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October 20, 2015

Village of Tuckahoe Planning Board
Village of Tuckahoe Building Inspector
Village of Tuckahoe Planning Commission,
Mayor of Tuckahoe
NYS Department of Environmental Conservation
NYS Department of Health

RE: ADDENDUM TO HYDROQUEST REPORT OF SEPTEMBER 15, 2015: ADDITIONAL KARST AQUIFER DISCUSSION

To whom it may concern,

Please accept the text material and new figures presented below as an addendum to my September 15, 2015 HydroQuest report submitted to the Village of Tuckahoe Planning Board and the Village of Tuckahoe Building Inspector. My September 15, 2015 report and three GIS maps are hereby incorporated by reference.

To further highlight the karstic nature of a portion of the bedrock aquifer that underlies the proposed Marbledale Road chemical waste and proposed development site, please review attached color GIS maps titled Figure 4 (Potential Contaminant Transport to Bronxville High School, Other Schools and the Bronx River) and Figure 5 ("Brown Field" Development of Huge Chemical Waste Sites Should Not Remove the Need to Investigate Off-Site Environmental and Potential Adverse Public Health Impacts).

Figure 4 examines the potential depth to groundwater and a few of the many potential contaminant receptors located along the groundwater flow path between the Marbledale Road chemical waste site and the Bronx River (e.g., Bronx School, Reformed Church Nursery School). Any new or existing buildings situated along the alignment of the Inwood Marble that have deep foundations in bedrock that penetrate the groundwater table or have foundation inverts close to it have the potential of being contaminant receptors (e.g., for waterborne and airborne volatile organic chemicals). To date, the former marble quarry landfill site has been partially examined within the limited confines of the site area property itself, under the misguided concept that developing buildings and capping/covering much of the site area will in any significant or meaningful way stop the off-site migration of hazardous contaminants. Instead, premature site development will make it difficult or impossible to effect remedial actions or contaminant removal efforts should additional site testing and characterization support such actions.

Figure 5 illustrates that hydrogeologically it is not prudent to leave a huge chemical waste mass within an active groundwater flow system with no knowledge of where contaminants are going or who may be adversely impacted. The former marble quarry on Marbledale Road was filled with massive quantities of chemical wastes, inclusive of volatile and semi-volatile organics, metals, PCBs and more. Waste material is in direct contact with bedrock in an unlined setting with no chemical leachate collection or treatment. Groundwater flow is documented from north-northeast to south-southwest along the alignment of the soluble Inwood Marble. Developing and covering the waste material will not alter or stop down valley contaminant flow. Unfortunately and inappropriately, regulating agencies have not required characterization of off-site contaminant flow routes, presence, type, or concentration. More importantly, down-gradient receptors, inclusive of schools, have not been identified or investigated for potential adverse environmental and health impacts.

Testing conducted to date at the quarry site is limited both areally and vertically. Almost nothing has been assessed relative to contaminant presence or absence within the bedrock aquifer. It appears that site development and "closure" with a brownfield development option is being advanced with no consideration whatsoever to down-gradient contaminant investigation or assessment. Regulators have not recognized the hydrogeologic setting and aquifer types present, much less evaluated and used modeling programs to assess groundwater hydraulics. They have obtained very limited hydrologic data. Regulators have not required a very extensive monitoring program suitable for full characterization of the three main aquifer types present. Similarly, there has been no State recognition of hydrologic constraints on groundwater flow imposed by low permeability schists and gneisses laterally bounding the soluble Inwood Marble (see HydroQuest Figure 3).

While there are many excellent qualities of brownfield developments, they should not be used as band aids to cover massive hazardous sites that require significant investigation of the sites themselves and of the aquifers down-gradient of them. Whereas brownfield development may be suitable for many sites, here it is a poor excuse to dismiss virtually all contaminant concerns in the complete absence of down-gradient assessment of contaminant transport, multiple subsurface flow routes, offsite chemical presence and concentrations, assessment of all potential contaminant receptors, and assessment of potential adverse health impacts.

Old topographic maps depict two large quarry pit areas that later became water filled, as seen in historic aerial photographs, prior to the quarry being filled with contaminant-laden material. Boring logs provided in one or more of the reports provided by NYSDEC show at least two large and deep quarry areas. The actual boring logs are not available for review, making it unclear as to how deeply three of the nine monitoring wells penetrate the Inwood Marble or how the wells are completed. Furthermore, the full lateral and vertical extent of these pits has been adequately defined.

