctional Facility	O&M INCREM	$217,994	2003
Bedford Hills Correctional Facility	REG CONSTR	$3,008,106	2001
Bedford Lake Apartments	O&M INCREM	$39,430	2001
Bedford Lake Apartments	REG CONSTR	$767,492	2001
Bedford Park Apartments	O&M INCREM	no estimate	
Bedford Park Apartments	REG CONSTR	no estimate	
Blackberry Hill Sanitary Sewer District STP	O&M INCREM	$77,000	2004
Blackberry Hill Sanitary Sewer District STP	REG CONSTR	$2,151,885	2004
Brewster Central Schools	O&M INCREM	$119,760	2000
Brewster Central Schools	REG CONSTR	$2,793,027	2003, 2004
Brewster Heights Sewer District #1	O&M INCREM	$293,457	2003
Brewster Heights Sewer District #1	REG CONSTR	$2,951,400	2003
Camp Edward Isaacs	O&M INCREM	$89,620	2001
Camp Edward Isaacs	REG CONSTR	$2,180,000	2001
Camp L'man Achai	O&M INCREM	$34,854	2004
Camp L'man Achai	REG CONSTR	$918,297	2004
Camp L'man Achai	SPDES CONSTR	$47,000	2004
Camp Loyaltown	O&M INCREM	$5,527	2004
Camp Loyaltown	REG CONSTR	$179,800	2003 (interim upgrade, Loyaltown connecting to Hunter WWTP)
Camp Loyaltown	SPDES CONSTR	$190,235	1998
Camp Ludington	O&M INCREM	$45,990	2003
Camp Ludington	REG CONSTR	$2,555,814	2003
Camp Nubar	O&M INCREM	$0	
Camp Nubar	REG CONSTR	$921,515	2002
Camp Timber Lake	O&M INCREM	$18,616	2003
Camp Timber Lake	REG CONSTR	$1,669,944	2003
Carmel Sewer District #2	O&M INCREM	$139,600	2003
Carmel Sewer District #2	REG CONSTR	$5,454,600	2004
Carmel Sewer District #4	O&M INCREM	$105,000	2003
Carmel Sewer District #4	REG CONSTR	$3,780,400	2004
Carmel Sewer District #7	O&M INCREM	$115,325	2001
Carmel Sewer District #7	REG CONSTR	$1,798,235	2002
Clear Pool Camp, Inc.	O&M INCREM	$98,800	2002
Clear Pool Camp, Inc.	REG CONSTR	$2,890,163	2004

Clock Tower Commons	O&M INCREM	$50,050	2001	
Clock Tower Commons	REG CONSTR	$1,549,500	2004	
Colonel Chair Estates-Block 8	O&M INCREM	$12,121	2004	
Colonel Chair Estates-Block 8	REG CONSTR	$194,720	2003	(interim upgrade -- connecting to Hunter's WWTP)
Cornwall Meadows	O&M INCREM	$37,655	2001	
Cornwall Meadows	REG CONSTR	$1,116,001	2001	
Delaware-Chenango BOCES	O&M INCREM	$92,900	2004	
Delaware-Chenango BOCES	REG CONSTR	$1,614,265	2002	
Delaware-Chenango BOCES	SPDES CONSTR	$149,983	2002	
Elka Park Association	O&M INCREM	$206,671	2004	
Elka Park Association	REG CONSTR	$2,490,311	2003	(20 residential units)
Field Home / Holy Comforter	O&M INCREM	$0		
Field Home / Holy Comforter	REG CONSTR	$959,405	2003	
Forester Motor Lodge	O&M INCREM	$11,188	2004	
Forester Motor Lodge	REG CONSTR	$175,125	2003	(interim upgrade -- connecting to Hunter WWTP)
Fox Lane Campus Treatment Center	O&M INCREM	$114,190	2001	
Fox Lane Campus Treatment Center	REG CONSTR	$2,472,700	2001	
Fox Run Condominiums	O&M INCREM	$144,400	2001	
Fox Run Condominiums	REG CONSTR	$3,391,000	2001	
Frangel Realty Company	O&M INCREM	$88,380	2001	
Frangel Realty Company	REG CONSTR	$1,357,300	2001	
Fulmar Road Elementary School	O&M INCREM	$16,372	2001	
Fulmar Road Elementary School	REG CONSTR	$1,763,600	2001	
George Fischer Middle School	O&M INCREM	$91,560	2004	
George Fischer Middle School	REG CONSTR	$2,306,600	2004	
Golden Acres Farm and Ranch	O&M INCREM	$101,000	2004	
Golden Acres Farm and Ranch	REG CONSTR	$2,282,000	2004	
Harriman Lodge	O&M INCREM	$0		
Harriman Lodge	REG CONSTR	$914,000	2002	
Heritage Hills Pollution Control Plant	O&M INCREM	$229,110	2001	
Heritage Hills Pollution Control Plant	REG CONSTR	$7,513,810	2001	
Hill and Dale Country Club Condominiums	O&M INCREM	$144,000	2001	
Hill and Dale Country Club Condominiums	REG CONSTR	$1,908,000	2001	
Holly Stream Condominiums	O&M INCREM	$98,000	2001	
Holly Stream Condominiums	REG CONSTR	$144,200	2001	
Hunter Highlands	O&M INCREM	$97,500	2004	
Hunter Highlands	REG CONSTR	$1,562,953	2004	
Hunter Highlands	SPDES CONSTR	$1,500	2004	

Hunter's Glen Master Association, Inc.	O&M INCREM	$37,500	2001	
Hunter's Glen Master Association, Inc.	REG CONSTR	$2,074,000	2001	
I-684 Rest Area #45	O&M INCREM	$42,000	2001	
I-684 Rest Area #45	REG CONSTR	$1,864,423	2001	
Increase Miller Elem. School	O&M INCREM	$101,991	2001	
Increase Miller Elem. School	REG CONSTR	$1,474,563	2001	
Katonah Elementary School	O&M INCREM	$101,991	2001	
Katonah Elementary School	REG CONSTR	$1,508,125	2001	
K'Hal Adas Kashau Rabbinical College	O&M INCREM	$121,121	2003	
K'Hal Adas Kashau Rabbinical College	REG CONSTR	$3,674,000	2004	
Lake Plaza	O&M INCREM	no estimate		
Lake Plaza	REG CONSTR	no estimate		
Latvian Church Camp	O&M INCREM	$0		
Latvian Church Camp	REG CONSTR	$370,743	2003	
Lewisboro Elementary School	O&M INCREM	$101,741	2001	
Lewisboro Elementary School	REG CONSTR	$1,426,750	2001	
Liftside at Hunter Mountain	O&M INCREM	$12,121	2004	
Liftside at Hunter Mountain	REG CONSTR	$128,150	2003	(interim upgrade—connecting to Hunter LOWTP)
Lincoln Hall School	O&M INCREM	$123,680	2001	
Lincoln Hall School	REG CONSTR	$4,109,806	2001	
Mahopac Central Schools	O&M INCREM	$30,586	2001	
Mahopac Central Schools	REG CONSTR	$3,025,369	2001	
Mahopac Village Center	O&M INCREM	$45,480	2002	
Mahopac Village Center	REG CONSTR	$860,050	2002	
Maple Hill Estates H. O. A. Inc. Sewage Treatment Plant	O&M INCREM	$59,755	2001	
Maple Hill Estates H. O. A. Inc. Sewage Treatment Plant	REG CONSTR	$1,271,040	2001	
Meadows at Cross River	O&M INCREM	$45,800	2001	
Meadows at Cross River	REG CONSTR	$1,625,800	2001	
Michelle Estates Sewer Works Corp.	O&M INCREM	$166,200	2001	
Michelle Estates Sewer Works Corp.	REG CONSTR	$1,258,750	2001	(connected to the Delhi-WWTP)
Morningstar Foods, Inc./Ultra Dairy	O&M INCREM	$0		
Morningstar Foods, Inc./Ultra Dairy	REG CONSTR	$0		
Mountain View Estates #1	O&M INCREM	$60,975	2003	
Mountain View Estates #1	REG CONSTR	$892,700	2003	(24 residential units) } combined upgrade into one system
Mountain View Estates #2	O&M INCREM	$60,975	2003	
Mountain View Estates #2	REG CONSTR	$892,700	2003	(12 residential units) }
Mountainside Inn and Restaurant	O&M INCREM	$0		
Mountainside Inn and Restaurant	REG CONSTR	$454,000	2000	(purchase land and able to go to intermediate size subsurface disposal system and avoid the cost of being LOWTP)

orporate Center	O&M INCREM	$148,350	2001
Corporate Center	REG CONSTR	$2,980,000	2003
Salem Middle School	O&M INCREM	$188,300	2001
th Salem Middle School	REG CONSTR	$1,830,000	2001
Olive Woods	O&M INCREM	$16,200	2001
Olive Woods	REG CONSTR	$971,800	2001
Onteora Jr.-Sr. High School	O&M INCREM	$29,000	2002
Onteora Jr.-Sr. High School	REG CONSTR	$755,000	2002
Onteora Jr.-Sr. High School	SPDES CONSTR	$251,457	2004
Patterson Village Condominiums	O&M INCREM	$42,227	2001
Patterson Village Condominiums	REG CONSTR	$1,502,476	2001
Pepsi-Cola	O&M INCREM	$5,100	2001
Pepsi-Cola	REG CONSTR	$193,993	2001
Putnam Country Club	O&M INCREM	$110,000	2002
Putnam Country Club	REG CONSTR	$2,011,000	2002
Putnam Nursing and Rehabilitation Center	O&M INCREM	$89,700	2003
Putnam Nursing and Rehabilitation Center	REG CONSTR	$1,200,000	2003
Ralph Morando Bldg.	O&M INCREM	no estimate	
Ralph Morando Bldg.	REG CONSTR	no estimate	
Random Farm Homeowners Association	O&M INCREM	no estimate	
Random Farm Homeowners Association	REG CONSTR	no estimate	
Reed Farm Condominiums	O&M INCREM	$145,572	2004
Reed Farm Condominiums	REG CONSTR	$1,511,451	2003
Regis Hotel	O&M INCREM	$12,500	2004
Regis Hotel	REG CONSTR	$76,750	2003 (Interim upgrade -- connection to Fleischmanns WWTP)
Regis Hotel	SPDES CONSTR	$33,750	1999
Riverwoods/ Fox Hollow	O&M INCREM	no estimate	
Riverwoods/ Fox Hollow	REG CONSTR	no estimate	
Roxbury Run Village	O&M INCREM	$88,559	2004
Roxbury Run Village	REG CONSTR	$762,173	2003
Roxbury Run Village	SPDES CONSTR	$42,675	2003
SEVA Institute	O&M INCREM	$120,000	2004
SEVA Institute	REG CONSTR	$1,317,000	2004
Shop-Rite Plaza	O&M INCREM	$0	
Shop-Rite Plaza	REG CONSTR	$0	
Snow Time, Inc.	O&M INCREM	$21,000	2004
Snow Time, Inc.	REG CONSTR	$105,091	2003 (Interim upgrade – connecting to Windham WWTP)
Society Hill Condominiums	O&M INCREM	$77,700	2001

Society Hill Condominiums	REG CONSTR	$928,000	2001
Somers High School	O&M INCREM	$112,645	2001
Somers High School	REG CONSTR	$3,000,805	2003
Somers Intermediate School	O&M INCREM	$97,385	2002
Somers Intermediate School	REG CONSTR	$1,515,725	2002
Somers Manor Nursing Home	O&M INCREM	$39,830	2001
Somers Manor Nursing Home	REG CONSTR	$1,249,280	2001
Somers Office Building Complex	O&M INCREM	$134,723	2002
Somers Office Building Complex	REG CONSTR	$2,635,330	2002
South Kortright Center for Boys	O&M INCREM	$0	
South Kortright Center for Boys	REG CONSTR	$1,774,608	
St. Mary of the Assumption	O&M INCREM	$73,237	2001
St. Mary of the Assumption	REG CONSTR	$2,105,000	2001
Thompson House	O&M INCREM	$12,000	2004
Thompson House	REG CONSTR	$91,240	2003 (Interim upgrade -- connecting to Windham WWTP)
Thunder Ridge Ski Area	O&M INCREM	$81,218	2001
Thunder Ridge Ski Area	REG CONSTR	$1,658,000	2001
Towne Centre	O&M INCREM	$40,680	2001
Towne Centre	REG CONSTR	$999,676	2001
UJA Camp	O&M INCREM	$138,675	2001
UJA Camp	REG CONSTR	$3,053,513	2001
Village of Delhi	O&M INCREM	$467,910	2002
Village of Delhi	REG CONSTR	$6,918,002	2001
Village of Hobart	O&M INCREM	$183,190	2002
Village of Hobart	REG CONSTR	$2,897,407	2001
Village of Hobart	SPDES CONSTR	$291,711	2001
Village of Stamford	O&M INCREM	$400,103	2002
Village of Stamford	REG CONSTR	$4,322,699	2001
Village of Stamford	SPDES CONSTR	$1,058,200	2001
Village of Walton	O&M INCREM	$851,795	2002
Village of Walton	REG CONSTR	$8,785,996	2001
Village of Walton	SPDES CONSTR	$1,135,900	2001
Waccabuc Country Club	O&M INCREM	$54,930	2001
Waccabuc Country Club	REG CONSTR	$4,088,090	2001
Walter Panas High School	O&M INCREM	$250,200	2004
Walter Panas High School	REG CONSTR	$2,319,360	2004
Watchtower Educational Center	O&M INCREM	$66,294	2002
Watchtower Educational Center	REG CONSTR	$2,003,923	2001

Waterview Hills Nursing Center, Inc.	O&M INCREM	$71,216	2004
Waterview Hills Nursing Center, Inc.	REG CONSTR	$3,536,400	2004
Whistle Tree	O&M INCREM		
Whistle Tree	REG CONSTR		
Wild Oaks Utilities	O&M INCREM	$58,200	2004
Wild Oaks Utilities	REG CONSTR	$3,243,600	2004
Williamsburg Ridge Homeowners Association, Inc.	O&M INCREM	$62,856	2003
Williamsburg Ridge Homeowners Association, Inc.	REG CONSTR	$1,132,112	2003
Worcester Creameries, Corp.	O&M INCREM	$386,878	2004
Worcester Creameries, Corp.	REG CONSTR	$3,759,190	2004
Yeshiva Kehilath Yakov	O&M INCREM	$74,925	2003
Yeshiva Kehilath Yakov	REG CONSTR	$1,266,300	2003
Yorktown Heights S.D.	O&M INCREM	$109,753	2000
Yorktown Heights S.D.	REG CONSTR	$16,752,846	2000

(connecting to Hunter WWTP)

NEW YORK STATE DEPARTMENT
OF ENVIRONMENTAL CONSERVATION

In the Matter of the Application of

BELLEAYRE RESORT at the
CATSKILL PARK PROPERTY

Application Numbers
0-9999-00096/00005
0-9999-00096/00009

SEPARATELY BOUND APPENDIX TO THE POST ISSUE CONFERENCE MEMORANDUM OF LAW FOR THE COALITION OF WATERSHED TOWNS, DELAWARE COUNTY, TOWN OF MIDDLETOWN AND TOWN OF SHANDAKEN

Dated: December 23, 2004

Young, Sommer, Ward, Ritzenberg,
Baker & Moore, LLC
Executive Woods
5 Palisades Drive
Albany, NY 12205
(518) 438-9907

Jeffrey S. Baker
Kevin M. Young,
Of Counsel

Exhibit A

of real estate, and in proceedings against comptroller to have thirty days' notice before awards are confirmed.

ings that may hereafter be had to acquire real estate or hereditaments for or on behalf of the corporation of the city of New York, except as to proceedings to acquire lands under chapter five hundred and twenty-two of the laws of eighteen hundred and eighty-four, entitled "An act laying out public places and parks and parkways in the twenty-third and twenty-fourth wards of the city of New York and in the adjacent district of Westchester county, and authorizing the taking of the same," before an award shall be confirmed imposing an obligation upon the city to pay any moneys, the comptroller shall have thirty days' notice in writing, stating before whom and at what time such proceeding will take place.

§ 2. This act shall take effect immediately

L 1885

Chap. 543.

AN ACT to confer upon the state board of health power to protect from contamination, by suitable regulations, the water supplies of the state and their sources.

