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Town of Tuxedo Town Board
Attn: Peter Dolan, Supervisor
1 Temple Drive
Tuxedo, New York 10801

RE: **Evaluation of Environmental Aspects of the Tuxedo Reserve SEIS**

Dear Supervisor Dolan and honorable members of the board,

There are significant environmental risks associated with advancing the Tuxedo Reserve project based on incomplete assessments provided in the SEIS. These include inadequate assessment of infringement into 100-foot State wetland buffers, water quality risk to Mountain Lake and its wetland, possible dewatering of Mountain Lake stemming from aquifer pumping during dry periods, water quality risk resulting from contaminant infiltration from development within the aquifer recharge zone, risk of loss of adequate project water supply should long-term pumping reach and dewater bedrock fractures, and inadequate assessment of threatened species. On behalf of the Tuxedo Land Trust, I have reviewed portions of the September 2009 Tuxedo Reserve SEIS, with emphasis on hydrologic, hydrogeologic, and habitat issues.

Herein, I offer comments, conclusions, and recommendations on environmental issues based on my training as an environmental scientist, geologist, hydrogeologist, and hydrologist with more than twenty-seven years of environmental experience[1].

Wetland Hydrology

Construction of roads, utility lines, and homes in the Mountain Lake community may lead to significant adverse environmental impact to Mountain Lake and the surrounding New York State wetland. SEIS Figures 5-1a and 5-1b show planned development within the watershed tributary to Mountain Lake. The SEIS concludes that the disturbed area will be 4.5 acres (6%) of the Mountain Lake watershed (page 6-2). The Natural Resources section of the SEIS (page S-4) states that the:

> *"[T]uxedo Reserve has always been designed to maintain the integrity of the existing natural resource environment, focusing on the protection of wetlands and stream corridors, rock outcrops and ridgelines, wildlife habitat, and contiguous open space*

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areas and migratory corridors."

Significant alteration (e.g., construction, grading, excavating) of the watershed area tributary to the project area and site wetlands may permanently disrupt the natural hydrodynamics and nutrient balance that now sustain a healthy wetland ecosystem. Hydrologically, the physical boundaries of wetlands extend far beyond the mapped fringe area with a prevalence of wetland vegetation. Site wetlands receive water and nutrients from sustained groundwater flow and episodic surface water influxes. The water budget, water renewal rate, primary production, and health all depend on these fluxes. Grading, construction, and erosion within the watershed tributary to numerous wetlands will almost certainly permanently disrupt the hydrologic, chemical and thermal equilibrium now afforded by combined surface and shallow groundwater recharge, such that project site wetlands and their ecosystems may not be able to remain viable.

The applicant has not appropriately addressed the natural surface water and groundwater recharge (i.e., the shallow storm flow zone and groundwater/wetland interface) that now hydrologically sustain project wetlands and their ecosystems (i.e., species composition and richness, primary productivity, organic accumulation and nutrient cycling).

In my professional opinion, the Tuxedo Reserve project, as proposed (with numerous buildings, roads, and buried utility lines), will permanently degrade this combined New York State and Federal wetland complex, both within the Mountain Lake area and elsewhere within the subject property. The creation of preferentially permeable pathways for shallow groundwater flow as a result of utility line installation (e.g., sewer, water) may irreparably harm wetland ecology. Figure 1 (Water Line – Wetland Assessment) illustrates the planned placement of 12 inch (red) and 8 inch (black) water supply lines. Wetlands are also depicted on this figure. Most would be compromised by proposed adjacent or surrounding water lines. Trenches excavated and constructed for these lines will provide zones or pathways of preferentially high permeability. These pathways will disrupt the natural surface water and groundwater recharge that now provides the natural hydrologic and chemical fluxes that make this wetland complex healthy. As a result, existing wetland ecosystems may no longer be viable and may be destroyed. Road construction (see Figure 2 along with Figure 1), other utility lines, site grading, home construction, and contaminant loading within small headwater watersheds tributary to these wetlands are likely to further degrade the viability of many of these wetlands.