Hydrogeologically, the applicant and involved regulators have failed to identify the karstic nature of the valley axial carbonate aquifer present. This is discussed in the HydroQuest report. There are at least three functional aquifers operating up-gradient, at, and down-gradient of the

quarry site. These are: 1) an unconsolidated aquifer above bedrock, 2) non-karstic portions of a carbonate aquifer, and 3) a karstic aquifer with one or more solution conduits (i.e., where groundwater flow may be non-laminar and rapid, ultimately discharging in one or more springs at the Bronx River regional base level elevation). Karst aquifers are the most hydrologically vulnerable of all aquifers as, often, little or no contaminant dilution occurs. Sinking streams and sinkholes present in the Inwood Marble attest to the karstic nature of portions of the carbonate aquifer underlying the site.

HydroEnvironmental Solutions, Inc. do provide some information regarding the elevational difference between the ground surface and the water table in the site's nine monitoring wells (17.87 ft to 34.51 ft), albiet it was collected in a very short time period vs. over a longer period of time with seasonal water table fluctuations. Contouring the unconsolidated and bedrock aquifer data shows a southerly groundwater flow direction. The reports provided to date do not provide some of the most important geologic data needed to fully characterize the bedrock aquifer (either non-karstic or karstic portions). Only three of only nine site monitoring wells appear to be completed in bedrock. The boring logs and monitoring well completion diagrams are not provided.

Karst hydrogeologists are well aware of the limited data that may be obtained relative to karst aquifers via well data because wells often are not placed within conduit portions of karst aquifers where the hydraulic conductivity is orders of magnitude greater than non-conduit fractured bedrock portions. Since the karstic nature of the aquifer underlying a portion of the chemical waste site was not previously recognized, tracer testing was not conducted to determine subsurface flow paths and down-gradient spring discharge locations. Tracer testing is one aspect of correctly characterizing karst aquifers vs. erroneously relying on a few wells that most likely do not intersect conduit portions of the karst aquifer. Tracer testing requires recognition that karst aquifers are present, followed by hydrogeologic assessment of potential flow routes, and assessment of the likely aquifer discharge zone. The HydroQuest report and figures provide much of this initial assessment.

As clearly put forth in the HydroQuest report, groundwater flows into, through, and out of the chemical waste site. Reducing infiltration from directly above the site via building development and placement of cap/cover material will do nothing to stop groundwater through flow and down-gradient contaminant migration. Offsite testing, investigation, and characterization of contaminants and potential adverse health impacts is needed.

Evidence of Karst Aquifer Presence in the Tuckahoe & Surrounding Region

It is not surprising that geologists currently involved in Marbledale Road brownfield development project see no evidence for the presence of a karst aquifer, as many geologists, engineers, and consultants are not familiar with the intricacies of karst hydrology. To recognize the presence of the karst aquifer that is documented in the September 15, 2015 HydroQuest report and figures requires looking beyond the boundaries of the quarry site itself, knowing what

to look for geologically and hydrogeologically, and ultimately in following karst hydrogeologic testing procedures developed by karst hydrogeologists to fully characterize karst aquifers (inclusive of ASTM standards or updated equivalent). None of this has been done by others relative to the Marbledale Road quarry site and Inwood Marble valley area. Characterization of the karst aquifer present requires knowledge of karst aquifer flow systems and assessment of physical factors present in the region. Many geologists and hydrogeologists are, unfortunately, not trained in or familiar with karst hydrology. Clearly, this is the case with geologists and other individuals who see no evidence of karst in the Tuckahoe region. My expertise in karst hydrology is well-established and has been used to document the presence of a karst aquifer within the Inwood Marble. See two attached resume items with numerous karst publications.

Without going into an educational program in this addendum to bring involved individuals up to speed relative to karst aquifers and their hydrogeologic functioning, let it suffice to state a few simple facts. Karst aquifers are comprised of both conduit and non-conduit segments. Non-conduit portions behave hydrogeologically similar to fractured bedrock aquifers with laminar, Darcian, groundwater flow. Conduit portions of karst aquifers are characterized by non-laminar, rapid, groundwater flow where little or no dilution or cleansing of contaminants occurs - much like that present in open pipe flow. This makes them extremely vulnerable to contamination. Not all karst aquifers exhibit what modern hydrology textbooks commonly depict as karst features, namely sinking streams, sinkholes, caves, and large springs.

Tuckahoe and the surrounding region, however, do exhibit some classic karst features - sinking streams and sinkholes. Logically, consider surface streams that are pirated into the subsurface along carbonate/non-carbonate contacts or anywhere within a soluble carbonate bedrock unit, inclusive of the Inwood Marble. If an open, elongate, conduit were not present then surface water could not be shunted into the subsurface and flow underground to some down-gradient location where it surfaces in one or more spring discharge points. Review of topographic maps in the Tuckahoe region shows the presence of sinking streams and sinkholes that are not water-filled. For example, HydroQuest Figure 6 shows two streams sinking into the Inwood Marble via sinkholes north of the project site in the Hartsdale area.