Passed June 13, 1885; three-fifths being present.

The People of the State of New York, represented in Senate and Assembly, do enact as follows:

State board of health empowered to make rules etc

SECTION 1. The state board of health is hereby authorized and empowered to make rules and regulations for protecting from contamination any and all public supplies of potable waters and their sources within this state; provided, however, that any such rule or regulation shall not be operative in any county until the county judge of that county shall have approved the same.

Rules to be published

§ 2. The said state board of health shall also have power, and it shall be its duty: 1. To publish once a week, for at least six consecutive weeks, all such rules and regulations as it shall have made concerning the contamination of any sub-soil waters, springs, streams, lakes, ponds, reservoirs or other bodies of water contributing to the potable water supply of any municipality within this state, such publication to be made in one or more newspapers published in the county in which the waters affected by such regulations are located. The cost of publishing the regulations of the state board of health, as above provided, shall be paid by the corporation or municipality benefited by the protection of the water supply, concerning which the rules are made. 2. To impose penalties for the violation of, or the non-compliance with, their rules and regulations, not exceeding two hundred dollars in any one case.

Cost of publishing

Penalties may be imposed

Inspection of water supply.

§ 3. The officer or board having by law the management and control of the potable water supply of any municipality, in all cases where the said municipality derives its water supply in whole or in part from any sub-soil waters, springs, streams, lakes, ponds, reservoirs or other waters concerning which the state board of health shall make any rule or regulation, is hereby authorized and empowered to make such inspection of the sources of said water supply as said officer or board may deem advisable to secure the said water supply from any defilement, and to ascertain whether or not the rules and regulations made by the state board of health are complied with.

If inspection discloses violation of rules, notice to be served, etc.

§ 4. In case such inspection shall disclose the violation by any person or persons of any of the rules or regulations of the said state board of health relating to the sources of said water supply, the officer or board mentioned in section three of this act shall serve or cause to be served a copy of the said rules and regulations, accompanied by a notice specifying the rule or regulation claimed to have been violated, upon the said person or persons violating such rules or regulations. If the person or persons so served do not immediately comply with the said regulation, the said officer or board having charge of the water supply of the municipality affected thereby shall notify the state board of health of the violation of its rules; the state board of health shall thereupon examine into the said violation, and if the party complained of is found to have actually violated any of the said regulations, the secretary of the state board of health shall order the local board of health having jurisdiction thereof to convene and enforce obedience to the said regulation.

Action against persons violating rules in case local board fails to enforce order of secretary.

§ 5. In case any local board of health having jurisdiction thereof fails to enforce the order of the secretary of the state board of health within ten days after the receipt of a notification so to do, as provided in the last section, the corporation furnishing the water supply, or the municipality deriving its water supply from the waters for the sanitary protection of which such rules have been made, is hereby authorized and empowered to maintain an action in a court of record and which shall be tried in the county in which the cause of action arose, against the person or persons violating the said rules for recovery of the penalty therein provided.

Penalties

§ 6. Every person who shall willfully violate or refuse to obey any rule or regulation made and published by the state board of health, and approved, pursuant to the provisions of this act, shall be guilty of a misdemeanor, and on a conviction thereof shall be subject to a fine or imprisonment, or both, at the discretion of the court, such fine not to exceed three hundred dollars, nor such imprisonment six months. But the recovery of a penalty in a civil action, as provided in section five of this act, and criminal prosecution and conviction under the provisions of this section, shall not be had for the same offense.

Necessary works for sewage to be constructed

§ 7. When the state board of health shall, for the protection of a water supply from contamination, make regulations, the execution of which will require the providing of some public means of removal or purification of sewage, the municipality or corporation owning the water-works benefited thereby shall, at its own expense, construct and maintain such works or means for sewage disposal, as shall be approved by the state board of health.

Affidavit of printer publishing rules may be filed, etc.

§ 8. The state board of health, any local board of health, or any municipality or corporation furnishing water, may cause the affidavit of the printer, publisher or proprietor of any newspaper publishing the rules and regulations as provided by the second section of this act, to be filed with such rules as published in the clerk's office of the county in which the municipality or corporation furnishing the water supply in any case may be situated or located, and such affidavit and rules, or duly certified copies thereof, shall be deemed conclusive evidence of due publication and of all the facts therein stated in all courts and in all proceedings or prosecutions under the provisions of this act.

Evidence.

Inconsistent acts repealed.

§ 9. All acts or parts of acts inconsistent with the provisions of this act are hereby repealed.

§ 10. This act shall take effect immediately.

Exhibit B

L.1890

CHAP. 468.

AN ACT to amend chapter five hundred and forty-three of the laws of eighteen hundred and eighty-five, entitled "An act to confer upon the state board of health power to protect from contamination, by suitable regulations, the water supplies of the state and their sources," relative to the construction of systems of sewerage, and works for removal and disposal of sewage and the removal of buildings, and giving a right of action for damages.

APPROVED by the Governor June 2, 1890 Passed, three-fifths being present.

The People of the State of New York, represented in Senate and Assembly, do enact as follows:

SECTION 1. Section seven of chapter five hundred and forty-three of the laws of eighteen hundred and eighty-five, entitled "An act to confer upon the state board of health, power to protect from contamination, by suitable regulations, the water supplies of the state and their sources," is hereby amended so as to read as follows:

§ 7. When the state board of health shall, for the protection of a water supply from contamination, make regulations, the execution of which will require, or will make necessary, the construction and maintaining of any system of sewerage, or a change thereof, in or for any village or hamlet, whether the same be incorporated or otherwise, or the execution of which will require the providing of some public means of removal or purification of sewage, the municipality or corporation owning the water works benefited thereby, shall, at its own expense, construct and maintain such system or systems of sewerage, or change thereof, and also provide such means of removal and purification of sewage, and also such works or means for sewage disposal as shall be approved by the state board of health; and when the execution of any of the said regulations of the said state board of health will occasion or require the removal of any building or buildings, the municipality or corporation owning the water-works benefited thereby shall, at its own expense, remove said buildings and pay to the owner thereof all damages occasioned by such removal; and when the execution of any such regulation will injuriously affect any manufacturing or industrial enterprise which is not a public nuisance, the said municipality or corporation shall pay all damages occasioned by the enforcement thereof. And until such construction or change of such system or systems of sewerage and the providing of such means of removal or purification of sewage, and such works or means for sewage disposal, and the removal of any building, is so made by the said municipality or corporation owning the water-works to be benefited thereby, at its own expense, there shall be no action or proceeding taken against any person or corporation for the violation of any regulation of the state board of health under this act; and no person or corporation shall be considered to have violated or refused to obey any such rule or regulation. And the owner or owners of any building, the removal of which is occasioned or required or has been removed by any rule or regulation of the state board of health made under the provisions of this act, and all persons whose rights of property are injuriously affected by the enforcement of any such rule or regulation, shall have a right of action against the municipalty* or corporation owning the water-works

Construction of sewerage systems

Works for removal, etc., of sewage

Removal of buildings

Proviso as to commencement of actions for violations, etc

Right of action for damages

*So in the original

benefited by the enforcement of such rule or regulation, for all damages occasioned or sustained by such removal and enforcement of the said rule or regulation or either; and an action therefor may be brought against such municipalty* or corporation in any court of record in the county in which the premises or property affected is situated, and shall be tried therein.

§ 2. This act shall take effect immediately

CHAP. 469.

AN ACT to amend chapter three hundred and fifty-five of the laws of eighteen hundred and eighty, entitled "An act relating to the Central New York Institution for Deaf-mutes at Rome, New York."

APPROVED by the Governor June 2, 1890. Passed, three-fifths being present.

The People of the State of New York, represented in Senate and Assembly, do enact as follows:

SECTION 1. Section one of chapter three hundred and fifty-five of the laws of eighteen hundred and eighty, entitled "An act relating to the Central New York Institution for Deaf-mutes at Rome, New York," is hereby amended so as to read as follows:

Continuance of pupils at institution

§ 1. It shall be lawful for the superintendent of public instruction to continue at the Central New York Institution for Deaf-mutes, at Rome, New York, for a period not exceeding three years, for the purpose of pursuing a course of studies in the higher branches in learning, such pupils, not exceeding twenty in number as may have completed their full term of instruction and who may be recommended by the trustees of said institution.

§ 2. This act shall take effect immediately.

CHAP. 470.

AN ACT to amend chapter two hundred and twenty of the laws of eighteen hundred and sixty-six, entitled "An act to amend the charter of the village of Saratoga Springs and the several acts amendatory thereof;" to repeal certain acts relating thereto and to organize and establish a street department for the said village, and to define its powers and duties.

APPROVED by the Governor June 2, 1890. Passed, three-fifths being present.

The People of the State of New York, represented in Senate and Assembly, do enact as follows:

Street commissioners, appointment of.

SECTION 1. The president of the village of Saratoga Springs shall within thirty days after the passage of this act, appoint four street commissioners for the village of Saratoga Springs, two of whom shall belong to the Democratic party and two to the Republican party; one commissioner to hold his office for the period of five years, one for four years, one for three years, and one for two years, from the first Monday

*So in the original.

Exhibit C

L.1893

ARTICLE V.

POTABLE WATERS.

Section 70. Rules and regulations of state board.
71. Inspection of water supply.
72. Sewerage.
73. Discharge of sewage into Wallkill creek, prohibited.
74. Discharge of sewage into the Susquehanna near Binghamton, prohibited.

§ 70. **Rules and regulations of state board.** The state board of health may make rules and regulations for the protection from contamination of any or all public supplies of potable waters and their sources within the state, and impose penalties for the violation thereof or the non-compliance therewith, not exceeding two hundred dollars for every such violation or non-compliance. Every such rule or regulation shall be published at least once in each week for six consecutive weeks, in at least one newspaper of the county where the waters to which it relates are located. The cost of such publication shall be paid by the corporation or municipality benefited by the protection of the water supply, to which the rule or regulation published relates. The affidavit of the printer, publisher or proprietor of the newspaper in which such rule or regulation is published may be filed, with the rule or regulation published, in the county clerk's office of such county, and such affidavit and rule and regulation shall be conclusive evidence of such publication, and of all the facts therein stated in all courts and places.

§ 71. **Inspection of water supply.** The officer or board having by law the management and control of the potable water supply of any municipality, or the corporation furnishing such supply, may make such inspection of the sources of such water supply, as such officer, board or corporation deems it advisable, and to ascertain whether the rules or regulations of the state board are complied with. If any such inspection discloses a violation of any such rule or regulation such officer, board or corporation shall cause a copy of the rule or regulation violated to be served upon the person violating the same, with a notice of such violation. If the person served does not immediately comply with the rule or regulation violated, such officer, board or corporation shall notify the state board of the

violation, which shall immediately examine into such violation; and if such person is found by the state board to have actually violated such rule or regulation, the secretary of the state board shall order the local board of health of such municipality to convene and to enforce obedience to such rule or regulation. If the local board fails to enforce such order within ten days after its receipt, the corporation furnishing such water supply, or the municipality deriving its water supply from the waters to which such rule or regulation relates, may maintain an action in a court of record, which shall be tried in the county where the cause of action arose against such person, for the recovery of the penalties incurred by such violation, and for an injunction restraining him from the continued violation of such rule or regulation.

§ 72. Sewerage. When the state board of health shall, for the protection of a water supply from contamination, make orders or regulations the execution of which will require or make necessary the construction and maintenance of any system of sewerage, or a change thereof, in or for any village or hamlet, whether incorporated or unincorporated, or the execution of which will require the providing of some public means of removal or purification of sewage, the municipality or corporation owning the water-works benefited thereby shall, at its own expense, construct and maintain such system of sewerage, or change thereof, and provide such means of removal and purification of sewage and such works or means of sewage disposal as shall be approved by the state board of health. When the execution of any such regulations of the state board of health will occasion or require the removal of any building or buildings, the municipality or corporation owning the water-works benefited thereby shall, at its own expense, remove such buildings and pay to the owner thereof all damages occasioned by such removal. When the execution of any such regulation will injuriously affect any manufacturing or industrial enterprise which is not a public nuisance, such municipality or corporation shall pay all damages occasioned by the enforcement thereof. Until such construction or change of such system or systems of sewerage, and the providing of such means of removal or purification of sewage, and such works or means of sewage disposal and the removal of any building, are so made by the municipality or corporation owning the water-works to be

benefited thereby at its own expense, there shall be no action or proceeding taken by such municipality or corporation against any person or corporation for the violation of any regulation of the state board of health under this article, and no person or corporation shall be considered to have violated or refused to obey any such rule or regulation. The owner of any building the removal of which is occasioned or required, or which has been removed by any rule or regulation of the state board of health made under the provisions of this article, and all persons whose rights of property are injuriously affected by the enforcement of any such rule or regulation, shall have a cause of action against the municipality or corporation owning the water-works benefited by the enforcement of such rule or regulation, for all damages occasioned or sustained by such removal or enforcement, and an action therefor may be brought against such municipality or corporation in any court of record in the county in which the premises or property affected is situated and shall be tried therein; or such damages may be determined by a special proceeding in the supreme court or the county court of the county in which the property is situated. Such special proceedings shall be commenced by petition and notice to be served by such owner upon the municipality or corporation in the same manner as for the commencement of condemnation proceedings. Such municipality or corporation may make and serve an answer to such petition as in condemnation proceedings. The petition and answer shall set forth the claims of the respective parties, and the provisions of the condemnation law shall be applicable to the subsequent proceedings upon the petition and answer, if any. Either party may, before the service of the petition or answer respectively, offer to take or pay a certain sum, and no costs shall be awarded against either party unless the judgment is more unfavorable to him than his offer.

§ 73. Discharge of sewage into Wallkill creek prohibited. No person or corporation shall permit the discharge or escape of any sewage, or other matter deleterious to public health, or destructive to fish, or throw or cast any dead animal, carrion or offal, or other putrid or offensive matter into the waters of the Wallkill creek, in the counties of Ulster and Orange. Any person violating any provision of this section shall forfeit to the county where the violation occurred the sum of fifty dollars for every such violation

§ 74. Discharge of sewage into the Susquehanna near Binghamton, prohibited. No person or corporation shall cause to fall, flow or discharge into the Susquehanna river or any of its tributaries, between the Rock Bottom dam in such river at the city of Binghamton, and a point one mile east of the bridge that crosses such river at Conklin, any sewage matter, or other foul, noxious or deleterious, solid or liquid matter, or any matter that may be declared such by the board of health of any municipality adjacent to such river within such limit. The board of health of any such municipality shall examine into any alleged offense against this section and cause the same to be abated, if found to exist. Every person violating any provision of this section shall forfeit to the municipality having a local board of health where the violation occurs the sum of twenty five dollars for the first day when the violation takes place, and the sum of ten dollars for every subsequent day that such violation is repeated or continued.

ARTICLE VI.

QUARANTINE AT THE PORT OF NEW YORK.

Section 80. Quarantine commissioners; organization.
81. Other officers and employes.
82. Meetings; report.
83. Custody of quarantine establishment.
84. Quarantine establishment.
85. Docks and wharves.
86. Anchorage and floating hospital.
87. Boarding station.
88. The West Island hospital.
89. Crematory.
90. Burying ground

§ 80. Quarantine commissioners; organization. There shall continue to be a board of [illegible] of quarantine at the port of New York consisting of [illegible] appointed by the governor by and with the advice and consent of the senate. Each shall be a resident of the city of New York, Kings or Richmond, and shall hold office three years and receive an annual salary of twenty five hundred dollars. The board shall elect one

Exhibit D

§ 17. Nothing in this act contained shall be construed to in anywise impair or affect any claim for damage caused or cause of action arising by the carrying out of the work authorized by this act, but said village shall be liable for any damages caused by its operation under this act in the same manner and to the same extent as if such operations had been carried on by an individual. Claims for damages not affected by this act.

§ 18. This act shall take effect immediately. L. 1904

Chap. 484.

AN ACT to amend the public health law, relative to vital statistics, appointment of public officers, and the powers of the state department of health.

Became a law April 28, 1904, with the approval of the Governor. Passed, three-fifths being present.