Figure 1 also depicts four areas where it appears that water lines are planned directly within the 100-foot buffer minimally afforded to "protect" State wetlands. Significantly, one of these infringement areas lies along the northeastern and southeastern edges of Mountain Lake and its wetland. Furthermore, reference to Figures 5-1a and 5-1b, for example, show a roadway here, extending toward a water supply well. It is not clear if this roadway will be paved or left with a dirt base and used for vehicular traffic within the 100-foot wetland buffer. Alternately, the applicant may plan on constructing a roadway nearby, but outside the 100-foot protective State wetland buffer distance. Page 5-10 of the SEIS states that this wetland and its associated 100-foot adjacent area are being preserved as open space. For this statement to be accurate, a revised water line, utility line, and roadway project plan for the Mountain Lake area should be presented

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for public review.

Hydrologically, the mandated New York State 100-foot buffer distance outward from State wetlands will not afford the desired water quality protection. The underlying and erroneous concept inherent in the SEIS is that, by keeping all project development outside of the 100-foot ***minimum*** buffer mandated for New York State wetlands, the Mountain Lake wetland will remain healthy and viable. This concept is not addressed in the SEIS with respect to water supply and outflow and chemical fluxes. While the minimum 100-foot buffer guidance footage number may be suitable in large watersheds with regular stream water influx and outflow, it is decidedly not applicable in the small Mountain Lake watershed. This watershed almost certainly has no active year-round stream flow entering and leaving it. Instead, with brief exceptions during periods of intense precipitation and snowmelt, most of the water incident to the Mountain Lake wetland is via undefined groundwater pathways.

The hydrologic functioning of the Mountain Lake wetland requires continued natural groundwater and surface water influx from far beyond this minimum 100-foot buffer distance. Housing development is planned almost up to the 100-foot buffer. Development within the Mountain Lake watershed, of even a small number of homes, roads and utility lines may disrupt the slow, natural, groundwater flow regime present between the wetland recharge area and the wetland. As noted above, it is the steady, sustained, base flow that is necessary to maintain a healthy wetland ecosystem. Even though development is limited within the Mountain Lake watershed, storm water contaminant additions and water influx from water supply pipe trenches are completely different (e.g., thermally, chemically, flow distribution, nutrient-wise) and may alter the natural groundwater flow required by wetland ecosystems.

The importance of determining a prudent protective buffer distance outward from the Mountain Lake wetland should be assessed on a case-specific basis *after* baseline hydrologic data (shallow groundwater and surface water), species inventories, and habitat assessment have been conducted and characterized. In instances of particularly vulnerable habitats (i.e., ecosystems), as much as a 1000-foot wide buffer may be required to be ecologically effective. The calculation of the size of the buffer area is driven by the need to assure continuation of the natural water flow regime or equivalent substitute; since there are neither surface water nor groundwater profiles of the natural water flow regime, no width of buffer can be set with any scientific validity. By extension, the same considerations apply to the viability of numerous other Tuxedo Reserve wetlands where buildings, roads, and utility lines are planned both within 100 feet of them, as well as outward beyond this within a distance required to provide untainted and unaltered slow groundwater fluxes.

Aquifer Recharge & Wellhead Protection

The proposed Mountain Lake community and the remaining portions of the Tuxedo Reserve property will be serviced by an on-site public community water supply obtained from wells constructed in a fractured bedrock aquifer. The long-term community water quality may be at

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risk because significant development is planned directly above and within a major portion of the aquifer recharge zone (illustrated in Figure 2). Site groundwater flow directions and pumping test data, as determined by the applicant (e.g., Figures 3, 5, and 7; 2007 Water Supply Investigation Report – incorporated by reference into the SEIS, see page 6-3), document groundwater flow from the planned Tuxedo Reserve development areas down gradient into the zones of Reserve pumping well influence. Thus, the risk of project contaminants infiltrating downward and directly into the project's own community water supply is real. No assessment of aquifer vulnerability and contaminant loading are presented, nor is a wellhead protection plan provided (i.e., no assessment of the impacts that planned land and water uses located in the project area may have on the aquifer serving project wells has been conducted). These issues go directly to the long-term health and safety of the Mountain Lake community, as well as to the entire Tuxedo Reserve community. These are significant and critical omissions of the SEIS that warrant immediate investigation.