As streams flow underground in carbonate conduits, it is common for failure of overlying strata to slump into conduits with sinkholes being the resulting evidence of underlying, active, conduit portions of karst aquifers. Again, logically, if sinkholes exist within karst aquifers, the material that is missing from the sinkhole must have been (or is actively being) removed by downward sediment sapping and bedrock dissolution and is being carried down-gradient through a conduit network to one or more spring discharge locations. Furthermore, the fact that sinkholes are present in the Inwood Marble (including up-gradient of the project site and within the same watershed: Figure 3) provides direct evidence that groundwater flow in conduits is actively occurring in post-glacial times. If not, then glacial sediments would cover and mask sinkholes that are large enough to appear on USGS topographic maps, some of which are depicted on HydroQuest figures. Obviously, it is not possible to adequately view a small site area within a karst aquifer and thereby understand the groundwater flow dynamics understood by karst

hydrologists of the world. A broader regional view is needed to understand up-gradient and down-gradient groundwater flow dynamics throughout karst aquifers. In the text of my September report and on GIS maps I created for KI Martial Arts, I put forth the karst setting present that has not previously been recognized in the site area or watershed by others.

The HydroQuest September 2015 report details some of the important aspects of the karst aquifer that is present up-gradient, through, and down-gradient of the Marbledale Rd. chemical waste site. HydroQuest Figures 3 (Bedrock Geology), 4 and 5 depict sinkholes within the valley-axial trending karst aquifer over which the Marbledale Road chemical waste site was developed. Karst hydrogeologists of the world would quickly recognize the setting as karstic and would then proceed to further characterize it using methods developed specifically for delineating karst aquifers.