The People of the State of New York, represented in Senate and Assembly, do enact as follows:

Section 1. Section five of chapter six hundred and sixty-one of the laws of eighteen hundred and ninety-three, entitled "An act in relation to the public health, constituting chapter twenty-five of the general laws," as amended by chapter twenty-nine of the laws of nineteen hundred and one, is hereby amended to read as follows:

§ 5. Duties with respect to vital statistics.—There shall be in the state department of health a bureau of vital statistics for the registration of births, marriages, deaths and prevalent diseases, which shall be under the general charge and supervision of the commissioner of health. He shall prescribe and prepare the necessary methods and forms for obtaining and preserving such statistics, and to insure the prompt and faithful registration of the same in the several municipalties and in the state bureau. He shall from time to time recommend such forms and such amendments of law as shall be deemed necessary for the thorough organization and efficiency of registration of vital statistics throughout the state, as supervised by him. The clerical duties and safe-keeping of the state bureau shall be provided for by the

action in a court of record, which shall be tried in the county where the cause of action arose against such person, for the recovery of the penalties incurred by such violation, and for an injunction restraining him from the continued violation of such rule or regulation.

§ 5. Section seventy-two of the public health law, is hereby amended to read as follows:

§ 72. Sewerage.—When the state department of health shall, for the protection of a water supply from contamination, make orders or regulations the execution of which will require or make necessary the construction and maintenance of any system of sewerage, or a change thereof, in or for any village or hamlet, whether incorporated or unincorporated, or the execution of which will require the providing of some public means of removal or purification of sewage, the municipality or corporation owning the waterworks benefited thereby shall, at its own expense, construct and maintain such system of sewerage, or change thereof, and provide such means of removal and purification of sewage and such works or means of sewage disposal as shall be approved by the state department of health. When the execution of any such regulations of the state department of health will occasion or require the removal of any building or buildings, the municipality or corporation owning the waterworks benefited thereby shall, at its own expense, remove such buildings and pay to the owner thereof all damages occasioned by such removal. When the execution of any such regulation will injuriously affect any manufacturing or industrial enterprise which is not a public nuisance, such municipality or corporation shall pay all damages occasioned by the enforcement thereof. Until such construction or change of such system or systems of sewerage, and the providing of such means of removal or purification of sewage, and such works or means of sewage disposal and the removal of any building, are so made by the municipality or corporation owning the waterworks to be benefited thereby at its own expense, there shall be no action or proceeding taken by such municipality or corporation against any person or corporation for the violation of any regulation of the state department of health under this article, and no person or corporation shall be considered to have violated or refused to obey any such rule or regulation. The owner of any building the removal of which is occasioned or re-

quired, or which has been removed by any rule or regulation of the state department of health made under the provisions of this article, and all persons whose right of property are injuriously affected by the enforcement of any such rule or regulation, shall have a cause of action against the municipality or corporation owning the waterworks benefited by the enforcement of such rule or regulation, for all damages occasioned or sustained by such removal or enforcement, and an action therefor may be brought against such municipality or corporation in any court of record in the county in which the premises or property affected is situated and shall be tried therein; or such damages may be determined by a special proceeding in the supreme court or the county court of the county in which the property is situated. Such special proceedings shall be commenced by petition and notice to be served by such owner upon the municipality or corporation in the same manner as for the commencement of condemnation proceedings. Such municipality or corporation may make and serve an answer to such petition as in condemnation proceedings. The petition and answer shall set forth the claims of the respective parties, and the provisions of the condemnation law shall be applicable to the subsequent proceedings upon the petition and answer, if any. Either party, may, before the service of the petition or answer respectively, offer to take or pay a certain sum, and no costs shall be awarded against either party unless the judgment is more unfavorable to him than his offer.

§ 6. This act shall take effect immediately.

Chap. 485.

AN ACT to amend subdivision two of section twenty-four of chapter one hundred and twelve of the laws of eighteen hundred and ninety-six, the liquor tax law, as amended by chapter three hundred and twelve of the laws of eighteen hundred and ninety-seven relating to places in which the traffic in liquor shall not be permitted.

Became a law April 28, 1904, with the approval of the Governor. Passed, three-fifths being present.

The People of the State of New York, represented in Senate and Assembly, do enact as follows:

Section 1. Subdivision two of section twenty-four of chapter one hundred and twelve of the laws of eighteen hundred and

Exhibit E

Chap. 582.

AN ACT to amend the public health law, in relation to public water supplies

Became a law, May 23, 1906, with the approval of the Governor. Passed, three-fifths being present.

The People of the State of New York, represented in Senate and Assembly, do enact as follows:

Section 1. Section seventy-one of chapter six hundred and sixty-one of the laws of eighteen hundred and ninety-three, entitled "An act in relation to the public health, constituting chapter twenty-five of the general laws," as amended by chapter two hundred and fifty-one of the laws of eighteen hundred and ninety-nine and chapter four hundred and eighty-four of the laws of nineteen hundred and four, is hereby amended to read as follows:

§ 71. Inspection of water supply.—The officer or board having by law the management and control of the potable water supply of any municipality, or the corporation furnishing such supply, may make such inspection of the sources of such water supply, as such officer, board or corporation deems it advisable, and to ascertain whether the rules or regulations of the state department are complied with, and shall make such regular or special inspections as the state commissioner of health may prescribe. If any such inspection discloses a violation of any such rule or regulation relating to a permanent source or act of contamination, such officer, board or corporation shall cause a copy of the rule or regulation violated to be served upon the person violating the same, with a notice of such violation. If the person served does not immediately comply with the rule or regulation violated, such officer, board or corporation shall notify the state department of the violation, which shall immediately examine into such violation; and if such person is found by the state department to have actually violated such rule or regulation, the commissioner of health shall order the local board of health of such municipality wherein the violation or the noncompliance occurs to convene and enforce obedience to such rule or regulation. If the local board fails to enforce such order within ten days after its receipt, the corporation furnishing such water supply, or the municipality deriving its water supply from the waters to which such rule or regulation relates, or the state commissioner of health or the local

board of health of the municipality wherein the water supply protected by these rules is used, or any person interested in the protection of the purity of the water supply may maintain an action in a court of record, which shall be tried in the county where the cause of action arose against such person, for the recovery of the penalties incurred by such violation, and for an injunction restraining him from the continued violation of such rule or regulation.

§ 2. Section seventy-two of said chapter, as amended by chapter four hundred and eighty-four of the laws of nineteen hundred and four, is hereby amended to read as follows:

§ 72. Sewerage.— When the state department of health shall, for the protection of a water supply from contamination, make orders or regulations the execution of which will require or make necessary the construction and maintenance of any system of sewerage, or a change thereof, in or for any village or hamlet, whether incorporated or unincorporated, or the execution of which will require the providing of some public means of removal or purification of sewage, the municipality or corporation owning the water works benefited thereby shall, at its own expense, construct and maintain such system of sewerage, or change thereof, and provide and maintain such means of removal and purification of sewage and such works or means of sewage disposal as shall be approved by the state department of health. When the execution of any such regulations of the state department of health will occasion or require the removal of any building or buildings, the municipality or corporation owning the water works benefited thereby shall, at its own expense, remove such buildings and pay to the owner thereof all damages occasioned by such removal. When the execution of any such regulation will injuriously affect any property the municipality or corporation owning the water works benefited thereby shall make just and adequate compensation for the property so taken or injured. Under* such construction or change of such system or systems of sewerage, and the providing of such means of removal or purification of sewage, and such works or means of sewage disposal and the removal of any building, are so made by the municipality or corporation owning the water works to be benefited thereby at its own expense, and until the municipality or corporation owning the water works benefited shall make just and adequate payment for all injuries to property and for all injuries caused to the legitimate use or operation of

*So in original.

such property, there shall be no action or proceeding taken by any such municipality, officer, board, person or corporation against any person or corporation for the violation of any regulation of the state department of health under this article, and no person or corporation shall be considered to have violated or refused to obey any such rule or regulation. The owner of any building the removal of which is occasioned or required, or which has been removed by any rule or regulation of the state department of health made under the provisions of this article, and all persons whose rights of property are injuriously affected by the enforcement of any such rule or regulation, shall have a cause of action against the municipality or corporation owning the water works benefited by the enforcement of such rule or regulation, for all damages occasioned or sustained by such removal or enforcement, and an action therefor may be brought against such municipality or corporation in any court of record in the county in which the premises or property affected is situated and shall be tried therein; or such damages may be determined by a special proceeding in the supreme court or the county court of the county in which the property is situated. Such special proceedings shall be commenced by petition and notice to be served by such owner upon the municipality or corporation in the same manner as for the commencement of condemnation proceedings. Such municipality or corporation may make and serve an answer to such petition as in condemnation proceedings. The petition and answer shall set forth the claims of the respective parties, and the provisions of the condemnation law shall be applicable to the subsequent proceedings upon the petition and answer, if any. Either party may, before the service of the petition or answer, [illegible]

ture on the first day of July, nineteen hundred and twenty-six, and six of said bonds to mature on the first day of July, nineteen hundred and twenty-seven; such bonds to be issued in coupon form with the registration clause thereto attached, signed by the president of the board of education and attested by the clerk, with the corporate seal, and shall be a charge and first lien upon said district, enlarged as aforesaid, and paid at maturity. Such bonds when executed and delivered as aforesaid shall be and become a valid and binding obligation of said union free school district number one of the town of Ossining, New York, and the supervisor of said town is hereby authorized and empowered to levy and collect the interest and principal of said bonds, as they shall become due, upon the taxable property of said school district, so enlarged as aforesaid.

Tax levy by supervisor authorized

District annual levy.

§ 9. The board of education of such union free school district number one in the manner provided by law, shall cause such sum to be raised annually by tax as may be necessary to pay the principal and interest of said bonds, as the same shall become due, notwithstanding any omissions or irregularities or defects in said elections or proceedings.

Pending actions.

§ 10. Nothing herein shall affect any action or proceeding now pending in any court.

§ 11. This act shall take effect immediately.

Note:— Chapters 9–64, 88, 99 and 219 of the Laws of 1909, constitute the Consolidated Laws. By chapter 458, post, an official edition of the Consolidated Laws is provided for, to be prepared separate from and published in lieu of their publication as session laws. "The edition thus prepared shall be deemed a part of the session laws of nineteen hundred and nine and shall take the place of the publication by the state printer as session laws of the consolidated laws and shall be distributed as provided for in the contract with the state printer for the distribution of the session laws, and said consolidated laws shall not be again published as session laws except that the amendments thereto made after their adoption shall appear in the session laws as now provided by law." Accordingly, the text of the Consolidated Laws is omitted here, the titles only being given under the chapter numbers.

The official edition of the Consolidated Laws contains "the amendments made to the consolidated laws since their enactment

Chap. 43.

AN ACT in relation to negotiable instruments, constituting chapter thirty-eight of the consolidated laws.

Chap. 44.

AN ACT in relation to partnership, constituting chapter thirty-nine of the consolidated laws.

Chap. 45.

AN ACT relating to personal property, constituting chapter forty-one of the consolidated laws.

Chap. 46.

AN ACT in relation to the poor, constituting chapter forty-two of the consolidated laws.

Chap. 47.

AN ACT relating to prisons, constituting chapter forty-three of the consolidated laws.

Chap. 48.

AN ACT relating to public buildings, constituting chapter forty-four of the consolidated laws.

Chap. 49.

AN ACT in relation to the public health, constituting chapter forty-five of the consolidated laws.

Exhibit F

forthwith commence proceedings for the indictment and trial of the person charged with such violation. Nothing in this article shall be construed to in any way repeal or affect any of the provisions of the agricultural law, nor to prohibit the coloring of butter made from milk, the product of the dairy, or the cream from the same with coloring matter which is not injurious to health.

ARTICLE 5

Potable Waters

Section 70. Rules and regulations of department.
71. Inspection of water supply.
72. Rules and regulations for water supplies legalized.
73. Sewerage.
74. Discharge of sewage into *Walkill creek prohibited.
75. Discharge of sewage into the Susquehanna near Binghamton prohibited.
76. Discharge of sewage and other refuse matter into certain waters prohibited.
77. Permission to discharge sewage.
78. Permission to discharge refuse or waste matter from industrial establishments.
79. Plans for refuse discharge pipes must be submitted.
80. Revocation of permit.
81. Reports of municipal authorities to local boards of health.
82. Reports of proprietors of industrial establishments.
83. Record of permits; inspection of local boards of health.
84. Violations; service of notice; actions by local boards.
85. Penalties.
86. Constructions and limitations made by sections seventy-six to eighty-five, inclusive.
87. Actions by municipalities to prevent discharge of sewage into waters.

§ 70. Rules and regulations of department. The state department of health may make rules and regulations for the protection from contamination of any or all public supplies of potable waters and their sources within the state. If any such rule or regulation relates to a temporary source or act of contamination, any person violating such rule or regulation shall be liable to prosecution for misdemeanor for every such violation, and on conviction shall be punished by a fine not exceeding two hundred dollars, or imprisonment not exceeding one year, or both. If any such rule or regulation relates to a permanent source or

*So in original.

act of contamination, said department may impose penalties for the violation thereof or the non-compliance therewith, not exceeding two hundred dollars for every such violation or non-compliance. Every such rule or regulation shall be published at least once in each week for six consecutive weeks, in at least one newspaper of the county where the waters to which it relates are located. The cost of such publication shall be paid by the corporation or municipality benefited by the protection of the water supply, to which the rule or regulation published relates. The affidavit of the printer, publisher or proprietor of the newspaper in which such rule or regulation is published may be filed, with the rule or regulation published, in the county clerk's office of such county, and such affidavit and rule and regulation shall be conclusive evidence of such publication, and of all the facts therein stated in all courts and places.

§ 71. **Inspection of water supply.** The officer or board having by law the management and control of the potable water supply of any municipality, or the corporation furnishing such supply, may make such inspection of the sources of such water supply, as such officer, board or corporation deems advisable, and to ascertain whether the rules or regulations of the state department are complied with, and shall make such regular or special inspections as the state commissioner of health may prescribe. If any such inspection discloses a violation of any such rule or regulation relating to a permanent source or act of contamination, such officer, board or corporation shall cause a copy of the rule or regulation violated to be served upon the person violating the same, with a notice of such violation. If the person served does not immediately comply with the rule or regulation violated, such officer, board or corporation shall notify the state department of the violation, which shall immediately examine into such violation; and if such person is found by the state department to have actually violated such rule or regulation, the commissioner of health shall order the local board of health of such municipality wherein the violation or the non-compliance occurs to convene and enforce obedience to such rule or regulation. If the local board fails to enforce such order within ten days after its receipt, the corporation furnishing such water supply, or the municipality deriving its water supply from the waters to which such rule or regulation relates, or the state commissioner of health or the local board of health of the municipality wherein the water supply protected by these rules is used, or any person interested in the protection of the purity of the water supply, may maintain an action in a court of record, which shall be tried in the county where the cause of action arose against such person,

for the recovery of the penalties incurred by such violation, and for an injunction restraining him from the continued violation of such rule or regulation.

§ 72. Rules and regulations for water supplies legalized. All rules and regulations heretofore duly made and published for the sanitary protection of public water supplies, pursuant to chapter five hundred and forty-three of the laws of eighteen hundred and eighty-five, and chapter six hundred and sixty-one of the laws of eighteen hundred and ninety-three, as amended, are hereby legalized, ratified, confirmed and continued in force, until new rules and regulations become operative.

This section and the two preceding sections shall not be construed to repeal or affect any of the provisions of chapter three hundred and seventy-eight of the laws of eighteen hundred and ninety-seven, or its amendments.