The need for wellhead protection is recognized throughout the United States. To protect public water supplies ten states, including New York State, as well as the province of Ontario have cooperated and produced a document to insure this. This is the Recommended Standards For Water Works (2003 Edition), also referred to as the Ten States Standards.

Section 3 of the Ten States Standards specifically addresses water supply Source Development selection with emphasis on water quantity, water quality, source location, well testing, well construction, aquifer types, and a number of other important supply particulars. Section 3.2 (Groundwater), Subsection 3.2.3 (Location) provides detail designed to protect consumer water quality:

> *"3.2.3.1 Well location*
>
> *The reviewing authority shall be consulted prior to design and construction regarding a proposed well location as it relates to required separation between existing and potential sources of contamination and groundwater development. The well location should be selected to minimize the impact on other wells and other water resources.*
>
> *3.2.3.2 Continued sanitary protection*
>
> *Continued sanitary protection of the well site from potential sources of contamination shall be provided either through ownership, zoning, easements, leasing or other means acceptable to the reviewing authority. Fencing of the site may be required by the reviewing authority.*
>
> *3.2.3.3 Wellhead protection*
>
> *A wellhead protection plan for continued protection of the wellhead from potential sources of contamination shall be provided as determined by the reviewing authority."*

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It is not clear whether the State reviewing authority, and possibly the Town Board, are aware that significant portions of the proposed Tuxedo Reserve development directly overlie the aquifer planned for project water supply. Project areas within aquifer recharge zones will have concentrated housing units, vehicles, roadways, fuel tanks, and lawns - all being potential sources of storm water contamination. Elements of an effective groundwater protection program are those that seek to prevent potential sources of contamination from being released where they may degrade the groundwater quality. Once groundwater quality is degraded, it is extremely costly and exceedingly difficult to return it to its pristine, usable condition. It is for this reason that the goal of the federal wellhead protection program is to protect public water supply wellhead areas from contaminants which may have any adverse effects on the health of people. There appears to be no designated wellhead protection area whatsoever.

The applicant provides documentation that precipitation incident to the project area recharges the underlying aquifer that is the planned community water supply. Project related contaminants may readily combine with this precipitation, thus also directly recharging the bedrock aquifer. Relative to the Mountain Lake community water supply (i.e., part of the Tuxedo Reserve water supply), the SEIS relies on the Water Supply Investigation Report; Tuxedo Reserve Development; Tuxedo, New York dated May 2007 and prepared for The Related Group. This report (page 16) addresses groundwater recharge:

> *"The ground-water bearing formations underlying the Property receive recharge primarily from infiltrating precipitation. Recharge occurs when and where the precipitation infiltrates through the surficial materials (e.g. overburden, exposed bedrock fractures) and becomes assimilated into the local ground-water resource. ... Based on recharge rates in till-covered fractured bedrock aquifers with similar hydrogeologic settings, the average estimated natural ground-water recharge rate is expected to conservatively range between 10 to 12 inches per year for the Development. ... Based on the NJGS analysis of recharge for that portion of the aquifer in New Jersey, the average recharge calculated for this area is approximately 16-inches per year. Assuming a conservative average rate of 10 inches per year and an estimated Development area of about 1,200 acres, the total amount of ground-water recharge is about 900,000 gpd or 625 gpm. This value exceeds both the proposed average daily demand of 257 gpm and the peak demand of 580 gpm. Therefore, the amount of available recharge is greater than the proposed ground-water supply use at the property. Based on this available surplus recharge, the proposed use of the on-Site supply wells at the Development by Related at 257 gpm (average daily demand) and 580 gpm (peak demand) should not adversely impact the local ground-water resources and off-Site water supplies."*

The 2007 Water Supply Investigation Report (WSIR) has a number of large maps that portray groundwater flow directions throughout the Tuxedo Reserve project area under both non-pumping and pumping conditions. Importantly, the natural groundwater flow directions may generally be characterized as flowing radially outward from the Tuxedo Reserve site (i.e., from