Another key step in characterizing karst aquifers is to build upon research conducted by others in the region. For example, a short distance south of the project site in the West Mount Vernon area, geologic mapping and lithologic descriptions acknowledge the karstic nature of the Inwood Marble (U.S. Geological Survey; Miscellaneous Investigation Series Map I-2003; Bedrock and Engineering Geologic Maps of Bronx County and Parts of New York and Queens Counties, New York by Charles A. Baskerville, 1992):

> "*Inwood Marble encountered along the Bronx shore of the Harlem River south of the Alexander Hamilton Bridge (I-95) to Bronx Kill is deeply weathered and karstic to depths of nearly 200 ft below top of rock in some locations (Frank Irving, New York State Department of Transportation, personal commun., 1987).*"

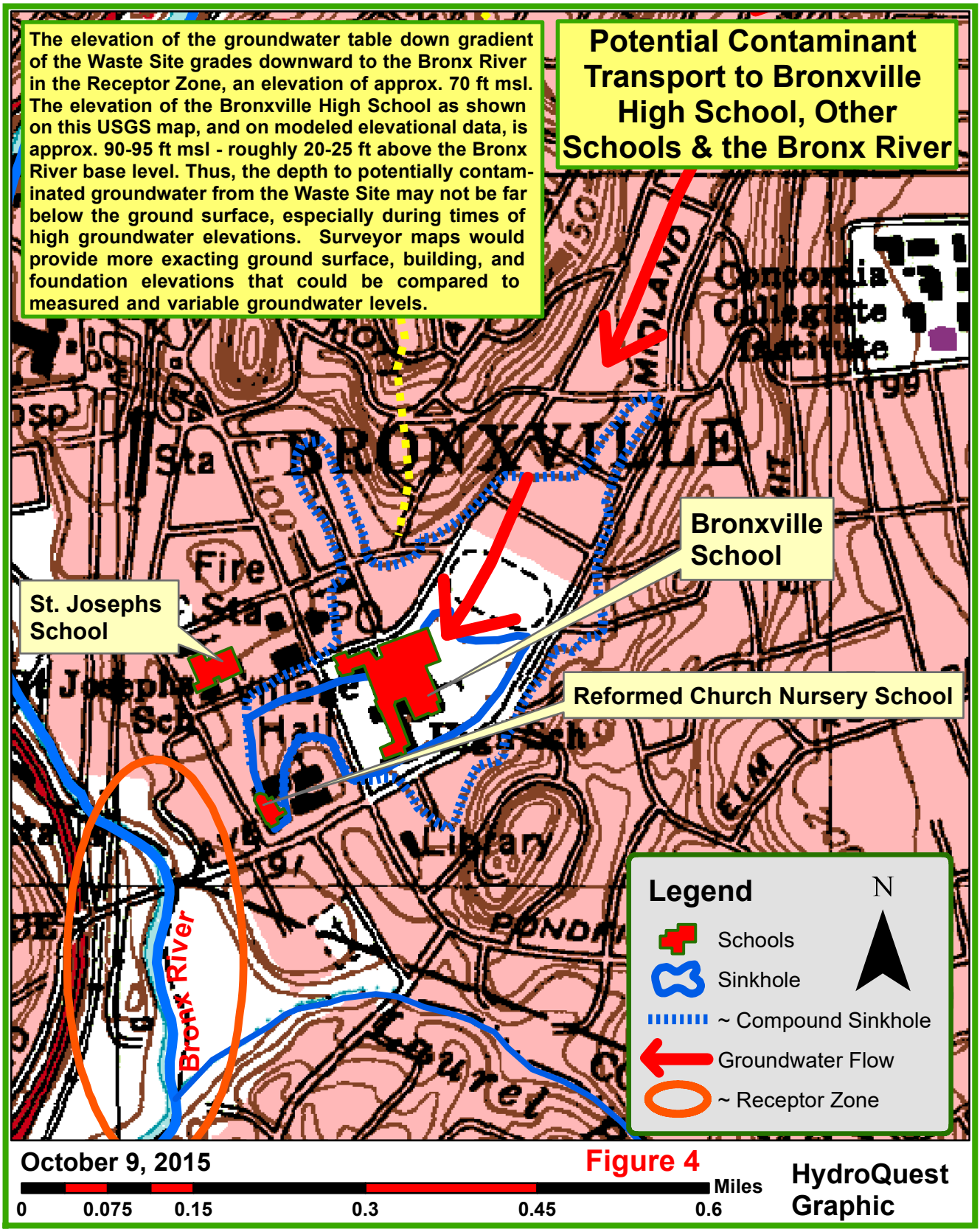
I recommend that project geologists who are not familiar with karst hydrology or my professional work have the material I have put together (i.e., HydroQuest report and all 6 figures) reviewed by James Garry, P.G. (NYSDEC; Bureau of Water Resources Management, Division of Water, Albany, NY 12233 [518- 402-8101]). In addition, I recommend that those involved in evaluating the Marbledale Quarry chemical waste site familiarize themselves with Dr. Arthur N. Palmer's 2007 book Cave Geology (454 pages) so that can educate themselves in the particulars of karst aquifers. He is the most frequently cited karst hydrologist in the world. I have coauthored numerous papers and co-led karst hydrology field trips with him. HydroQuest has provided ample evidence for the presence of a karst aquifer in the project site area. It is now necessary to conduct a comprehensive investigation of the site area itself and its interconnected offsite portions.