§ 73. Sewerage. When the state department of health shall, for the protection of a water supply from contamination, make orders or regulations the execution of which will require or make necessary the construction and maintenance of any system of sewerage, or a change thereof, in or for any village or hamlet, whether incorporated or unincorporated, or the execution of which will require the providing of some public means of removal or purification of sewage, the municipality or corporation owning the water works benefited thereby shall, at its own expense, construct and maintain such system of sewerage, or change thereof, and provide and maintain such means of removal and purification of sewage and such works or means of sewage disposal as shall be approved by the state department of health. When the execution of any such regulations of the state department of health will occasion or require the removal of any building or buildings, the municipality or corporation owning the water works benefited thereby shall, at its own expense, remove such buildings and pay to the owner thereof all damages occasioned by such removal. When the execution of any such regulation will injuriously affect any property the municipality or corporation owning the water works benefited thereby shall make just and adequate compensation for the property so taken or injured. Until such construction or change of such system or systems of sewerage, and the providing of such means of removal or purification of sewage, and such works or means of sewage disposal and the removal of any building, are so made by the municipality or corporation owning the water works to be benefited thereby at its own expense, and until the municipality or corporation owning the water works benefited shall make just and adequate payment for all injuries to

property and for all injuries caused to the legitimate use or operation of such property, there shall be no action or proceeding taken by any such municipality, officer, board, person or corporation against any person or corporation for the violation of any regulation of the state department of health under this article, and no person or corporation shall be considered to have violated or refused to obey any such rule or regulation. The owner of any building the removal of which is occasioned or required, or which has been removed by any rule or regulation of the state department of health made under the provisions of this article, and all persons whose rights of property are injuriously affected by the enforcement of any such rule or regulation, shall have a cause of action against the municipality or corporation owning the water works benefited by the enforcement of such rule or regulation, for all damages occasioned or sustained by such removal or enforcement, and an action therefor may be brought against such municipality or corporation in any court of record in the county in which the premises or property affected is situated and shall be tried therein; or such damages may be determined by a special proceeding in the supreme court or the county court of the county in which the property is situated. Such special proceedings shall be commenced by petition and notice to be served by such owner upon the municipality or corporation in the same manner as for the commencement of condemnation proceedings. Such municipality or corporation may make and serve an answer to such petition as in condemnation proceedings. The petition and answer shall set forth the claims of the respective parties, and the provisions of the condemnation law shall be applicable to the subsequent proceedings upon the petition and answer, if any. Either party may, before the service of the petition or answer respectively, offer to take or pay a certain sum, and no costs shall be awarded against either party unless the judgment is more unfavorable to him than his offer.

§ 74. Discharge of sewage into Wallkill creek prohibited. No person or corporation shall permit the discharge or escape of any sewage, or other matter deleterious to public health, or destructive to fish, or throw or cast any dead animal, carrion or offal, or other putrid or offensive matter into the waters of the Wallkill creek, in the counties of Ulster and Orange. Any person violating any provision of this section shall forfeit to the county where the violation occurred the sum of fifty dollars for every such violation.

§ 75. Discharge of sewage into the Susquehanna near Binghamton prohibited. No person or corporation

shall cause to fall, flow or discharge into the Susquehanna river or any of its tributaries, between the Rock Bottom dam in such river at the city of Binghamton, and a point one mile east of the bridge that crosses such river at Conklin, any sewage matter, or other foul, noxious or deleterious, solid or liquid matter, or any matter that may be declared such by the board of health of any municipality adjacent to such river within such limit. The board of health of any such municipality shall examine into any alleged offense against this section and cause the same to be abated, if found to exist. Every person violating any provision of this section shall forfeit to the municipality having a local board of health where the violation occurs the sum of twenty five dollars for the first day when the violation takes place, and the sum of ten dollars for every subsequent day that such violation is repeated or continued.

§ 76. Discharge of sewage and other refuse matter into certain waters prohibited. No person, corporation or municipality, shall place or cause to be placed, or discharge or cause to be discharged into any of the waters of this state, unless the same shall have been permitted by the state commissioner of health, any sewage, garbage, offal, dead animal, dead fish, dead bird or part thereof, or any decomposable or putrescible matter of any kind or any substance, chemical or otherwise, containing the same in quantities injurious to the public health, or any refuse or waste matter, either solid or liquid, in quantities injurious to the public health, from any shop, factory, mill or industrial establishment; unless express permission to do so shall have been first given in writing by the state commissioner of health as provided in this article, except as hereinafter provided. But this section shall not prevent the discharge of sewage from any public sewer system owned and maintained by a municipality, or the discharge of refuse or waste matter from any shop, factory, mill or industrial establishment, provided such sewer system was in operation and was discharging sewage, or such shop, factory, mill or industrial establishment was in operation and discharging refuse or waste matter, into any of the waters of this state on or prior to May seventh, nineteen hundred and three, nor to any extension or modification of such shop, factory, mill or industrial establishment or reconstruction thereof, provided the refuse or waste matter discharged therefrom is not materially changed or increased; but this exception shall not permit any increase in the discharge of such sewage, nor shall it permit the discharge of sewage from a sewer system which shall be extended, modified or reconstructed subsequent to said date.

§ 77. Permission to discharge sewage. Upon application duly made to the state commissioner of health by the public authorities having by law the charge of the sewer system of any municipality, the state commissioner of health shall have power to consider the case of a sewer system otherwise prohibited by the preceding section from discharging sewage into any of the waters of the state, and whenever in his opinion the general interests of the public health would be subserved thereby, he may issue a permit for the discharge of sewage from any such sewer system into any of the waters of the state, and may stipulate in the permit, modifications, regulations and conditions on which such discharge may be permitted. Such permit before being operative shall be recorded in the county clerk's office of the county wherein the outlet of the said sewer system is located, and a copy of the permit shall be transmitted by the state commissioner of health to the board of health of the municipality wherein the outlet of said sewer system is located.

§ 78. Permission to discharge refuse or waste matter from industrial establishments. Upon application duly made to the state commissioner of health by the proprietor, lessee or tenant of any shop, factory, mill or industrial establishment from which the discharge of refuse or waste matter into any of the waters of the state is otherwise prohibited by section seventy-six, the state commissioner of health shall have power to consider the case of the said shop, factory, mill or industrial establishment, and whenever the public health and purity of the waters shall warrant it, he shall issue a permit for the discharge of refuse or waste matter from such shop, factory, mill or industrial establishment into any of the waters of the state, and may stipulate in the permit such modifications, regulations and conditions as the public health may require. Such permit before being operative shall be recorded in the county clerk's office of the county where such shop, factory, mill or industrial establishment is located and a copy of such permit shall be transmitted by the state commissioner of health to the board of health of the municipality wherein the outlet discharging refuse or waste matter from such shop, factory, mill or industrial establishment shall be located.

§ 79. Plans for refuse discharge pipes must be submitted. Before any conduit or discharge pipe, or other means of discharging or casting any refuse or waste matter from

Exhibit 6

trates, may designate additional places for the holding of magistrates' or police courts and jail delivery to be held in and for the city; notice of any change of the places of holding such courts shall, before the same takes effect, be published in the City Record and the corporation newspapers for a period of not less than two weeks. Said publication shall be made under the direction of the comptroller. The commissioners of the sinking fund may by resolution designate from time to time any building or buildings within the city to be the common jails of said city or of any of the counties contained within its territorial limits, for all the purposes for which common jails may by law be used, and such building or buildings so designated shall be such common jails until changed by a like resolution of the commissioners of the sinking fund. The sinking fund commissioners of the city of New York shall not have the power in any event to compromise or release any existing liability or obligation to the city of New York or to the mayor, aldermen or commonalty of the city of New York, or to any of the municipalities or parts of municipalities consolidated with the former city of New York, under the provisions of chapter six hundred and forty-two of the laws of eighteen hundred and eighty-six or under chapter four hundred and thirty-four of the laws of eighteen hundred and ninety three, but such liabilities and obligations shall be and remain inviolable.

§ 3. This act shall take effect immediately.

Chap. 695.

AN ACT to amend the public health law, in respect to conferring upon the city of New York control over the potable water supply of said city.

Became a law July 18, 1911, with the approval of the Governor. Passed, three-fifths being present.

Accepted by the City.

The People of the State of New York, represented in Senate and Assembly, do enact as follows:

Section 1. Sections seventy, seventy-one and seventy-three of chapter forty-nine of the laws of nineteen hundred and nine, entitled "An act in relation to the public health, constituting chap- L. 1909, ch. 49, §§ 70, 71, 73 amended.

ter forty-five of the consolidated laws," and known as the public health law, are hereby amended to read as follows:[1]

§ 70. Rules and regulations of department. The state department of health may make rules and regulations for the protection from contamination of any or all public supplies of potable waters and their sources within the state, [2]and the commissioner of water supply, gas and electricity of the city of New York may make such rules and regulations subject to the approval of the state department of health for the protection from contamination of any or all public supplies of potable waters and their sources within the state where the same constitute a part of the source of the public water supply of said city. If any such rule or regulation relates to a temporary source or act of contamination, any person violating such rule or regulation shall be liable to prosecution for misdemeanor for every such violation, and on conviction shall be punished by a fine not exceeding two hundred dollars, or imprisonment not exceeding one year, or both. If any such rule or regulation relates to a permanent source or act of contamination, said department may impose penalties for the violation thereof or the noncompliance therewith, not exceeding two hundred dollars for every such violation or noncompliance. Every such rule or regulation shall be published at least once in each week for six consecutive weeks, in at least one newspaper of the county where the waters to which it relates are located. The cost of such publication shall be paid by the corporation or municipality benefited by the protection of the water supply, to which the rule or regulation published relates. The affidavit of the printer, publisher or proprietor of the newspaper in which such rule or regulation is published may be filed, with the rule or regulation published, in the county clerk's office of such county, and such affidavit and rule and regulation shall be conclusive evidence of such publication, and of all the facts therein stated in all courts and places.

§ 71. Inspection of water supply. The officer or board having by law the management and control of the potable water supply of any municipality, and in the city of New York, the commissioner of water supply, gas and electricity, or the corporation furnishing such supply, may make such inspection of the sources of such water supply as such officer, board or corporation deems advisable and to ascertain whether the rules or regulations of the state department and of the commissioner of water supply, gas and

[1] References to commissioner of water supply, gas and electricity of the city of New York are new and are not specifically indicated by footnote.
[2] Remainder of sentence new.

electricity of the city of New York, are complied with, and shall make such regular or special inspections as the state commissioner of health, or the commissioner of the department of water supply, gas and electricity of the city of New York, may prescribe. If any such inspection discloses a violation of any such rule or regulation relating to a temporary or[3] permanent source or act of contamination, such officer, board or corporation shall cause a copy of the rule or regulation violated to be served upon the person violating the same, with a notice of such violation. If the person served does not immediately comply with the rule or regulation violated, such officer, board or corporation, except in a case concerning the violation of a rule or regulation relating to a temporary or permanent source or act of contamination affecting the potable water supply of the city of New York,[4] shall notify the state department of the violation, which shall immediately examine into such violation; and if such person is found by the state department to have actually violated such rule or regulation, the commissioner of health shall order the local board of health of such municipality wherein the violation or noncompliance occurs, to convene and enforce obedience to such rule or regulation. If the local board fails to enforce such order within ten days after its receipt, the corporation furnishing such water supply or the municipality deriving its water supply from the waters to which such rule or regulation relates, or the state commissioner of health or the local board of health of the municipality wherein the water supply protected by these rules is used, or any person interested in the protection of the purity of the water supply, may maintain an action in a court of record which shall be tried in the county where the cause of action arose against such person, for the recovery of the penalties incurred by such violation, and for an injunction restraining him from the continued violation of such rule or regulation. [5]If the person served does not comply within five days with the rule or regulation violated, in case such rule or regulation relates to a temporary or permanent source or act of contamination affecting the potable water supply of the city of New York, the commissioner of water supply, gas and electricity of said city may summarily enforce compliance with such rule or regulation, and may summarily abate or remove the cause of the violation of such rule or regulation or the nuisance

[3] Words "temporary or" new.
[4] Words "except in a case concerning . . . New York," new.
[5] Remainder of section new.

so created, and to that end may employ such force as may be necessary and proper; provided, however, that no building or improvements shall be removed, disturbed or destroyed by the said commissioner of water supply until he shall cause measurements to be made of the buildings and photographs of the exterior views thereof, which measurements and photographs shall be at the disposition thereafter of the owners or their attorneys, and failure to exercise such right of abatement shall not be deemed a waiver thereof. Failure to comply within five days with such rule and regulation shall further entitle the city of New York to maintain an action in any court having jurisdiction thereof for the recovery of the penalties incurred by such violation and for an injunction restraining the person or persons violating such rule or regulation, or creating or continuing such nuisance, from the continued violation of such rule or regulation or continuance of such nuisance; the remedy by abatement being not exclusive.

§ 73a. Sewerage. When the state department of health, or the commissioner of water supply, gas and electricity of the city of New York, shall, for the protection of a water supply from contamination, make orders or regulations the execution of which will require or make necessary the construction and maintenance of any system of sewerage, or a change thereof, in or for any village or hamlet, whether incorporated or unincorporated, or the execution of which will require the providing of some public means of removal or purification of sewage, the municipality or corporation owning the water works benefited thereby shall, at its own expense, construct and maintain such system of sewerage, or change thereof, and provide and maintain such means of removal and purification of sewage and such works or means of sewage disposal as shall be approved by the state department of health, [a]and for that purpose said municipality or corporation may acquire, under the general condemnation law, the necessary real estate or interest therein whether now used for public or private purposes. When the execution of any such regulations of the state department of health, or the commissioner of water supply, gas and electricity of the city of New York, will occasion or require the removal of any building or buildings, the municipality or corporation owning the water works benefited thereby shall, at its own expense, remove such buildings and pay to the owner thereof all damages occasioned by such removal. When the execution of any such regulation will injuriously affect any property the municipality or corporation

[a] Remainder of sentence new

owning the water works benefited thereby shall make just and adequate compensation for the property so taken or injured [6]and for all injuries caused to the legitimate use or operation of such property. Until such construction or change of such system or systems of sewerage, and the providing of such means of removal or purification of sewage, and until[7] such works or means of sewage disposal and the removal of any building are so made by the municipality or corporation owning the water works to be benefited thereby at its own expense, and until, except in the case of a municipality,[8] the[9] corporation owning the water works benefited shall make just and adequate payment for all injuries to property and for all injuries caused to the legitimate use or operation of such property, there shall be no action or proceeding taken by any such municipality, officer, board, person or corporation against any person or corporation for the violation of any regulation of the state department of health under this article, and no person or corporation shall be considered to have violated or refused to obey any such rule or regulation. The owner of any building the removal of which is occasioned or required, or which has been removed by any rule or regulation of the state department of health, or the commissioner of water supply, gas and electricity of the city of New York, made under the provisions of this article, and all persons whose rights of property are injuriously affected by the enforcement of any such rule or regulation, shall have a cause of action against the municipality or corporation owning the water works benefited by the enforcement of such rule or regulation, for all damages occasioned or sustained by such removal or enforcement including all injuries caused to the legitimate use or operation of such property,[10] and an action therefor may be brought against such municipality or corporation in any court of record in the county in which the premises or property affected is situated and shall be tried therein; or such damages may be determined by a special proceeding in the supreme court or the county court of the county in which the property is situated. Such special proceedings shall be commenced by petition and notice to be served by such owner upon the municipality or corporation in the same manner as for the commencement of condemnation proceedings. Such munici-

6 Remainder of sentence new.
7 Word "until" new.
8 Words "except in the case of a municipality" no
9 Words "municipality or," omitted.
10 Words "including all injuries . . . such property," new.

pality or corporation may make and serve an answer to such petition as in condemnation proceedings. The petition and answer shall set forth the claims of the respective parties, and the provisions of the condemnation law[11] shall be applicable to the subsequent proceedings upon the petition and answer, if any. Either party may, before the service of the petition or answer respectively, offer to take or pay a certain sum, and no costs shall be awarded against either party unless the judgment is more unfavorable to him than his offer. [12]Provided, however, that in the case of a summary abatement by a municipality as hereinbefore provided, no costs shall be awarded against the owner of the property damaged, and the commissioners of appraisal in their report shall recommend such additional sum as may in their judgment be reasonable as compensation for witnesses and other necessary expenses of claimant. Such municipality shall, within three calendar months after the confirmation of the report of the commissioners of appraisal, pay to the respective owners and bodies politic or corporate, mentioned or referred to in said report, in whose favor any sum or sums of money shall be estimated and reported by said commissioners, the respective sum or sums so estimated and reported in their favor respectively, with lawful interest thereon. And in case of neglect or default in the payment of the same within the time aforesaid, the respective person or persons or bodies politic or corporate in whose favor the same shall be so reported, his, her, or their executors, administrators or successors, at any time or times, after application first made by him, her, or them to such municipality for payment thereof, may sue for and recover the same, with lawful interest as aforesaid, and the costs of suit in any proper form of action against such municipality in any court having cognizance thereof, and it shall be sufficient to declare generally for so much money due to the plaintiff or plaintiffs therein by virtue of this act, and the report of said commissioners, with proof of the right and title of the plaintiff or plaintiffs to the sum or sums demanded shall be conclusive evidence in such suit or action.