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an area of higher topographic elevation to lower down gradient elevations to the west [toward Tuxedo Lake], east, and south – WSIR Figures 3, 5, and 7). For this outward groundwater flow pattern to occur, groundwater recharge must be significant and it must originate throughout much of the project site. This is further documented by water level rises in piezometers coincident with precipitation events. Thus, project related contaminants (e.g., herbicides, pesticides, hydrocarbons, road salt) will directly recharge the underlying groundwater aquifer and will primarily flow to two receptor locations: 1) inward into Tuxedo Reserve community water supply wells, and 2) outward to off-site receptor watersheds to the west and east. From a wellhead protection and community health standpoint, this is undesirable.

The Tuxedo Reserve project plans to use five wells as a groundwater supply. The distribution lines are portrayed in HydroQuest Figure 1. Simultaneous pumping tests were conducted to determine the cones of depression or the areal extent of the recharge area tributary to each well. The "cones" of depression (i.e., the area surrounding a well within which groundwater is drawn inward toward a pumping well) are more elliptical than cone-shaped because the aquifer is anisotropic and heterogeneous in nature, typically drawing groundwater from interconnected fractures in the bedrock (i.e., secondary porosity). Excellent examples of these fractures were observed both immediately southeast and southwest of Mountain Lake. These near vertical fractures were measured as trending N31°E to N38°E and almost certainly extend deep into the subsurface. These fractures are associated with a lineament that can be observed on aerial photography. These bedrock fractures, with little overlying soil mantle, provide a direct infiltration pathway for rainfall, snowmelt, and any overland water flow into the underlying bedrock aquifer. The SEIS (page 6-3) states that infiltration can be limited to the upper several tens of feet of the underlying bedrock, or continue to deeper portions of the local and regional fractured bedrock aquifer system. This is the means by which the aquifer is recharged and a reason why a groundwater source was sought near Mountain Lake. However, because Mountain Lake is situated above this fracture domain, there is a possibility that long-term, continuous, pumping (vs. relatively short-term aquifer testing that was conducted) may induce downward lake water infiltration into the fracture network present here (even if semi-confined aquifer conditions exist).

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Vertical fractures located near the southwest end of Mountain Lake. Orientation: N32°E

Vertical bedrock fractures in unpaved roadway immediately southeast of Mountain Lake Orientation: N31°E to N38°E

The applicant conducted pumping tests, monitoring a number of locations including production wells, monitoring wells, and surface locations. The approximate maximum areal extent of each of the five cones of depression was interpreted from large maps maintained by the Town of Tuxedo as part of a 2007 report titled: Water Supply Investigation Report; Tuxedo Reserve Development Tuxedo, New York. Portions of these maps were scanned, brought into a GIS database, georeferenced, interpreted, and digitized. This made it possible to compare the cones of depression with surface water bodies, roads, and development buildings (Figure 2). The cones of depression are areally extensive and might conceivably, with time, overlap resulting in less water availability than the quantities pump tested.

Reference to HydroQuest Figure 2 documents that the cone of depression that recharges the water supply well situated northeast of Mountain Lake (LBG-1) extends beneath Mountain Lake and its surrounding wetland. The cones of depression depicted on Figure 2 are plotted conservatively. Based on drawdown in monitoring wells, the applicant calculated that the radius-of-influence for well LBG-1 is approximately 2,700 feet. Part of this assessment is based on drawdown that occurred in monitoring well WC-4 (see Figure 6-2, SEIS for location) during the first comprehensive pumping test. The water level in WC-4 was drawn down 1.27 feet. This well is located within the Mountain Lake community near the southwestern tip of the State wetland that surrounds Mountain Lake, some 2,562 feet from water supply well LBG-1. Thus, storm water contaminants from a portion of the Mountain Lake community may potentially adversely impact the water quality of the Tuxedo Reserve water supply.