Thank you for considering information provided in this addendum. If I can provide further clarification or information, please contact me.

Sincerely yours,

Paul A. Rubin

Paul A. Rubin
Hydrogeologist


The elevation of the groundwater table down gradient of the Waste Site grades downward to the Bronx River in the Receptor Zone, an elevation of approx. 70 ft msl. The elevation of the Bronxville High School as shown on this USGS map, and on modeled elevational data, is approx. 90-95 ft msl - roughly 20-25 ft above the Bronx River base level. Thus, the depth to potentially contaminated groundwater from the Waste Site may not be far below the ground surface, especially during times of high groundwater elevations. Surveyor maps would provide more exacting ground surface, building, and foundation elevations that could be compared to measured and variable groundwater levels.
Potential Contaminant Transport to Bronxville High School, Other Schools & the Bronx River
BRONXVILLE
Bronxville School
St. Josephs School
Reformed Church Nursery School
Bronx River
Legend
N
Schools
Sinkhole
~ Compound Sinkhole
Groundwater Flow
~ Receptor Zone
October 9, 2015
Figure 4
Miles
0
0.075
0.15
0.3
0.45
0.6
HydroQuest Graphic

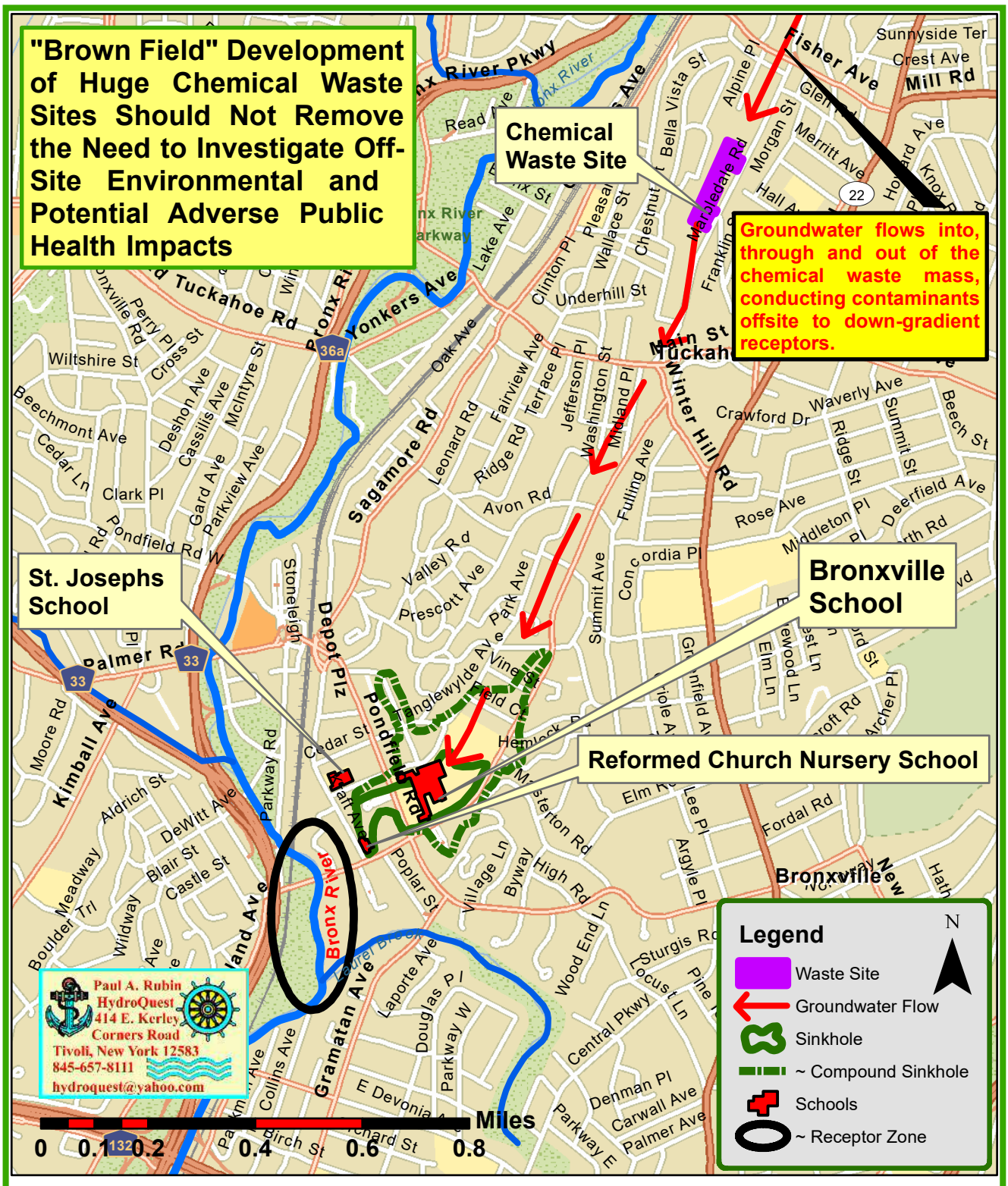


Figure 5. Hydrogeologically, it is not prudent to leave a huge chemical waste mass within an active groundwater flow system with no knowledge of where contaminants are going or who may be adversely impacted. The former marble quarry on Marbledale Road was filled with massive quantities of chemical wastes, inclusive of volatile and semi-volatile organics, metals, PCBs and more. Waste material is in direct contact with bedrock in an unlined setting with no chemical leachate collection or treatment. Groundwater flow is documented from north-northeast to south-southwest along the alignment of the soluble Inwood Marble. Developing and covering the waste material will not alter or stop down valley contaminant flow. Unfortunately and inappropriately, regulating agencies have not required characterization of off-site contaminant flow routes, presence, type, or concentration. More importantly, down-gradient receptors, inclusive of schools, have not been identified or investigated for potential adverse environmental and health impacts.