Saving clause.

§ 2. Nothing herein contained shall repeal or modify any of the provisions of chapter seven hundred and twenty-four of the laws of nineteen hundred and five, as amended by chapter three hundred and fourteen of the laws of nineteen hundred and six

§ 3. This act shall take effect immediately

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[11] See code of civil procedure, §§ 3357–3384

[12] Remainder of section new.

Exhibit H

TITLE I

POTABLE WATERS

Section 1100. Rules and regulations of the department.
1101. Inspection.
1102. Violation; injunction and abatement.
1103. Violation; penalties.
1104. Sewage removal or purification; condemnation of property.
1105. Sewage removal or purification; rights of property owners.
1106. Limitations; city of New York.
1107. Orders of commissioner.

§ 1100. Rules and regulations of the department. 1. The department may make rules and regulations for the protection from contamination of any or all public supplies of potable waters and water supplies of the state or United States, institutions, parks, reservations or posts and their sources within the state, and the commissioner of water supply, gas and electricity of the city of New York and the board of water supply of the city of New York may make such rules and regulations subject to the approval of the department for the protection from contamination of any or all public supplies of potable waters and their sources within the state where the same constitute a part of the source of the public water supply of said city.

2. Every such rule or regulation shall be published at least once in each week for two consecutive weeks, in at least one newspaper of the county where the waters to which it relates are located. The cost of such publication shall be paid by the corporation, municipality, state or United States or state or United States institution, park, reservation or post benefited by the protection of the water supply to which the rule or regulation published relates.

3. The affidavit of the printer, publisher or proprietor of the newspaper in which such rule or regulation is published shall be filed, together with the rule or regulation published, in the county clerk's office of such county, and such affidavit and rule and regulation shall be conclusive evidence of such publication, and of all the facts therein stated in all courts and places.

4. All rules and regulations heretofore duly made and published for the sanitary protection of public water supplies, pursuant to chapter five hundred forty-three of the laws of eighteen hundred eighty-five, and chapter six hundred sixty-one of the laws of eighteen hundred ninety-three, as amended, are hereby legalized, ratified, confirmed and continued in force, until new rules and regulations become operative.

5. This section shall not be construed to repeal or affect any of the provisions of chapter three hundred seventy-eight of the laws of eighteen hundred ninety-seven, or its amendments.[88]

[88] NOTE.—Subds. 1, 2 and 3 derived from § 70. Subds. 4 and 5 derived from former § 72.

§ 1101 Inspection. 1. The person, officer, board or commission having the management and control of the potable water supply of any municipality, state or United States institution, park, reservation or post, and in the city of New York, the commissioner of water supply, gas and electricity, and the board of water supply of the city of New York, or the corporation furnishing such supply, may make such inspection of the sources of such water supply as such person, officer, board, corporation or commission deems advisable and to ascertain whether the rules or regulations of the department, and of the commissioner of water supply, gas and electricity of the city of New York, and of the board of water supply of the city of New York, are complied with, and shall make such regular or special inspections as the commissioner, or the commissioner of the department of water supply, gas and electricity of the city of New York, or the board of water supply of the city of New York, may prescribe.

2. The authorities in charge of the water supply or their duly authorized representatives may without fee or hindrance, enter, examine and survey all grounds, structures, buildings and places on the watershed tributary to the sources of such water supply in order to ascertain whether such rules or regulations are complied with.[89]

§ 1102. Violation; injunction and abatement. 1. If any inspection discloses a violation of any rule or regulation promulgated pursuant to section one thousand one hundred of this chapter relating to a temporary or permanent source or act of contamination, the person, officer, board, or commission having the management and control of the potable water supply of the municipality, state or United States institution, park, reservation or post, and in the city of New York, the commissioner of water supply, gas and electricity, and the board of water supply of the city of New York, or the corporation furnishing such supply shall cause a copy of the rule or regulation violated to be served upon the person violating the same, with a notice of such violation. If the person served does not comply immediately with the rule or regulation violated, such person, officer, board, corporation or commission, except in a case concerning the violation of a rule or regulation relating to a temporary or permanent source or act of contamination affecting the potable water supply of the city of New York, shall notify the department of the violation

2 (a) Upon being notified of any violation as herein provided, the department shall examine immediately into such violation; and if the department finds such rule or regulation to have been violated, the commissioner shall order the local board of health of the health district wherein the violation or noncompliance occurs, to convene and enforce compliance with such rule or regulation

(b) If the local board of health of the health district wherein the violation or noncompliance occurs, fails to enforce the order of the commissioner within ten days after its receipt, the corporation furnishing such water supply or the municipality, state, or

[89] NOTE—Derived from former § 71

United States or state or United States institution, park, reservation or post deriving its water supply from the waters to which such rule or regulation relates, or the commissioner, or the local board of health of the health district wherein the water supply protected by these rules is used, or any person interested in the protection of the purity of the water supply, may maintain an action in a court of record which shall be tried in the county where the cause of action arose against such person, for the recovery of the penalties incurred by such violation, and for an injunction restraining the person violating such rule or regulation from the continued violation thereof

3. (a) If the person served with notice of violation does not comply within five days with the rule or regulation violated, in case such rule or regulation relates to a temporary or permanent source or act of contamination affecting the potable water supply of the city of New York, the commissioner of water supply, gas and electricity of said city, or the board of water supply of the city of New York, may summarily enforce compliance with such rule or regulation and may summarily abate or remove the cause of the violation of such rule or regulation or the nuisance so created, and to that end may employ such force as may be necessary and proper; provided, however, that no building or improvement shall be removed, disturbed or destroyed by the said commissioner of water supply or the said board of water supply until he or they shall cause measurements to be made of the buildings and photographs of the exterior views thereof, which measurements and photographs shall be at the disposition thereafter of the owners or their attorneys, and failure to exercise such right of abatement shall not be deemed a waiver thereof

(b) Failure to comply within five days with such rule or regulation shall further entitle the city of New York to maintain an action in any court having jurisdiction thereof for the recovery of the penalties incurred by such violation and for an injunction restraining the person from violating such rule or regulation, or creating or continuing such nuisance. The remedy by abatement herein provided for shall not be construed to be exclusive.[90]

§ 1103. Violation; penalties. 1. If any rule or regulation promulgated pursuant to section one thousand one hundred of this chapter relates to a temporary source or act of contamination, any person violating such rule or regulation shall be liable to prosecution for misdemeanor for every such violation, and on conviction thereof shall be punished by a fine not exceeding two hundred dollars, or imprisonment not exceeding one year, or both.

2. If any rule or regulation promulgated pursuant to section one thousand one hundred of this chapter relates to a permanent source or act of contamination, the department may impose penalties for the violation thereof or the noncompliance therewith, not exceeding two hundred dollars for every such violation or noncompliance.[91]

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[90] NOTE—Derived from former § 71
[91] NOTE—Derived from former § 70

§ 1104. Sewage removal or purification; condemnation of property. 1. When the department or the commissioner of water supply, gas and electricity of the city of New York, or the board of water supply of the city of New York, shall, for the protection of a water supply from contamination, makes orders or regulations the execution of which will require or make necessary the construction and maintenance of any system of sewerage, or a change thereof, in or for any village or hamlet, whether incorporated or unincorporated, or the execution of which will require the providing of some public means of removal or purification of sewage, the municipality, corporation, state or United States or state or United States institution, park, reservation or post owning the waterworks benefited thereby shall, at its own expense, construct and maintain such system of sewerage, or change thereof, and provide and maintain such means of removal and purification of sewage and such works or means of sewage disposal as shall be approved by the department. For such purpose said municipality, corporation, state or United States or state or United States institution, park, reservation or post, may acquire, by condemnation the necessary real estate or interest therein or the easement or use thereof whether now used for public or private purposes

2. When the execution of any such regulations of the department, or the commissioner of water supply, gas and electricity of the city of New York, or the board of water supply of the city of New York will occasion or require the removal of any building or buildings, the municipality, corporation, state or state institution, park, reservation or post owning the waterworks benefited thereby shall, at its own expense, remove such buildings and pay to the owner thereof all damages occasioned by such removal.

3. When the execution of any such regulation will injuriously affect any property the municipality, corporation, state or state institution, park, reservation or post owning the waterworks benefited thereby shall make just and adequate compensation for the property so taken or injured and for all injuries caused to the legitimate use of operation of such property

4. Until such construction or change of such system or systems of sewerage, and the providing of such means of removal or purification of sewage, and until such works or means of sewage disposal and the removal of any buildings are so made by the municipality, corporation, state or state institution, park, reservation or post owning the waterworks to be benefited thereby at its own expense, and until, except in the case of a municipality, state or state institution park, reservation or post, the corporation owning the waterworks benefited shall make just and adequate payment for all injuries to property and for all injuries caused to the legitimate use or operation of such property, there shall be no action or proceeding taken by any such municipality, officer, board, person, commission or corporation against any person or corporation for the violation of any regulation of the department under this article, and no person or corporation shall be considered to have violated or refused to obey any such rule or regulation [92]

[92] NOTE—Derived from former § 73

§ 1105. Sewage removal or purification; rights of property owners. 1 The owner of any building the removal of which is occasioned or required, or which has been removed by any rule or regulation of the department, or the commissioner of water supply, gas and electricity of the city of New York, or the board of water supply of the city of New York, made under the provisions of this article, and all persons whose rights of property are injuriously affected by the enforcement of any such rule or regulation, shall have a cause of action against the municipality or corporation, and shall have the right to present a claim against and to the state or state institution, park, reservation or post owning the waterworks benefited by the enforcement of such rule or regulation, for all damages occasioned or sustained by such removal or enforcement, including all injuries caused to the legitimate use or operation of such property.

2. (a) An action for such damages may be brought against such municipality or corporation in any court of record in the county in which the premises or property affected is situated and shall be tried therein; or such damage may be determined by a special proceeding in the supreme court or the county court of the county in which the property is situated. Such special proceeding shall be commenced by petition and notice to be served by such owner upon the municipality or corporation in the same manner as for the commencement of condemnation proceedings. Such municipality or corporation may make and serve an answer to such petition as in condemnation proceedings. The petition and answer shall set forth the claims of the respective parties and the provisions of the condemnation law shall be applicable to the subsequent proceedings upon the petition and answer, if any.

(b) Either party may, before the service of the petition or answer respectively, offer to take or pay a certain sum, and no costs shall be awarded against either party unless the judgment is more unfavorable to him than his offer.

3. (a) In the case of a summary abatement by a municipality no costs shall be awarded against the owner of the property damaged, and the commissioners of appraisal in their reports shall recommend such additional sum as may in their judgment be reasonable as compensation for witnesses and other necessary expenses of claimant.

(b) Such municipality shall, within three calendar months after the confirmation of the report of the commissioners of appraisal, pay to the respective owners and bodies politic or corporate, mentioned or referred to in said report, in whose favor any sum or sums of money shall be estimated and reported by said commissioners, the respective sum or sums so estimated and reported in their favor respectively, with lawful interest thereon.

(c) In case of neglect or default in the payment of the same within the time aforesaid, the respective person or persons or bodies politic or corporate in whose favor the same shall be so reported, his, her, or their executors, administrators, successors, or assigns, at any time or times, after application first made by him, her, or

them to such municipality for payment thereof, may sue for and recover the same, with lawful interest as aforesaid, and the costs of suit in any proper form of action against such municipality in any court having cognizance thereof, and it shall be sufficient to declare generally for so much money due to the plaintiff or plaintiffs therein by virtue of this act, and the report of said commissioners, with proof of the right and title of the plaintiff or plaintiffs to the sum or sums demanded shall be conclusive evidence in such suit or action.[93]

§ 1106. Limitations; city of New York. Nothing contained in this chapter shall extend the sanitary control of the board of water supply of the city of New York, beyond the sources of potable water supply, tributary to the Catskill and Delaware aqueducts; and the powers granted by this chapter to the board of water supply of the city of New York shall cease at the time of the transference of the jurisdiction over the source of water supply, by the board of water supply to the commissioner of water supply, gas and electricity of the city of New York; and at no time shall the commissioner of water supply, gas and electricity of the city of New York and the board of water supply of said city have or exercise concurrent powers or sanitary control over any source of potable water supply tributary to the Catskill or Delaware aqueduct.[94]

§ 1107. Orders of commissioner. 1. When the commissioner, after investigation of the condition of any public water supply used for drinking or other domestic purposes, whether maintained and operated by a municipality, water district or private corporation, company or individual, shall certify to the board, corporation, company, officer or person in charge of the maintenance and operation of such water supply that in his opinion such water supply is so polluted or subject to dangerous pollution or so inadequate or of such objectionable physical quality as to constitute a menace to the public health and shall order reasonable improvements to be made for the protection of public health and such municipality, water district or private corporation, company or individual maintaining and operating such water supply shall fail to carry out such order forthwith, any court of competent jurisdiction may, upon the application of the commissioner, enforce prompt compliance with such order.

2. Service of the certificate by the commissioner as aforesaid shall be made upon the mayor or corporation counsel of the municipality or upon an officer of the water district or private corporation or company as the case may be.[95]

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[93] NOTE—Derived from former § 73.
[94] NOTE—Derived from former § 73-a.
[95] NOTE—Derived from § 38, renumbered § 75 by L. 1949, ch. 666, renumbering effective April 1, 1959.

Exhibit I

41 NY 2d 769

Part 3

To be argued by
STEPHEN P. KRAMER

Court of Appeals

State of New York

SUPREME COURT
JUN 29 1977
FILED

FREDERICK R. HAINES, for himself and on behalf of all other property owners in the Town of Hunter; the Village of Tannersville, County of Greene, State of New York, similarly situated,

Plaintiffs-Respondents,

TOWN OF HUNTER and VILLAGE OF TANNERSVILLE,

Intervenor-Plaintiffs-Respondents,

THE CITY OF NEW YORK, DEPARTMENT OF WATER RESOURCES, BUREAU OF WATER SUPPLY, EDWARD C. MAGUIRE, HERBERT M. ROSENBERG and WALTER B. COLEMAN, constituting the Board of Water Supply of the City of New York, MAURICE M. FELDMAN, as Deputy Administrator of the Department of Water Resources; ABRAHAM M GROOPMAN, Chief Engineer, Bureau of Water Supply of the City of New York,

Defendants-Appellants.

BRIEF OF DEFENDANTS-APPELLANTS

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NEW YORK STATE DEPARTMENT
OF ENVIRONMENTAL CONSERVATION

In the Matter of the Application of

Application Numbers
0-9999-00096/00005
0-9999-00096/00009

BELLEAYRE RESORT at the
CATSKILL PARK PROPERTY

REPLY MEMORANDUM OF LAW FOR THE COALITION OF WATERSHED TOWNS, DELAWARE COUNTY, TOWN OF MIDDLETOWN AND TOWN OF SHANDAKEN

Dated: January 21, 2005

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POINT I

A. CPC HAS FAILED TO MEETS ITS BURDEN TO DEMONSTRATE THAT THERE IS A SIGNIFICANT ADVERSE IMPACT ON COMMUNITY CHARACTER THAT HAVE NOT BEEN ADEQUATELY MITIGATED THAT SHOULD BE ADDRESSED IN THE ADJUDICATORY HEARING 1

B. CPC AND DEP HAVE FAILED TO MEETS ITS BURDEN TO DEMONSTRATE THAT THERE IS A SIGNIFICANT ADVERSE IMPACT ON STORMWATER THAT HAVE NOT BEEN ADEQUATELY MITIGATED THAT SHOULD BE ADDRESSED IN THE ADJUDICATORY HEARING 5

POINT I

A. CPC HAS FAILED TO MEETS ITS BURDEN TO DEMONSTRATE THAT THERE IS A SIGNIFICANT ADVERSE IMPACT ON COMMUNITY CHARACTER THAT HAVE NOT BEEN ADEQUATELY MITIGATED THAT SHOULD BE ADDRESSED IN THE ADJUDICATORY HEARING

In its post hearing memorandum of law, CPC argues that the adjudicatory hearing should include the following: (i) community character; (ii) visual impact; (iii) noise impacts on hikers, campers and other users of the forest preserve; (iv) traffic impacts; (v) secondary and induced growth impacts; (vi) wildlife habitat impacts; (vii) impacts to the forest preserve; (viii) impacts to the Catskill Forest; (ix) stormwater impacts; (x) potable water supply impacts; (xi) aquatic habitat impacts; an (xii) and other alternatives are preferable. Finally, CPC argues that the DEIS failed to assess the cumulative impacts of the project with the Belleayre Mountain Ski Center and other pending projects.