Similarly, during dry times when no water flows into Mountain Lake from its small watershed

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area (74-acres; SEIS page 6-2), it is possible that the lake and its wetland may become dewatered. This may be indicated by slightly lowered water levels recorded in near lakeside monitoring points PZ-ML, PZ-ML2, and SG-ML during the second comprehensive pumping test (Table 3-1; 2007 Water Supply Investigation Report). Lake and wetland water level drawdown would adversely impact wetland ecology.

Two pumping tests were conducted on Mountain Lake well LBG-1, both at 130 gallons per minute. The first test drew the static water level down 104.18 feet to minus 253.03 feet (below the top of the casing) after 72.8 hours. When drawdown vs. time is plotted on semi-log paper the drawdown at 180 days (a time period used in water supply investigations) is projected to increase to about minus 324 feet. The second pumping test drew the static water level down 75.01 feet to minus 245.32 feet at 74.1 hours. This projects to a 180-day drawdown of about minus 295 feet. These numbers are important because reference to the boring log of well LBG-1 indicates that significant groundwater was not encountered until minus 334 feet. The fact that the well was drilled to 590 feet may have little or no relationship to groundwater availability. A fracture here at minus 334 feet yielded over 100 gallons per minute. It is quite possible that once the water level in well LBG-1 drops below minus 334 feet that groundwater availability may drop appreciably. This level is only 10 feet below the 180-day projected drawdown associated with the first pumping test conducted from March 26 to March 29, 2007 – typically a wet period. The 2007 Water Supply Investigation Report documents that conditions were wet in the time period of both simultaneous pumping tests (2007 Water Supply Investigation Report, page 8).

HydroQuest recommends that a longer term pumping test (e.g., 30 day constant rate test at maximum anticipated yield) be conducted on well LBG-1 during a dry summer or fall period to adequately assess the potential adverse environmental impact to Mountain Lake and its wetland. This supplemental aquifer test should be conducted in advance of an FEIS.

It is likely that project area wells reflect a mix of unconfined, semi-confined, and confined wells – some receiving recharge from directly on-site and some receiving recharge from farther away. Regardless of the exact source of each individual well, what matters in terms of the long-term sustainability of the groundwater source is that the aquifer be capable of producing the high yields required during long periods of drought. Reference to the 2007 Water Supply Investigation Report shows a number of semi-log plots of drawdown vs. elapsed time that project well water level at 180 days for each of the supply wells. These plots are deceiving because they show projected 180-day water levels well above the pump inlet ports. In reality, one could simply drill a well to any depth below the projected 180-day water level and few would question that an adequate water supply would always be present. However, in a fractured bedrock aquifer what really matters is the depth that significant water was encountered and whether or not the aquifer will be dewatered when the drawdown level in a well reaches the depth of the water-bearing fracture(s). Using the example above for well LBG-1, the pre-pumping static water level in the well was at minus 148.85 feet. At the end of the test, the water level had dropped to minus 253.03 feet, down some 104.18 feet. By adding together the static water level in the well and the 180-day projected water level drawdown (175 feet), the 180-day water level is found to be some 324 feet below the ground surface or about 10 feet above the top

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of the fracture. Whether sufficient, or any, appreciable groundwater will still be present after the aquifer water level has been drawn 175 feet is questionable.

This situation is far more pronounced, and perhaps dire, for some of the other project water supply wells that are planned for use by the Mountain Lake community and others. For example, at well LBG-2, a planned 250 gallon per minute water source, the 180-day water level projection required in New York State water supply investigations is some 22 feet below the top of the water-bearing fracture at minus 349 feet. Similarly, two pumping tests conducted on well LBG-6, a 130 gpm water source, showed the 180-day projected water level to be about 8 feet above and then 58 feet below the top of the major, discrete, water-bearing fracture. In a few cases, while the well logs are not completely clear as to the exact elevation of discrete water bearing fractures, there appears to be evidence that 180-day water levels will fall below or slightly above reported fracture depths. Clearly, these projections when represented against the elevation of discrete water-bearing fractures vs. an arbitrarily selected elevation of a pump placed somewhere far below a water-bearing fracture reveal that the Tuxedo Reserve project might potentially dewater the aquifer during periods of drought (i.e., particularly at peak water demand rates). Neither the SEIS nor the 2007 Water Supply Investigation Report examine the relationship between water-bearing fracture depths and 180-day water projections, especially with respect to drought conditions. This is critical because the water supply may not be able to sustain the planned housing density. This assessment and how it potentially impacts the Mountain Lake community, as well as the entire Tuxedo Reserve community, is a significant and critical omission in terms of the reliability of the community water supply, particularly during periods of drought.