October 13, 2015

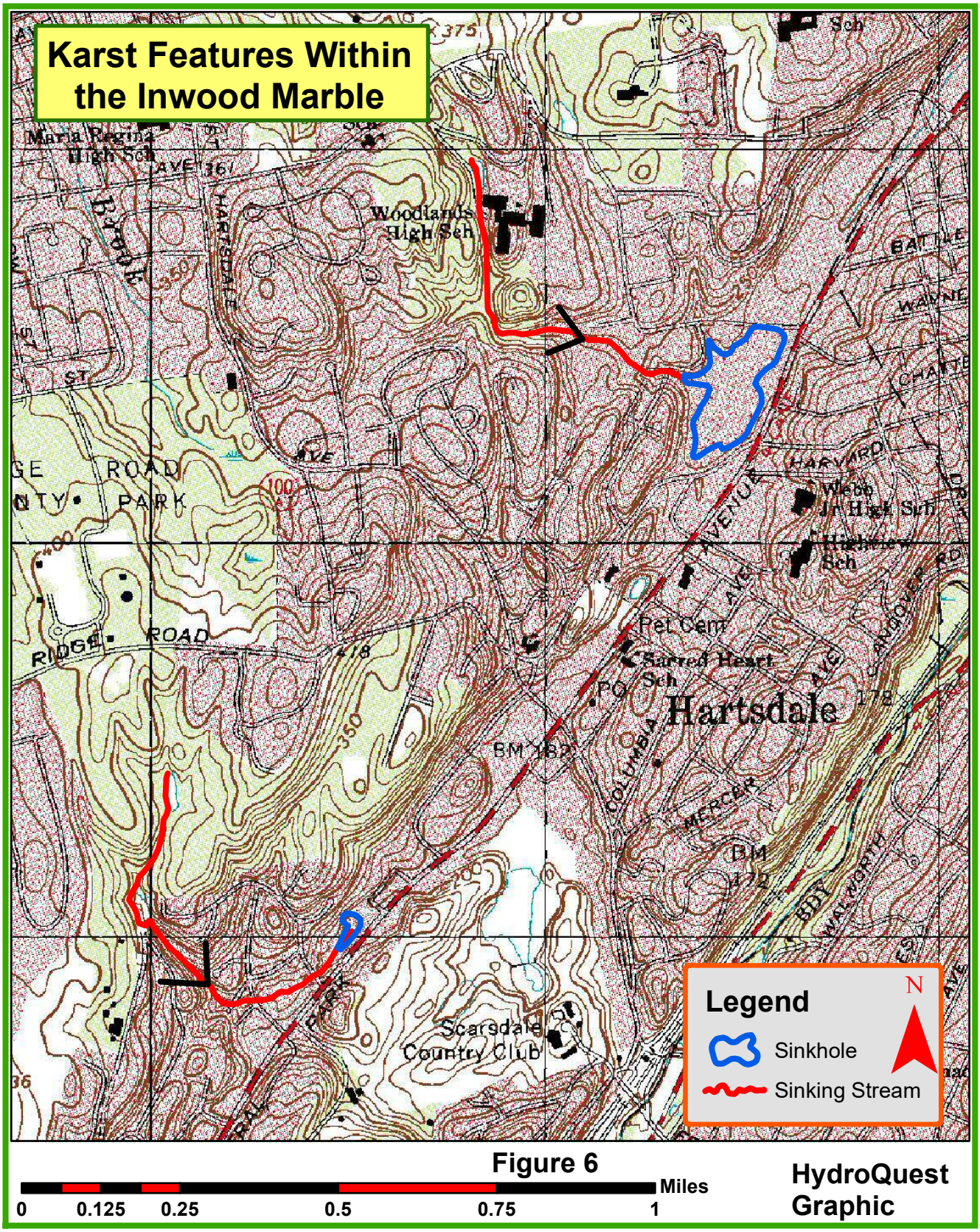


Figure 6

HydroQuest Graphic

HydroQuest

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September 15, 2015

Ms. Anne Marie Ciaramella, Chairwoman
Village of Tuckahoe Planning Board
65 Main Street Tuckahoe, New York 10707

Mr. Bill Williams, Village of Tuckahoe Building Inspector
2nd Floor, Room #200
Village Hall
65 Main Street
Tuckahoe, New York 10707

RE: **Hydrogeologic Considerations Relative to the Proposed Conditioned Negative Declaration for the 109-125 Marbledale Road Brownfield Development; Tuckahoe, New York**

Dear Chairwoman of the Tuckahoe Planning Board, Mr. Williams, and Village of Tuckahoe Planning Board Members,

On behalf of KI Martial Arts, please accept my comments on the proposal to issue a Conditioned Negative Declaration (CND) on the proposed hotel and restaurant at 109-125 Marbledale Road in Tuckahoe, New York. As a hydrogeologist, it is my professional opinion that further data and review is needed for a declaration of significance under the State Environmental Quality Review Act (SEQRA), and if the Planning Board nevertheless makes a declaration of significance now, it must make a positive declaration and require preparation of a full Environmental Impact Statement (EIS). Simply put, at present there is insufficient information to adequately address the likelihood of significant adverse environmental impacts as a result of down-gradient migration of volatile and semi-volatile, pesticide, metals, and PCB contaminated groundwater originating at the project site.

In keeping with the zoning code of Tuckahoe and as stated by Ms. Caliano, the overarching principle in zoning and planning is the protection of public safety, health and welfare. For reasons discussed below, we do not recommend ratifying a Conditioned Negative Declaration. Instead, in light of almost certain ongoing significant adverse environmental impacts offsite, as well as potential impacts associated with site development, we respectfully request that you defer any declaration of significance or require the applicant to prepare a full environmental impact statement (EIS).

Site Characterization & "Remedial" Analogy

The project applicant incorrectly characterized the site as devoid of solid or hazardous waste. Given the documented contamination this is spectacularly inaccurate, and given the site's inclusion in the DEC Brownfield Cleanup Program (BCP), it seems to be a deliberate misstatement. In fact, health and safety risks remain today for site workers. Site disturbance and alteration may increase the health risk to the surrounding community.