In this proceeding, the Watershed Communities do not take a position on whether the noise impacts, visual impacts, traffic impacts, aquatic habitat, and other traditional environmental impacts need or need not to be adjudicated. The Watershed Communities do object to the adjudication of community character as a separate issue and also contest the need to adjudicate the issue of secondary impacts and induced growth. In particular, the Watershed Communities believe that CPC has misinterpreted the Watershed Communities' arguments and the proper context of the 1997 New York City Watershed Memorandum of Agreement.

CPC appears to argue that the Watershed Communities are taking the position that the MOA specifically permitted large scale projects and that such projects are exempt from a SEQRA analysis. That is not the position of the Watershed Communities. As noted in our initial brief, neither the MOA, the New York City watershed regulations, nor the Filtration Avoidance Determination include any presumption, one way or another regarding the size or location of projects. The sole issue is compliance with the regulations.

CPC correctly notes that the MOA included the creation of the Catskill Fund for the Future ("CFF"), a $59 million economic development fund. It must be noted that use of the CFF is not limited to any size of a project, and resorts are not excluded. In fact, during the watershed negotiations and the drafting of the MOA, an effort was made by the environmental parties to exclude CFF funding from resorts. That attempt was rejected due to the recognition that there was nothing *per se* environmentally improper with a resort project. The Watershed Communities wished to maintain their flexibility in the use of the economic development funds to assist a new resort or an expansion of an existing resort.

Nor is it relevant that the Crossroads project is not currently seeking CFF funds. There is nothing to preclude an application for CFF funding in the future and it may be considered by the CWC at that time. In fact, any application at this time would be premature. Finally, if Crossroads does apply for funding, support by DEP is not required for approval. New York City has only one seat on the 15 member Board of Directors of the CWC. (MOA ¶117). Thus, DEP concurrence regarding a CFF funding decision is not required.

It is the position of the Watershed Communities that resorts are consistent with the letter and spirit of the MOA and there cannot be any presumption to the contrary. While there is a historical record of the past grand resorts, there are also resorts and ski areas currently prevalent throughout the West of Hudson watershed, including, for example, Hunter Mountain, Ski Windham, Belleayre and the Hanah Country Inn. The Catskills as a recreation area, for both small and large scale resorts was always intended to be continued, subject of course to compliance with applicable laws and regulations.

As noted in our initial brief, the Watershed Communities do not take a position on the adjudication of visual impacts, noise or impacts to open space. However, as noted in St. Lawrence Cement Company, LLC (DEC Comm'r Decision, Sept. 8, 2004) community character should not be separately adjudicated, but can be considered by the Commissioner after full consideration of the other substantive issues. Any consideration of community character must provide deference to the locally adopted land use plans and zoning laws. It must also be noted that contrary to the situation in St. Lawrence Cement, where the host community of the Town of Greenport does not have any zoning, both Shandaken and Middletown have zoning, the prerequisite to deference to local visions of community character.

Finally, with respect to the need to adjudicate secondary impacts, the Watershed Communities take exception to CPC's claim that there is a likelihood of unfettered growth triggered by this project that would result in environmental problems and otherwise escape environmental review. While the MOA did provide funds for new infrastructure projects in Phoenicia and

Fleischmanns, those projects are only designed to accommodate a flow 10% greater than the existing development For Phoenicia the total size will be approximately 185,000 gpd. For Fleischmanns the total flow is 146,000 gpd. For both communities, any secondary growth in the hamlet/village is already accommodated in those flow numbers and serves as a limit to development in those areas. Similarly, for the Sewer Extension Programs associated with the Margaretville and Pine Hill wastewater treatment plants, the length of the extensions is very limited and designed to capture areas of existing septic system failures, thus reducing pollution sources to the watershed. And, like the wastewater treatment plants proposed for Phoenicia and Fleischmanns, the Margaretville and Pine Hill plants are of limited capacity and the City has indicated no willingness to expand their capacity. Finally the Septic System Rehabilitation and Repair program only deals with existing homes and is designed to upgrade septic systems to meet current requirements and eliminate sources of pollution. It is not a means of subsidizing new residential or commercial development. [1]

Outside of those projects any future development of any size is prohibitively expensive because commercial projects will require the construction of private wastewater treatment plants that must meet the City's watershed regulations and are not eligible for funding from the City. Therefore, in terms of wastewater loadings there is little potential for secondary growth and as was demonstrated at the Issues Conference, even using DEP's figures for additional stormwater loadings of 4 kg/yr, that number is, by definition, an insignificant increase in the watershed.

---

[1] Fully commercial entities are not even eligible for the septic fund.

B. CPC AND DEP HAVE FAILED TO MEETS ITS BURDEN TO DEMONSTRATE THAT THERE IS A SIGNIFICANT ADVERSE IMPACT ON STORMWATER THAT HAVE NOT BEEN ADEQUATELY MITIGATED THAT SHOULD BE ADDRESSED IN THE ADJUDICATORY HEARING

The City asserts several issues that should be adjudicated with respect to stormwater. The first two issues are set forth below:

1. The Applicant's hydrogeological analysis does not represent existing on-site conditions and, as a result, the Applicants failure to perform an accurate assessment of predevelopment conditions is a substantive and significant issue.

2. The Applicant's failure to accurately assess predevelopment pollutant loads from the project is a substantive and significant issue.

Although these two points absorb 23 pages, the City's position is relatively simple: the models used by the Applicant to evaluate predevelopment flow and pollutant loadings over estimated both the predevelopment flow and the predevelopment pollutant loadings. The City bases its position, in large part, on flow measurements taken on September 18, 2004 during Hurricane Ivan, weeks after the Administrative Law Judge ceased taking testimony on stormwater. The City also bases its arguments on water quality monitoring that it has done over the past several years and shows that the water quality on the site for TSS and phosphorus is "incredibly low" and lower than the models used by the Applicant predicted for predevelopment loadings. DEP argues that by

overestimating the predevelopment flow, the Applicant underestimated the impact of the post development flow. The Applicant, however, used the same models to estimate the post development flow, thus, to the extent the models overestimated actual conditions, those conditions have now been, at least, consistently evaluated. Under the Phase II Stormwater Permit, as adopted by DEC, there is no condition or requirement that pollutant loading from the post development flow be no greater than the pollutant loading from predevelopment flow. Rather, the Phase II Permit creates a technology based standard of implementing control measures that will reduce TSS by 80% and phosphorus by 40%. If the models used by the Applicant truly overestimate the predevelopment and post development flow, then the measures proposed by the Applicant will be conservative and potentially oversized.

The City also argues that the Applicant should have modeled the impact from each and every outfall rather than to have modeled the impact from the project as a whole This concept is impracticable and, if applied statewide, would substantially increase the costs incurred to obtain and approve Stormwater Pollution Prevention Plan. The Watershed Communities are concerned that this Applicant (and other potential applicants within the Watershed) will be forced under DEP's interpretation to collect years of monitoring data and to modify the generally accepted models to account for that data. In the end, the years of delay and additional costs will have little effect on the overall design of the Stormwater Pollution Prevention Plan. In the meantime, the delay and data collection cost will stop the project and send a message to other potential developers to look elsewhere.

In the end, the draft SPDES permit requires the Applicant to measure the pollutant concentration both upstream and downstream of the site. The impact of the runoff from the property on the pollutant loading will be obvious from the analysis. If the DEP staff and/or the DEC staff have concerns regarding the modeling, those concerns can be addressed outside the adjudicatory hearing through the approval of the SPPP. Both the DEC staff (under the proposed SPDES permit) and the DEP staff (under the Watershed Regulations) have to approve of the Stormwater Pollution Prevention Plan and its components. As part of the supporting documentation for the SPPP, both DEC staff and the DEP staff can require the Applicant to supplement their SPPP with additional information or modeling. Adjudicating this issue will only delay the resolution of the issue.

In Issue No. 3, DEP seeks to adjudicate whether the "waiver from the five acre standard in the construction of Big Indian is substantive because the construction as proposed could contribute to further violations of water quality standards in Birch Creek, Esopus Creek and the Ashokan Reservoir. These are the type of DEP arguments that make the Watershed Communities blood boil because it demonstrates that DEP is attempting to stop this project through delay and permitting cost. Under both the Watershed Regulations and under the proposed permit, the Applicant has to submit an erosion control plan for construction to both DEP and DEC for approval. The Applicant has stated in his application that at times, the Applicant will need to keep open up more than five acres at one time. DEC has stated that prior to it approving the erosion control plan, the Applicant will have to demonstrate that the plan is adequate to handle the disturbed area. Before DEP can issue its stormwater pollution prevention permit to the Applicant, the Applicant will have to demonstrate that the plan is adequate to handle the disturbed area. The five acre criteria asserted by the DEP is a

general guidance which states that it should not be exceeded absent unique circumstances and adequate controls. DEC has acknowledged that the construction of a golf course requires or constitutes the special circumstances that require that more than five acres being disturbed at one time. The issue is not whether the waiver should be granted; the issue is whether the measures proposed in the erosion control plan are adequate to address potential erosion issues. Again, this is not a "yes or no" issue, it is a "how to" issue. The details of "how to" must await detailed design. At this stage, DEC need only determine that it is possible for the Applicant to develop an erosion control plan that will be adequate to meet the regulatory requirements. The SPDES permit will prohibit the Applicant from proceeding without such a plan.

DEP also argues that this watershed is a sensitive area for TSS and, as a result, stormwater impacts should be micromanaged. This is another prime example of the City taking the position that the watershed communities should do what the City says and not what the City does. For example, Appendix A to Watershed Communities Exhibit #6 entitled: New York City Department Environmental Protection Guidance for Phosphorous Offset Pilot Programs, March 1997, prepared by: Bureau of Water Supply Quality and Protection, Engineering and Operation Division, Project Management Group describes the "calculations required to determine pre- and post- development point and non-point source phosphorous loadings from the wastewater treatment plant site and the sites that will be contributing to the wastewater treatment plant's flow volume". These calculations: "form the basis for determining the amount of phosphorous that must be offset through the phosphorous offset mechanism." With respect to the calculation, applicants are instructed to "assign development categories and runoff coefficients(R) to each subbasin of the development site using

the National Urban Runoff Program data (see Appendix E and "Results of Nationwide Urban Runoff Program" USEPA, 1993)." Appendix E identifies the pollutant loading coefficients; Appendix D specifies the annual average rain fall that is to be used in the calculation for each county within the watershed, and Appendix F identifies the BMP pollutant removal efficiencies. In other words, for purposes of permitting new phosphorus discharges in a phosphorous restricted basin, DEP has already developed and published a methodology for determining the pre and post development phosphorous loadings that is much simpler than and does not require the site specific data being suggested by DEP in this proceeding.

In the United States District Court, Northern District of New York Decision dated February 6, 2003 in the matter entitled *Catskill Mountain Chapter of Trout Unlimited, Inc. et al. v. New York City*, 1:00-CV-511, Chief Judge Scullin explains that the post-1996 turbidity problems in the Esopus Creek as being attributed primarily to New York City's point source discharge for the Shandaken Tunnel (Watershed Community Exhibit No. 17). Chief Judge Scullin required the City to submit and obtain a SPDES permit from the DEC for the Shandaken Tunnel discharge. Approximately 2 years has passed since the Court issued its decision and the DEC has not, as yet, issued a revised draft permit. The initial drafts the SPDES permit was opposed by the DEP, in part, because the permit attempted to hold DEP accountable for turbidity exceedences in the Ashokan. Watershed Communities Exhibit No. 18 is a letter from Michael A. Principe, Ph.D. of the New York City Department of Environmental Protection to Thomas D. Engle regarding the initial draft Shandaken Tunnel SPDES Permit 3-5150-00420/00001. This letter is New York City Department of Environmental Protection's comment letter in response to DEC's Draft SPDES permit for discharges

from the Shandaken Tunnel issued for public comment on February 18, 2004. In that letter, DEP states as follows:

> The draft permit proposes that when the action levels are exceeded, DEP shall investigate the sources of the exceedance and propose measures to reduce turbidity from the sources. (Draft Permit Page 3). However, in reality, it is unlikely that exceedances and the discharges from the Tunnel will relate back to a single identifiable source of turbidity in the watershed, such as the failure or collapse of a particular stream bank. Rather, turbidity events are more likely to result from a storm, or snow melt that had occurred sometime prior to the effective discharge, and are unrelated to any particular source that can be located and addressed .....
>
> [T]he draft permit states that once the sources of exceedance are identified, "the identified sources shall be used to prioritize compliance actions to be taken in the schedule of compliance - action level items on page 9 of this permit." Thus, DEC relies on underlying assumption that the program set forth in page 9 - stream restoration, critical area seeding and conservation easements – will actually reduce turbidity in the Schoharie Watershed. This underlying assumption has not been established. We believe that these programs provide water quality benefit by, among other things, for stalling new potential sources of turbidity in the watershed that by virtue of its geology and topography is prone to erosion. **Moreover, while the programs may lead to localized turbidity reductions during low flow conditions, we do not believe that they will significantly reduce turbidity exceedances under the permit, which are more directly related to severe wet weather events. It is these high flow storm events that are likely to lead to the most significant increase in turbidity in the Schoharie Reservoir and the Shandaken Tunnel. For the same reasons, we urge DEC to delete the reference to the "the expected on-going decreases in turbidity from the Shandaken Tunnel" in the SPDES fact sheet (page 2, FN 1).**
>
> * * *
>
> Finally, as discussed above, while stream restoration may prevent the further exacerbation of turbidity in the Catskill system, it is unproven

to date that stream restoration of even a substantial stream area actually reduces turbidity in a measurable way."

In other words, the City's position with respect to it being held accountable for the turbidity coming out of the Shandaken Tunnel, is that (i) the turbidity is due to the severe weather conditions and the natural localized geology and topography and (ii) that best management programs such as critical area seeding, stream bank restoration and even conservation easements will not have a measurable impact on downstream turbidity. This position is in contrast to the City's position in this proceeding in which the City asserts that the proposed project may have significant turbidity impacts on the Ashokan.

Dated: January 21, 2005
Albany, New York

Respectfully submitted,

YOUNG, SOMMER, WARD, RITZENBERG,
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5 Palisades Drive
Albany, NY 12205
(518) 438-9907

By: _____
Jeffrey S. Baker, Esq.

By: _____
Kevin M. Young, Esq.

wpdata\coalition of watershed towns\crossroads\050121 Reply MOL kmy

NEW YORK STATE DEPARTMENT
OF ENVIRONMENTAL CONSERVATION

In the Matter of the Application of

Application Numbers
0-9999-00096/00005
0-9999-00096/00009

BELLEAYRE RESORT at the
CATSKILL PARK PROPERTY

STATE OF NEW YORK)
: ss.:
COUNTY OF ALBANY)

ELIZABETH B. POPOLIZIO, being duly sworn, deposes and says as follows:

1 I am not a party to this action and am over 18 years of age.

2. On January 21, 2005, I served the Reply Memorandum of Law submitted on behalf of the Coalition of Watershed Towns, Delaware County, Town of Middletown and Town of Shandaken, in the above-referenced matter by placing the same in a postage prepaid, first-class, properly addressed wrapper in a depository under the exclusive care and custody of the United States Postal Service located at 4 Atrium Drive, Albany, New York 12205, upon

Carol Krebs
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Elizabeth B. Popolizio
ELIZABETH B. POPOLIZIO

Sworn to before me this
21st day of January, 2005

Judith A. Whitford
Notary Public

JUDITH A. WHITFORD
Notary Public, State of New York
Qualified in Rensselaer County
No. 4964498
Commission Expires April 2, 2006

DEC Brief

New York State Department of Environmental Conservation
Division of Legal Affairs, Region 3
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Erin M. Crotty
Commissioner

by overnight mail

December 22, 2004

Hon. Richard R. Wissler, ALJ
NYS DEC
OHMS, 1st Floor
625 Broadway
Albany, NY 12233-1550

re: Crossroads Ventures LLC
The Belleayre Resort at Catskill Park
DEC Application 3"s 0-9999-00096/00001,3,5,7,9 & 10

Your Honor and Counsel:

I have enclosed Department Staff's brief in the above matter. Thank you.