It is undesirable to construct numerous homes, buildings, and roads directly above a major portion of the recharge area above a water supply. This provides little wellhead protection that is typically desirable to avoid adverse impacts from fuel oil or chemical spills, road salt, herbicides, pesticides, hydrocarbons and other storm water contaminants. Contaminant infiltration into the underlying aquifer might necessitate costly cleanup, expensive treatment, or possibly alternate water supply sources. Beyond this, contaminants drawn from a recharge area directly above a water supply may pose a health and safety risk. This risk potentially exists for water drawn into the Mountain Lake well that may contain contaminants from homes and roads in the small watershed. By extension beyond the Mountain Lake well, the overlay of cones of depression above large-scale project development (Figure 2) raises the issue of induced storm water contaminant infiltration throughout much of the project site. Consideration should be given to having the applicant expand the SEIS to include an analysis of potential contaminant infiltration downward from site development - aquifer recharge areas to project water supplies.

Threatened Species

Beyond my work as a hydrogeologist, I have extensive experience conducting GIS analyses of key rattlesnake habitat features. My work has been accepted by recognized rattlesnake experts

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including Dr. Bill Brown, Randy Stechert, and Al Breisch, former head of NYSDEC's Endangered Species Unit. With this background in mind, I offer the following comments.

Wildlife surveys of the project site did not identify any threatened or endangered species (SEIS, pages 5-5 and 5-10), inclusive of the area in the vicinity of Mountain Lake. In keeping with these surveys, the SEIS fails to identify the timber rattlesnake, a threatened species protected by New York State's Endangered Species Act of 1972, as being present on-site. It is my understanding that a timber rattlesnake was sighted, captured, and eaten on site, possibly northwest of the Bog Meadow wetland. Development of the Tuxedo Reserve project will almost certainly infringe on important rattlesnake basking and, perhaps, den sites – including suitable habitat adjacent to Mountain Lake. In light of the confirmed taking of a rattlesnake on the property since completion of previous SEQRA studies, the omission of thorough field surveys and habitat assessment relative to one of New York State's threatened species is an obvious deficiency in the scope of the SEIS. The justification for, apparently, not disclosing a known sighting of a timber rattlesnake on the project property is unsettling. Herein, I provide additional information and justification that provides evidence that timber rattlesnakes almost certainly use the project site. The Tuxedo Reserve site is well-suited for the continued survival and restoration of the species.

Location and Setting

HydroQuest Figures 3, 4, and 5 (color GIS maps) accent the project location amidst rugged topography. Hillshaded Digital Elevation Model (DEM) data was used on Figures 3 and 5 to provide a topographic effect. The numerous large and small wetlands throughout and surrounding the project site, including both State and Federal wetlands and adjacent uplands, make this one of the most species rich sites in New York State.

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Rattlesnake Migration

Sterling Forest and the Tuxedo Reserve site are part of the Hudson Highlands western region, a species-rich area that is home to 41 native species of reptiles and amphibians, the second-highest concentration in the state. The Hudson Highlands western region contains 24 percent of New York State's threatened timber rattlesnake population. Rattlesnake telemetry studies were conducted proximal to the nearby and now protected Sterling Forge site in an effort to learn where some of the local rattlesnake population moves. A relatively small number of snakes were tracked during the process.