The Phase I Environmental Site Assessment (9-06-13; Appendix 5: Pertinent Local Records) includes a completed SEQR Full Environmental Assessment Form. In the Site Description section (Part 1), item 20 provides the following erroneous entry:

"*20. Has the site ever been used for the disposal of solid or hazardous wastes?* ***NO***"

This declaration is not consistent with the sites' filling with chemical wastes and contaminated fill. Mr. Howard Slotnick of Ardmar Realty stated that the open pit mine was reportedly over 100 feet deep. HydroEnvironmental Solutions, Inc. found one test location with a depth of 85 feet. The volume of fill required to fill one or more quarry holes to this depth is enormous.

The quoted statement above implies that there is little or no risk of significant adverse environmental impact either onsite or offsite. Site characterization of this nature has no place in sound environmental assessment and impedes the Planning Board's ability to protect public health and safety, and the environment. The SEQRA EIS process requires full environmental assessment of known hazards, complete with public review and comment, and the Board should not tolerate misstatements meant to induce it to ignore or underestimate hazards. Even the limited soil and groundwater testing conducted to date, a half century after waste disposal, documents the presence of numerous chemical compounds - some of which remain a potent health risk to site workers even today.

Assorted anecdotal reports and field evidence indicate that the waste mass includes fly and bottom ash (chemical-metals rich dregs of the incineration process associated with numerous contaminant sites), volatile and semi-volatile organic chemicals, petroleum products, pesticides, contractor waste, solvents, batteries, large quantities of metals waste, and PCBs. Soil and groundwater has been documented to be impacted with SVOCs, and metals in exceedance of applicable standards.

The former 3.45-acre Tuckahoe Quarry waste disposal site (Former Marble Quarry Landfill; Site code: C360143) is not simply another brownfield with minimal contamination present. Instead, much like the Love Canal case, the toxic dump that led to the enactment of the federal Superfund law, the large and deep Tuckahoe marble quarry was filled with large volumes of chemical wastes placed directly in contact with an unlined base and left in place without any treatment whatsoever. [I served for 8.5 years as a hydrogeologist at the NYS Attorney General's Office, assisting in determining a remedial option for the Love Canal in Niagara Falls, NY.]

In such cases it is necessary either to remove the highly contaminated soil and groundwater or to construct a means of maintaining an inward hydraulic gradient toward to prevent its outward migration. Unlike the Love Canal site, nothing has been done to stop site contaminants from leaving the Tuckahoe waste site with the groundwater flow system. The capping proposal would render this failure permanent. While some testing has been conducted onsite, it is not sufficient to fully characterize the waste mass or to ascertain the best remedial option.

Chemical Characterization

While some chemical characterization of soil, groundwater, and vapors has been conducted, it is not sufficient to characterize the large volume and areal extent of the waste mass present. Also, the Remedial Investigation Report provides no metals analyses of groundwater in any of the nine wells tested.

The project applicant has erroneously concluded that " … *groundwater based on the proposed development plan is <u>not</u> a factor*" and "*Development will serve to cap the contaminated soils making them less environmentally accessible*." Site contaminants pose a great risk to the environment. Chemical concentrations and chemical distribution are highly variable between the limited test boring and well locations, indicating that the full nature and composition of wastes filling the former quarry site have not been adequately assessed. Many groundwater and soil samples collected were found to be laced with volatiles (e.g., acetone, benzene, chloroform, dichlorodifluoromethane, isopropylbenzene, methyl ethyl ketone, MTBE, methylcyclohexane, xylenes, trichloroethene), semi-volatiles (e.g., 2,4-dimethylphenol, benz(a)anthracene, benzo(a) pyrene, bis(2-ethylhexyl)phthalate, fluorine, phenol, 3&4-methylphenol (m&p-cresol), caprolactam), pesticides (4,4'-DDD, 4,4'-DDE), PCBs, numerous metals, and cyanide.

Results of field work conducted on the site revealed that soil at some locations contained significant concentrations of volatile and semi-volatile chemicals and inorganic parameters above laboratory MDLs and NYSDEC UUSCOs. Surprisingly, no metals analyses were presented for any of the nine groundwater wells. This omission must be corrected. Perhaps the Appendices will provide this data once they are available or, perhaps, metals were not analyzed. In the meantime, it would be premature to advance a CND without any chemical data to review and assess. Other chemical issues are also present. Many of the analyses reported cannot provide chemical concentration information because the Reporting Limit exceeds the criteria being evaluated. Consideration should have been given to testing for other chemicals of potential concern, such as dioxin. All told, the horizontal and vertical nature and extent of chemical contamination are not fully known onsite or offsite.

Importantly, development of the site as proposed would preclude potential large scale contaminant removal or remedial options designed to stop offsite migration of contaminated groundwater. Simply capping and covering a large chemically-laden waste site that has

groundwater actively flowing through it is ill-conceived and inconsistent with protecting public health because it will not stop contaminants from leaching into groundwater or streams offsite. Groundwater moves down-gradient toward the site, through the site, and then down-gradient from the site, as do contaminants in the groundwater. Capping the site is in no way a remedial measure.