Very truly yours,

Carol Krebs

Carol Krebs
Assistant Regional Attorney
Region 3

cc: attached service list

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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

---

PRELIMINARY STATEMENT

The Department Staff respectfully submits this closing argument to the Issues Conference in the above captioned matter concerning the applications by Crossroads Ventures, LLC (the "Applicant") for State Pollution Discharge Elimination System ("SPDES") Permits, Water Supply permits, use of protected waters permit, a water quality certification, and additional related matters.

FACTUAL BACKGROUND

Applicant proposes to build two hotels, each with an 18 hole golf course, on land near or adjacent to the Belleayre Ski Center and the Catskill Park, which incorporates the Catskill Forest Preserve, the Big Indian and Slide Mountain Wilderness Areas. The Department of Environmental Conservation ("DEC") was designated lead agency under the State Environmental Quality Review Act ("SEQRA") and issued a completeness determination on November 26, 2003. Legislative Hearings were held beginning January 14, 2004, before the Honorable Richard R. Wissler, Administrative Law Judge ("ALJ"). On April 23, 2004, the Catskill Preservation Coalition ("CPC") filed a Petition for Party Status, as did the City of New York (the "City"). Petitions were also filed by the Town of Shandaken Planning Board, and by the Coalition of

Water Towns. ALJ Wissler convened an Issues Conference, which began on May 25, 2004, which included various site visits on and around the proposed project site, the Route 28 corridor, and resorts already in operation. DEC Staff submits this closing argument to its presentations at the Issues Conference, which addresses the various alleged issues raised by the interveners in the order first proposed by ALJ Wissler.

ARGUMENT

Certain issues raised in the petitions for party status and developed at the Issues Conference involve the permit authority of DEC, other issues pertain solely to the SEQRA review. Staff's positions on the DEC permit-related issues and the SEQRA issues are address individually as follows:

Legal Standard: When is an Issue Adjudicable?

The environmental information contained in an application for a desired permit, the draft permit, and the attendant information required by DEC Staff, constitute an applicant's *prima facie* case for issuance of the permit. In the Matter of Athens Generating Co., Interim Decision, p. 4 (NYSDEC June 2, 2000). The Commissioner has held that "[o]nly offers of proof that raise issues that are substantive and significant will be set for adjudication, the balance will be decided in the applicant's favor without further administrative process (6 NYCRR 624.6(f))." In the Matter of the Application of Monroe County, 1991 WL 208424, *2 (NYSDEC July 2, 1991). The Commissioner further explained that:

> In many decisions, the Department has discussed the meaning that it attributes to the terms "substantive and significant." An issue will be found to be substantive if, after consideration of the offer of proof, the application and any rebuttal, there are sufficient doubts about the applicant's ability to meet all statutory and regulatory criteria such that reasonable minds would inquire further (In the Matter of Hydra-Co. Generations, Inc., Interim Decision of the

> Commissioner, April 2, 1988). Put another way, only when the decision-maker is convinced that there is a realistic chance that adjudication will lead to permit denial or the imposition of significant conditions will an issue be adjudicated (In the Matter of Jay Giardina, Interim Decision of the Commissioner, September 21, 1990). To do otherwise would burden the adjudicatory system and result in an inefficient process. . . . Similarly, no party has the right to an adjudicatory hearing unless there is a showing that there are issues in substantial dispute. (Emphasis added).

Id. at *1-*2. Holding an adjudicatory hearing where "offers of proof, at best, raise uncertainties" does not meet the intent of DEC's regulatory process. In the Matter of Adrian Girourd, 2001 WL 300580, *3 (NYSDEC Mar. 6, 2001) (quoting In the Matter of AKZO Nobel Salt Inc., Interim Decision of the Commissioner (NYSDEC Jan. 31, 1996)). "[A] conclusory statement without a factual foundation is not sufficient to raise issues" for adjudication. In the Matter of Halfmoon Water Improvement Area, Commissioner Decision (NYSDEC Apr. 12, 1982). "A substantive issue must be based on facts that can be adjudicated, and "cannot be based merely on speculation." In the Matter of Athens Generating Co., Interim Decision (NYSDEC June 2, 2000, at p. 3 (citing Matter of Concerned Citizens Against Crossgates v. Flacke, 89 A.D.2d 759 (3rd Dep't 1982), aff'd, 58 N.Y.2d 919 (1983)). "If a proposed intervener cannot marshal any facts to raise sufficient doubt about an applicant's ability to meet statutory or regulatory criteria, no adjudicable issue exists." In the Matter of the Application of Ramapo Energy Limited Partnership, 2001 WL 827903, *4 (NYSDEC July 13, 2001).

Discussion of proposed issues

Proposed Issue 1

> Whether Interveners offered sufficient evidence to carry their burden of proving a substantive and significant issue concerning wastewater from the proposed project.

Staff state that the interveners have not offered sufficient evidence to prove that a substantive and significant issue exists regarding the wastewater discharges from the proposed project. Specifically, the City raised two points. One, that there were different standards for wastewater discharge for the Big Indian and for the Wild acres projects, and that the standards for the Big Indian project are inappropriate and inadequate. Staff made a distinction between the two projects due to the receiving waters (Tr. 162-167). However, since the applicant has agreed to using the same standards for both projects, this matter does not require adjudication (Tr. 146). Additionally, the City agreed that if the applicant and staff agree to the same effluent limits, the issue would not require adjudication (Tr.172). The second point raised by the City concerns the hydraulic loading estimates for the project, and the concern that the values used were not appropriate. Staff stated that, based upon the presentations during the issues conference, the loading estimates appeared to include an abundance of conservatism in the estimate and that the flow limits in the SPDES permits do not require modification (Tr. 169, 179-180).

Proposed Issue 2

> Whether Interveners offered sufficient evidence to carry their burden of proving a substantive and significant issue concerning the alleged need for a mining permit for the proposed project.

A mining permit is not needed at this site for the proposed project because the proposed activity clearly falls under the mining permit exemption for construction activity. That the basins are being constructed as part (or as subpart) of an overarching, obvious construction site brings the whole project under the construction exemption. All of the proposed excavation is intertwined together into this larger construction activity, and therefore, all the activity enjoy the benefit of the exemption.

To hold otherwise would require that every time a contractor wanted to build a residential development, or perhaps a relatively large one, which would have heretofore been exempt from a mining permit, such developments would need such a permit simply because the project incorporates the building a water retention basin. That is not the purpose of the mining law, which is to regulate mine sites. The applicant's proposed project is clearly not a mine.

Regarding surety, when mine activity is underway (for example, a strip mine), if the mine operation goes out of business or reaches the end of the deposit, there is a need for some sort of surety to ensure the reclamation of the site. Here, because the proposed activity is essentially construction activity, the site is being reclaimed as it is being excavated because the buildings, the golf courses and appurtenances that follow are the sole purpose for the project. Thus, the intent behind the surety requirement regarding mine sites is not applicable here. "Specific water bodies, defined under the construction and agricultural categories and small general purpose

recreational ponds, may also be exempt where a reclamation is inherent in their construction." (TGM, May 4, 1992).

In light of the foregoing, the interveners have failed to satisfy their burden to establish a substantive and significant issue under the Mined Land Reclamation Law.

Proposed Issue 3

> Whether Interveners offered sufficient evidence to carry their burden of proving a substantive and significant issue concerning alleged traffic impacts due to the proposed project, under SEQRA.

DEC is the lead agency in the SEQRA review, however, Staff relies on the expert opinion of the NYS Department of Transportation ("DOT"), the agency that regulates the roadways, in which the DOT found that the improvements proposed as a part of the project were "appropriate", as long as they received proper approval as part of the highway work permit process. (Tr. 1461, App. Ex. 19, p. 3).

Proposed Issue 4

> Whether Interveners offered sufficient evidence to carry their burden of proving a substantive and significant issue concerning alleged visual impacts from the proposed project, under SEQRA.

The consultant to Department staff, Saratoga Associates, reviewed the Scope of Work, the DEIS, submissions from the applicant and the interveners, and the Department's policy regarding visual impacts, titled "Assessing and Mitigating Visual Impacts", DEP-00-2, issued July 31, 2000. In conjunction with the consultant, Staff's position is that the applicant has met the requirements set forth by this Policy and the requirements of SEQR, by conducting a visual inventory and assessment, which the Department has accepted, and employing measures to eliminate, mitigate or compensate for adverse effects. See, Assessing and Mitigating Visual

Impacts, DEP-00-2, p. 2, III, "Policy", and SEQR, 6 NYCRR Part 617.11(d)(5). During the issues conference, Saratoga Associates noted that the applicant produced an appropriate inventory of aesthetic resources (Tr. 500-501, 509), conducted a thorough and accurate visual assessment (Tr. 503, 509), appropriately assessed the potential significance of the impact of the project (Tr. 503, 510), and employed reasonable and effective mitigation strategies that would mitigate the effect on the resources of statewide concern, to the maximum extent practicable. (Tr. 510-513). Specifically, in reviewing the visual assessment, the consultant and Department staff concluded that the consultant's visual assessment exceeded the line-of-sight requirement in the DEC Policy by including both a digital viewshed as well as photo simulations, with photo simulations being a "higher technology and a more revealing way of illustrating visual impact than a line-of-sight profile..." . (Tr. 498-499).

Therefore, the interveners did not establish that a substantive or significant issue exists regarding the visual impacts of the proposed project.

Proposed Issue 5

> Whether Interveners offered sufficient evidence to carry their burden of proving a substantive and significant issue concerning alleged noise impacts from the proposed project, under SEQRA.

Staff takes no position on this issue and leaves it to the discretion of the ALJ based on the record developed in this matter.

Proposed Issue 6

> Whether Interveners sufficiently proffered evidence to carry their burden of proving a substantive and significant issue concerning alleged impacts on community character from the proposed project, under SEQRA.

Staff takes no position on this issue and leaves it to the discretion of the ALJ based on the record developed in this matter.

Proposed Issue 7

> Whether Interveners sufficiently proffered evidence to carry their burden of proving a substantive and significant issue concerning viable alternatives to the proposed project, under SEQRA.

DEC Staff defers to the ALJ regarding the SEQRA issue of whether there are viable alternatives to the proposed project. Nevertheless, Staff would comment that purely economic questions are beyond the reach and intent of SEQRA, although the economic aspects of a project influence what may be considered a feasible alternative for an Applicant. Here, Staff reasonably accepted the Applicant's discussion of alternatives in the DEIS as complete and ready for public review. However, if your Honor views the proffers regarding economic feasibility to allow lesser alternatives, then the environmental assessment of such alternatives would have to be further developed in the FEIS.

Proposed Issue 8

> Whether Interveners offered sufficient evidence to carry their burden of proving a substantive and significant issue concerning alleged impacts on the Catskill Forest Preserve, under SEQRA.

The interveners failed to establish a significant and substantive issue regarding alleged adverse impacts by the proposed project to the Catskill Preserve because (1) a purpose of the Preserve to is to provide public recreation; (2) the Catskill Preserve is currently underutilized for

recreational purposes, thus, DEC Staff promotes such usage in order to increase visitors; (3) DEC Staff has control mechanisms in place to protect the Park; and (4) Staff offered a special condition to further enhance its knowledge and control over impacts from the Park which may flow from the proposed project.

The Catskill Forest Preserve Public Access Plan of 1999 provides that the primary justification for establishing the Preserve was to protect water resources and that the secondary goal was to "establish the forest preserve for public recreation." (Tr. 1306; Staff Ex. 1, p. 8). The establishment of the Preserve was in reaction to the past logging of the area for various needs, at various times, and the consequent impacts thereon. (Tr. 1307-08). The purpose of this "access plan was to try to promote more public recreational usage of the Catskill Forest preserve lands." (Tr. 1309). The Plan seeks to provide "appropriate access for all - hikers, sportsmen, cross-country skiers, equestrians, mountain bikers, snowmobilers, wildlife observers . . . ." (Tr. 1309-10, quoting Staff Ex.1, p. 21).

Next, at the Issues Conference, DEC Staff stated that the Catskill Preserve is currently "underutilized for public recreation." (Tr. 1308). Staff can determine or estimate trail use in the Preserve based on trail registers, direct observations of trail conditions, and the number of permits issued regarding certain Preserve activities, i.e, camping. (Tr. 1316, 1327; CPC Ex.41 (DEC, Region 3 Catskill Forest Preserve Trailhead Tally Summary)). Staff noted that many trials do not have registers because of low usage. (Tr. 1348).

In response to points one and two above, DEC Staff actively promote the use recreational use of the Catskill Preserve. DEC publishes the Catskill Forest Preserve Map and Guide for the purpose of promoting more recreational use of the Preserve. (Tr. 1310-11; Staff Ex. 3). Tens of thousands of such maps are distributed every year. (Tr. 1311-12). Moreover, Staff recently

sponsored a centennial celebration for the Preserve, with the idea of promoting further use of the Preserve for recreational purposes. (Tr. 1311-12).

Third, Staff stated at the Issues Conference that the trails in the Preserve are controlled as to erosion *via* the construction of diversionary structures such as "rock water bars." (Tr.1316-17). DEC also places stepping stones, construct stone staircases, and use native materials when doing same. (Tr. 1317). Further, DEC redirects trails so they are less steep. For example, as to new trails, DEC tries to limit the slope to 10 degrees incline, or less, and employs switchbacks to maintain this standard. (Tr. 1319). The forgoing is done to lesson water erosion from the trails. Tr. 1316-17).

In addition, Staff is also authorized to limit the number of persons using trails, if necessary to protect them. Staff explained that it may limit the size and quantity of campers who use the trials *via* the permit process. (Tr. 1319; Big Indian UMP, Slide Mt. Wilderness UMP; 6 NYCRR Part 199.4 (e)). DEC may "restrict the total number of persons who have access to or remain in a wilderness area " (Tr. 1333) and may also order the "temporary closure of all or portions of wilderness area to permit rehabilitative measures." (Tr. 1334).

Finally, Staff proposed a two-part special condition to even better protect the Preserve in light of the proposed project:

> [N]umber 1, . . . Prior to the start of resort construction, Crossroads Ventures, LLC, shall develop a plan to be submitted to NYS DEC for its approval to implement a program to educate and guide resort guests in the use of trails in the forest preserve. In developing the plan, the Applicant shall consult with the New York State DEC and other appropriate groups, including the New York-New Jersey Trail Conference, to identify area trails, in particular, those which may be the subject of overuse, in order to redirect guests to less intensively visited trails. Plans shall include a method of keeping track of resort guests' usage of forest preserve trails or seeking feedback from resort guests on all trail conditions. The information on guest usage and trail condition shall be compiled

into an annual report and submitted to New York State DEC. In addition, Crossroads Ventures, LLC shall provide a monthly report to NYS DEC of uses of forest preserve trails. (Tr. 1350-51; Staff Ex. 6).

The second part of the special condition provides:

"Crossroads Ventures, LLC shall develop a plan to be submitted to NYS DEC for its approval to implement a maintenance program for all trails on its property. This maintenance program shall emphasize the prevention and minimization of erosion and sedimentation from these trails." (Tr. 1352; Staff Ex.6).

These conditions provide extra information and controls that will allow DEC to manage the Preserve in light of any extra use of such *via* the project.

The interveners have failed to satisfy their burden that a substantive and significant issue exists as to alleged adverse effects to the Catskill Preserve due to the proposed project. Rather, Staff's view is that the Preserve is underutilized for recreational purposes and control mechanisms will avoid any alleged adverse impact due to any added use of the Preserve from persons originating at the proposed hotels.

Proposed Issue 9

Whether Interveners offered sufficient evidence to carry their burden of proving a substantive and significant issue concerning alleged wildlife habitat and plant impacts from the proposed project.