Gordon's Den is located southwest of the proposed Tuxedo Reserve project site and is believed to contain one of the largest timber rattlesnake populations in New York State. Telemetry studies revealed a maximum rattlesnake movement distance of 1.83 miles from Gordon's Den (Sterling Forge DSEIS; Appendix I; p. 5; TR#11). The attached *HydroQuest* figure titled *Potential Rattlesnake Migration Zones* (Figure 1) depicts circles extending 1.83 miles outward from den sites known to be near the proposed project area. This figure shows that timber rattlesnake dens lie southwest, west, northwest, north, and east of the Tuxedo Reserve site. As portrayed by overlapping circles extending outward from known den locations, a number of dens fall within the locally documented movement distance of 1.83 miles. If the distance outward from the proposed project boundary is extended to 3.3 miles, a documented rattlesnake movement distance based on other telemetry studies, 12 dens are known.

Figure 3 depicts overlapping circles of 1.83 miles, each centered on a documented den, for an idea of potential rattlesnake "traffic," so to speak. The areas with the greatest overlap of these potential ranges are shown in dark red, west of the project area. Closer to the Tuxedo Reserve project area, the proposed development is located at a veritable crossroads of potential snake activity. Project development will fragment this critical timber rattlesnake habitat. Analysis of the potential overlap in movement distance of 1.83 miles from each of the nearest dens reveals substantial overlap within proposed project home sites. The snakes from each of these dens may potentially utilize the project site as migratory routes which would allow genetic exchange between dens, for foraging, and for basking. Overlap of these potential movement ranges (i.e., migration routes) is accented on this figure, indicating that additional telemetry radio location work of timber rattlesnakes may find that numerous individual specimens may move through the project area.

HydroQuest strongly recommends that telemetry studies be conducted using rattlesnakes from the three nearest documented den sites. The presence of a threatened species on the Tuxedo Reserve site, coupled with the strong likelihood that they bask on rock outcrops in the vicinity of Mountain Lake, provide solid rationale for requesting the applicant to complete a revised SEIS. By extension, a rattlesnake investigation should be conducted throughout the entire Tuxedo Reserve site, including the area where a rattlesnake was captured and eaten.

The Tuxedo Reserve site, inclusive of the Mountain Lake area, must be revisited to be professionally assessed for timber rattlesnake den sites and basking areas, perhaps by a different investigator than who conducted the first study. Much of the site is ideally suited for this. A detailed assessment of important factors that combine to make suitable rattlesnake habitat was

conducted in close proximity to Tuxedo Reserve by HydroQuest for the Sterling Forest Partnership with input from NYSDEC. Key site factors common to den locations of healthy rattlesnake populations are slopes greater than five degrees, south facing slopes, elevations greater than 300 feet, exposed bedrock or talus, oak forests, and unfragmented habitat. The SEIS identifies some of these features:

> *"The Mountain Lake community also encompasses areas of Appalachian oak heath, Appalachian oak sedge, acidic woodland, and cliff and talus forested."* (page 5-1) *"Appalachian oak heath is a hardwood forest that occurs on well-drained sites, usually on ridgetops, upper slopes, or south- and west-facing slopes. ...Appalachian oak heath is one of the dominant vegetative communities on the Southern Tract of the Project site, including a large portion of the southern half of the Mountain Lake neighborhood."* (page 5-2) … *"Talus areas comprise an accumulation of broken rock fragments that are unstable and steeply sloping; the unstable nature of the rock results in uneven slopes and many rock crevices. ... The western shore of Mountain Lake is dominated by cliff and talus forested."* (page 5-3) … *"As indicated in 5-1b, the Proposed Modifications would also disturb Appalachian oak heath, Appalachian oak sedge, acidic woodland, and cliff and talus forested vegetative communities."* (page 5-6)

These rocky bedrock outcrops, located in or very near the proposed Mountain Lake community, are excellent examples of habitat used by the threatened timber rattlesnake for basking and dens.

The Mountain Lake area appears to be well-suited habitat for rattlesnake dens and basking. The nearest known den sites lie less than 1 mile west of the site and less than 0.6 miles east of the site – both well within documented rattlesnake travel distance of 1.83 miles. Both Figures 3 and 4 depict a reasonable approximation of where the Tuxedo Reserve rattlesnake may have been found and eaten. Figure 4 (Tuxedo Reserve: Slope Analysis & Rattlesnake Habitat Suitability) documents that much suitable rattlesnake habitat is present throughout the Tuxedo Reserve site. This figure was generated using GIS technology. Analysis of current surface elevations indicates moderate 15 to 25 percent slopes in yellow, 25 to 33 percent highly sloping areas in blue, and severe slopes, over 33 percent, in red. Much of the site is suitable rattlesnake habitat.

Clearly, the Tuxedo Reserve project site may be integral to the continued survival of the threatened timber rattlesnake, as it lies very close to areas with observed rattlesnakes. Again, the scope of the SEIS should be expanded to include a detailed evaluation of the suitability and use of the site specific to the threatened timber rattlesnake.

Potential Modification of the Habitat of a Threatened Species

New York State's Endangered Species Act was enacted in 1972 to protect species whose continued survival is in jeopardy (e.g., the timber rattlesnake). It was amended in 1979 and 1981 and now protects threatened species. Recent Supreme Court and Appellate Division decisions in *State vs. Sour Mountain Realty, Inc*. affirm New York State's Endangered Species Act (ESA), recognizing that:

1) Adverse modification of habitat may jeopardize the continued existence of endangered species;

2) The definition of disturbing, harrying or worrying in the ESA includes habitat modification;

3) Habitat modification and/or degradation includes disruption and prevention of normal dispersal, movement, foraging, mating, and migration patterns; and

4) Habitat modification may constitute an illegal take of an endangered or threatened species under the ESA.

Because the timber rattlesnake is present near or in the proposed project area, it is almost certain that project construction will irreparably harm and modify critical habitat required for the species. Numerous developmental activities have the potential of modifying rattlesnake habitat as a result of site grading, living on the project site, and related activities. Some examples include 1) fragmentation of forested landscape and existing species habitat via tree removal, 2) modification of foraging and migratory pathways, 3) infringement into and alteration of wetland buffers and cover vegetation, 4) modification of landscape via cut and fill and as required for road and home construction, 5) contact with homeowners and dogs in critical habitat may result in rattlesnake deaths, 6) modification of sub-basins, runoff, and shallow groundwater flow may modify the habitat that now comprises a healthy ecosystem, and 7) chemical additions (e.g., pesticides, herbicides, road deicing agents) throughout the habitat may significantly disrupt the existing habitat. The Tuxedo Reserve site may provide one of the last strongholds of the timber rattlesnake. On behalf of the Tuxedo Land Trust, I recommend full study, documentation, and analysis of the Tuxedo Reserve site relative to rattlesnake habitat suitability and use before advancing to an FEIS.

Conclusions

There are significant environmental risks associated with advancing the Tuxedo Reserve project based on incomplete assessments provided in the SEIS. These include infringement into 100-foot State wetland buffers, water quality risk to Mountain Lake and its wetland, possible dewatering of Mountain Lake stemming from aquifer pumping during dry periods, water quality risk resulting from contaminant infiltration from development within the aquifer recharge zone, risk of loss of adequate project water supply should long-term pumping reach and dewater bedrock fractures, and inadequate assessment of threatened species. As such, unless these issues are addressed before SEQRA has been completed, it is difficult to see how the Town Board as lead agency will be able to satisfy their legal obligation to take a "hard look" at the potential adverse impacts posed by this project. I therefore recommend that the scope of the SEIS be expanded to include significant outstanding issues raised in this letter before advancing to an FEIS.

If you would like to meet and discuss the issues raised in this letter, please contact me. Thank you.

Sincerely,

Paul A. Rubin
HydroQuest

Cc: Tuxedo Land Trust

HydroQuest Color GIS Figures in Report:

Figure 1: Water Line – Wetland Assessment
Figure 2: ~ Groundwater Drawdown Surrounding Tuxedo Reserve Water Supply Wells
Figure 3: Potential Rattlesnake Migration Zones
Figure 4: Tuxedo Reserve: Slope Analysis & Rattlesnake Habitat Suitability
Figure 5: Tuxedo Reserve: 3-Dimensional Topography