The Belleayre Resort at Catskill Park Draft Environmental Impact Statement (DEIS) has been reviewed by DEC Bureau of Wildlife staff. It has been determined that the DEIS

adequately addresses all potential impacts the proposed project may have on wildlife species and their habitats. This determination is based on the following (as set forth in Staff Supp. Ex. 2):

No federal or state threatened or endangered wildlife species are known to occur on, or in, the immediate vicinity of the project site. While the DEC is responsible for managing all wildlife species in the State, not just those that are officially protected by federal and/or state endangered species laws, typically, project sponsors are not required to do surveys to document the occurrence of any species not listed as threatened or endangered, unless there is a specific reason to do so. Even species listed as Special Concern are not subject to the provisions of Part 182 of the Environmental Conservation Law governing the protection of wildlife and are listed for informational purposes only. For a project of the scope and scale as the Belleayre Resort at Catskill Park it is often recommended that the applicant conduct surveys to assess the wildlife assemblages present in order to guide the project design and assist with any mitigation to minimize the impact to all wildlife species, whether listed or not. The surveys are not, however, intended to be a complete inventory of all species occurring on site.

Even still, the surveys adequately characterize the wildlife species composition on the project site. The bird surveys were sufficient enough to detect more than 70 of the 90 or so species of birds potentially occurring based on the 1985 Breeding Bird Atlas data. This was followed by a supplemental survey which corroborated that no endangered or protected species are present on the site. The views of the Audubon New York IBA regarding which bird should be protected are not recognized under New York law. Furthermore, the amphibian and reptile surveys employed standard methods and were able to detect 14 of the 21 potentially occurring herpetofaunal species based on the NYSDEC Amphibian and Reptile Atlas Project. This total includes one salamander species (slimy salamander) and two snake species (redbelly snake and

black rat snake) that were not documented to occur in the quadrangles in which the project site is located during the 10-year atlas project.

Although there is currently no evidence (including live snakes, dead snakes, or shed skin) to suggest that the timber rattlesnake occurs on site, the project sponsor conducted searches to determine the presence of the species and its habitats, including potential den sites. Four snake species were detected during searches and "most rocky outcrops and large slabs of rocks in the project area were located on north-facing slopes in closed canopy forest" and thus determined to be unsuitable for timber rattlesnakes. Timber rattlesnakes exhibit very high site fidelity and follow the same migration path year after year, where the maximum distance traveled is less than four miles. The closest known active timber rattlesnake population is more than 13 miles away from the project site. With no known populations occurring within 5 miles of the site, it is unlikely that a previously unknown population would exist in such isolation and away from any nearby snakes with which to exchange genetic material and keep the population healthy and viable.

With respect to the Indiana Bat, the DEIS states that "habitats present on the project site are not suitable for Indiana bat maternity roosts." Currently, it is Staff's view there is no evidence (including data from an ongoing telemetry study of female Indiana bats dispersing from the closest known hibernacula in Rosendale) to suggest that the Indiana bat uses the project site.

It is somewhat of a moot point whether or not a particular unlisted species would have been found if the surveys were more intensive. In fact, if a proposed project site and the known distribution of an unlisted species overlap, the species can be assumed to be present if suitable habitat exists. Thus, for any project, disturbance in the "development footprint" is likely to result in at least temporary removal of a species formally occurring on the site. For some imperiled

wildlife (i.e. threatened or endangered species) habitat loss is normally determined to likely have a significant, adverse impact on the long-term survival of the local, regional, or, in some cases global population of the species. For other species, the loss of habitat will impact individuals and potentially the local population, but is not likely to have a significant negative impact of the long-term survival of the species.

When viewed from a landscape perspective, the diversification of habitat types through natural processes, such as fire or man-made events such as timber harvesting, generally provides for an increase in biodiversity. Thus, alteration of the existing habitat from a relatively homogeneous forested landscape to that which includes edge and open areas, will, as always, be a detriment to some species, while benefitting others including the aforementioned common nighthawk, which requires early successional habitats.

With respect to plants onsite, the DEIS reveals that applicant examined the plant database of the New York Natural Heritage Program and found "no records of known occurrence of rare or state-listed animals or plants . . . on or in the vicinity of [the Crossroads] site."

In summation, DEC staff have reviewed the Belleayre Resort at Catskill Park Draft Environmental Impact Statement, have determined that this action should not impact any endangered or threatened wildlife species, and concur with the preventative mitigation measures that will be employed to minimize the impacts to all wildlife species.

Proposed Issue 10

> Whether Interveners offered sufficient evidence to carry their burden of proving a substantive and significant issue concerning alleged forestry impacts from the proposed project.

DEC Staff's opinion is that the Scope of Work and DEIS appropriately identified and analyzed forestry impacts. The DEIS also addressed the timber industry, which–in Staff's

view–was adequately addressed and analyzed. In Staff's view, the interveners have failed in their burden to prove a substantive and significant issue. (Tr. 2689).

Proposed Issue 11

> Whether Interveners offered sufficient evidence to carry their burden of proving a substantive and significant issue concerning alleged cumulative impacts from the proposed project, under SEQRA.

Staff takes no position on this issue and leaves it to the discretion of the ALJ based on the record developed in this matter.

Proposed Issue 12

> Whether Interveners offered sufficient evidence to carry their burden of proving a substantive and significant issue concerning alleged stormwater impacts from the proposed project.

Based upon the material submitted by the applicant and the City, including the supplemental exhibits and responses, Staff recommend that stormwater hydrology (as discussed in City supplemental exhibit 1) continue to full adjudication. The City has submitted credible concerns and Staff believe that further inquiry is required on this issue.

Proposed Issue 13

> Whether Interveners offered sufficient evidence to carry their burden of proving a substantive and significant issue concerning alleged ground and surface water impacts from the proposed project.

Department Staff state that the interveners have not offered sufficient proof that ground and surface water impacts from the proposed project require adjudication. Staff's position is that there is adequate water for the project (discussed in more detail in Proposed Issue17 regarding the water supply permits) so that there should be no detrimental impacts on groundwater. In

addition, staff have included special conditions in the water supply permits that addresses potential adverse impact to residential wells in the vicinity of the proposed project (Tr. 3752-3754, Staff Ex. 9, special condition 14). Staff have included a condition regarding the use of Silo A which requires that impacts to the surface water due to ground water withdrawals by the project be measured and mitigated, if necessary (Tr. 3748-3751, Staff Ex. 9, special condition on p. 3). Finally, staff have reviewed the applicant's submissions regarding the pumping of the Rosenthal bedrock wells, and have concluded that the data indicates that the pumping of the wells does not appear to impact Birch Creek or shall water levels adjacent to Birch Creek. (Staff Supp. Ex. 1). Staff conclude that the interveners have not offered sufficient proof that ground and surface water impacts from the proposed project require adjudication.

Proposed Issue 14

> Whether Interveners offered sufficient evidence to carry their burden of proving a substantive and significant issue concerning alleged pesticide impacts from the proposed project.

Department staff have drafted SPDES permits containing restrictions on pesticide use by the applicant (OHMS ex. 10, Big Indian permit, p. 9, 12, 13; Wild Acres p. 12-15). In addition, the draft SPDES permits require monitoring for pesticides (Staff Ex.7). Department staff reviewed the modeling and the modeling results provided by the consultants for the applicant (GLEAMS and LEACH), and accepted the use of the models chosen and the overall results arrived at by the applicant, despite the arguments set forth by the interveners concerning the GLEAMS and LEACH models. These results reflected undiluted values of pesticides, whereas in reality, the pesticides would likely be significantly diluted before reaching any surface water, if at all (Tr. 3371-72). The results obtained by the applicant are therefore conservative in nature.

Staff believe that a sufficiently conservative approach and protocol were used, particularly when viewed with the additional conservatism of the dilution factor, and the additional conservatism staff have used in setting the pesticide limits, as described below.

Staff evaluated five separate considerations in determining the proposed pesticide limits contained in the draft SPDES permits (Staff Ex. 8; Tr. 3362-3370). Staff considered State Department of Health criteria, ground and surface water standards, proposals by the applicant, and toxicity data from 3 separate classes of organisms, which reflect the actual effect on aquatic life. For each proposed pesticide which was not initially rejected by the Department due to toxicity, the Department used the lowest concentration determined through its evaluation to use as the proposed limit in the SPDES permits (Tr. 3362-3370, Staff Ex. 7, 8).

Staff are in agreement with the applicant's proposal regarding the shallow groundwater monitoring wells, including the location of the wells. Staff believe that these locations are the most desirable for monitoring pesticides, in that they are located in areas with the highest potential for indicating contamination, if any (Tr. 3378-3379).

The intervener's have not met their burden in establishing whether a substantive or significant issue exists regarding the use of pesticides at the proposed project.

Proposed Issue 15

> Whether Interveners offered sufficient evidence to carry their burden of proving a substantive and significant issue concerning the use of chitosan at the proposed project.

Staff have reviewed the submissions by the applicant and the interveners concerning the use of chitosan as a flocculent at the proposed project. As a result of questions raised by the interveners, Department staff requested that the applicant conduct toxicity testing of chitosan. The results are set forth in the report by Nautilus Environmental LLC, dated October 11, 2004.

Based upon staff's review of the applicant's and the intervener's submissions and the additional toxicity testing data, Department staff conclude that the use of chitosan by the applicant should not have a detrimental impact on the environment. Staff have included a water treatment chemical authorization condition in the draft SPDES permits, which requires prior authorization from Staff before any use of water treatment chemicals (including chitosan) by the permitted. (OHMS Ex. 10, Big Indian p. 17, Wildcards p. 19). In addition, Staff have proposed additional conditions regarding the use of chitosan in subsequent drafts of the SPDES permits (published in the Environmental Notice Bulletin, November 17, 20024), which would require the applicant to test the chitosan concentrations in affected detention ponds before discharging to vegetated land. This discharge would be a substantial distance from any surface water. In the unlikely event the chitosan would reach surface water (and therefore aquatic life), the chitosan would be at even lower levels than those used in the toxicity tests, due to physical, chemical, and biological processes.

The interveners have therefore not offered evidence necessary to require the use of chitosan be adjudicated.

Proposed Issue 16

> Whether Interveners offered sufficient evidence to carry their burden of proving a substantive and significant issue concerning the phosphorus TMDL.

Upon review of the entire record regarding Total Phosphorus export rates, including the applicant's re-submission of calculations, Department staff have determined that the TMDL limits proposed in the draft SPDES permits for both the Wildacres Resort and Big Indian Plateau sites are appropriate. (Drafts published in Environmental Notice Bulletin, November 17, 2004). This determination is based on staff's acceptance of the consultant's calculations of Total

Phosphorus export, of which the factors described below were considered. It is noted that initially the WinSLAMM storm water model was used for estimating Total Phosphorus export, and after this model was found to be not entirely appropriate, follow-up modeling using the more appropriate "Hydrologic Simulation Program, Fortran" (HSPF) model was initiated. However, the applicant suggested using the simultaneously-derived results of the Simple Method described in the New York State *Stormwater Management Design Manual (2001)* for establishing final estimates for Total Phosphorus loadings from both sites. Thus, the Department terminated review of HSPF modeling results. The Department has accepted the applicant's Simple Method approach.

Referencing the applicant's phosphorus loading calculations, submitted by its consultants on August 24, 2004, various component Total Phosphorus loading rates used for the calculations, including base flow concentration, impervious surfaces, landscaping, golf turf (exhibit 157, p.3) were noted by the Department. These rates were obtained primarily from NYC DEP data. In addition, Total Phosphorus event monitoring data obtained by the NYC DEP during 2002, and non-storm event data obtained during 2000 - 2001, for a stream located on the Big Indian Plateau site (Giggle Hollow), were used for deriving an average existing conditions (pre-development) Total Phosphorus loading rate using a rational averaging approach (exhibit 157, p. 5). The Department accepts this approach.

Concerning precipitation data, the consultant used NYC DEP regional event monitoring data provided in that agency's publication *Guidance for Phosphorus Offset Pilot Program, Bureau of Water Supply Quality and Protection* (1997), as part of the storm water quantity component of its estimates. Runoff coefficients (R values) used for the calculations were obtained from the NYC *2001 Watershed Protection Program Summary, Assessment and Long*

Term Plan, as well as the TR-55 Soil Conservation Service storm water model for impervious areas (exhibit 157, Executive Summary, Table A).

Finally, the applicant has proposed the application of a "margin of safety" of 30% in arriving at total site export values. The margin of safety takes into account the variability in rainfall amounts over a 24 year period, as quantified by a rain gage at a regional NOAA station (Tannersville), and represents the approximate increase in Total Phosphorus loading rates between the lowest precipitation year and highest precipitation year (exhibit.* , p.). Recognizing the high degree of variability of real-world conditions and imprecise nature of TMDL estimating, and that margins of safety are commonly used in TMDL estimating, the Department accepts this approach. (* October 28, 2004 Bakner letter).

The Department believes that the applicant's use of similar or identical input factors as those used by the NYC DEP in that agency's own calculations, as well as a conservative approach used throughout the calculations, should substantially diminish differences between the NYC DEP's and applicant's Total Phosphorus estimates, and lead to reasonable estimates for ultimately establishing Total Phosphorus TMDL permit limits.

The interveners have not offered sufficient proof that would require this issue be fully adjudicated.

Proposed Issue 17

Whether Interveners sufficiently proffered evidence to carry their burden of proving a substantive and significant issue concerning alleged water supply impacts from the proposed project.

The applicant has applied for water supply permits for the Big Indian and Wildcards projects. Staff have submitted draft water supply permits for the Big Indian resort (Staff Ex. 9) and for the Wild Acres resort (OHMS Ex. 11). The intervening parties are opposed to permit issuance due to perceived inadequacy of water supply, and potential impacts on ground and surface water. Having reviewed the material regarding the water supply permits in the record, Staff remain in favor of permit issuance. Staff have determined that the permits meet the applicable regulatory standards set forth in 6 NYCRR Part 601 (Tr. 3754). The staff accepted the applicant's pump tests as showing water supply permits could be issued and meet the regulatory standards and the Ten States Standards (Staff Ex. 10, Tr. 3762-3764). DEC staff properly accepted the applicant's 72-hour test as appropriate (Tr. 3774-3775). The NYS Department of Health serves in a role as "technical advisors" to Department staff during DEC review of water supply applications. (Tr. 3774-3775). As part of that role, DOH reviewed permit application materials, required changes from the applicant, and was in support of the draft permits (Tr. 3773, 3774, 3776). By letter dated April 23, 2004, DOH raised certain concerns with staff (Staff Ex. 11). Those issues were satisfied by the applicant (Tr. 3771, 3772). DOH also accepted the pump tests, believing that they had reached stabilization (Tr. 3778-80), one of the concerns raised by the interveners.

The interveners have raised alleged issues regarding the potential impact on groundwater and surface water of the withdrawal of water by the project pursuant to the water supply permits.

This issue is more fully set forth above in Proposed Issue 13. To summarize staff's position, after review of the materials in the record, staff believe that the withdrawal of water pursuant to the water supply permits will not have an adverse impact on ground and surface water, due to a lack of hydraulic connection between the main wells for the Big Indian resort and surface water, and due to a special condition in the water supply permit for Big Indian which should protect the waters of Crystal Spring from negative impact.

Staff's position is therefore that the interveners have not established that water supply is a substantive or significant issue requiring full adjudication.

Proposed Issue 18

> Whether Interveners sufficiently proffered evidence to carry their burden of proving a substantive and significant issue concerning alleged aquatic habitat impacts from the proposed project.

The interveners have not established that a substantive or significant issue exists regarding potential impacts on aquatic habitat by the proposed project. The SPDES discharge limits meet the criteria set forth by the Department that are protective of the environment. Upon review of the record in this matter, staff conclude that there is no hydraulic connection between the Rosenthal wells and Birch Creek, based upon the pump tests conducted by the applicant (Staff Supp. Ex.1), and thus there should be no negative impact on Birch Creek by the withdrawal of groundwater by the project. As more fully addressed above, the pesticide limits and the pesticides monitoring program set forth in the SPDES permit are adequately protective of the environment.

CONCLUSION

Based on the foregoing, the DEC Staff respectfully requests that the ALJ find one issue for adjudication, stormwater hydrology. Where specified above, Staff respectfully requests that the ALJ find no issue for adjudication. Staff defers to the ALJ's decision on all other proposed issues.

Dated: December 23, 2004

DEPARTMENT OF ENVIRONMENTAL

CONSERVATION, REGION 3

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