Hydraulic Gradient at the Proposed Project Site

Three sets of onsite groundwater levels were taken in a very short period of time. This does not provide information on seasonal water table fluctuations. Furthermore, additional information is needed to address the highly variable water table surface present in bedrock and unconsolidated wells.

For example Figure 8 of the Remedial Investigation Report ("RIR"), which shows groundwater elevations and general flow directions, depicts some large changes in hydraulic head over very short distances. A good example of this is found between MW-9 and MW-2 where, on 5-11-15, a 14.03 foot elevational change in the water table surface occurs over a distance of about 158 feet (it is difficult to determine the actual distance because the map has no scale bar that would allow correct distance determination, only a stated scale that would change based on the size of the map viewed for reference). A change in hydraulic gradient of this magnitude over a very short distance might make sense on a steep mountain slope, but is unlikely in this site's physical setting. It is necessary to fully understand the site's hydrogeology and factors controlling contaminant transport in advance of evaluating and assessing potential remedial options that may have significant adverse onsite and offsite environmental impacts far into the future - inclusive of impacts to off-site receptors that may receive high concentrations of waste moving with the groundwater flow system under a steep hydraulic head. In the absence of this and other data, it would be premature to issue any declaration of significance, and since SEQRA requires a "hard look" at the known impact, it would be wrong to issue anything other than a positive declaration if a declaration of significance must be presently determined.

Regional Groundwater Flow

The applicant has not correctly determined the drainage basin into which the site contaminants migrate. In addition, the applicant has not recognized that portions of the waste site are underlain by a karst aquifer (i.e., conduit-bearing with rapid groundwater flow characteristics) that is extremely vulnerable to contamination. Too little hydrogeologic information is available to rely upon for ratifying a Conditioned Negative Declaration.

For the most part, the RIR focusses on the assessing the proposed Marbledale Road quarry site itself. Water levels measured in the nine onsite wells show a southerly groundwater flow direction. However, the 8-31-15 RIR characterizes the Regional Hydrogeology (section 2.5.3) as follows:

> "*Based on the regional topography, the groundwater flow in the vicinity of the Site is expected to flow to the southeast towards the Hutchinson River drainage system or southwest towards the Bronx River drainage system, both ultimately discharging into the Long Island Sound*."

Thus, the applicant has determined that groundwater moves through a massive chemical waste site, yet has not conducted any type of hydrogeologic analysis to document where contaminated groundwater moving through sediments and bedrock actually flows, has not evaluated the topographic, hydrologic, and structural constraints controlling groundwater migration offsite, has not determined where contaminant receptors are located, and has not evaluated potentially significant offsite adverse environmental impacts. As quoted above, even the nearest drainage basin is questionable. Below, HydroQuest addresses these very important hydrogeologic issues.

Yet, in the absence of addressing these and other critical items, the applicant and the Planning Board's planning consultant have recommended that site development should proceed rapidly after the site area is capped and thereafter monitored periodically.

The RIR lacks boring logs that are needed to assess the subsurface geology and the water quality sampling intervals in monitoring wells. While it appears that three wells were completed in bedrock, this is not clear. Furthermore, the depth of penetration into bedrock is also not documented in the RIR. Also, it appears that groundwater samples were only collected from at or very close to the water table, not at various intervals within the bedrock.

The Project Site is Underlain by a Karst Aquifer

A waste site must not be considered in isolation from functioning groundwater flow systems. The applicant has not recognized that hydrogeologically the project site lies above a karst aquifer where offsite contaminant transport may actively be occurring through solution conduits. Offsite contaminant receptors have not been identified. "*Remedial*" actions contemplated at the Marbledale waste site (i.e., cap, cover, monitoring) will do <u>nothing</u> to stop contaminant migration offsite. Ratification of a Conditioned Negative Declaration will not require evaluation of potential adverse environmental impacts to the broader community and the Bronx River.

A waste site's hydrogeology cannot be comprehensively evaluated based solely on data limited to the site area itself. It is necessary to evaluate the entire groundwater flow system within which the site in question lies. The lack of complete information regarding site wells and lack of metals analyses from all groundwater samples is further compounded by the fact that the applicant has failed to recognize that the waste site is hydrogeologically within a karst bedrock aquifer (i.e., a vulnerable marble aquifer characterized by rapid groundwater flow through conduit portions of it, as well as sinkholes and sinking streams). HydroQuest Figure 3 documents the karstic nature of the aquifer. Sinkholes commonly form over conduits as material is sapped away from above, flows through conduits, and is discharged in one or more down-gradient springs.

Notably, the site area is positioned between two ridges yet there is NO surface stream. The reason is that the site area is underlain by the Inwood marble which is sandwiched between two bedrock units with low permeability. Looking at the broader hydrogeologic picture (i.e., beyond the site itself) it is clear that the Inwood marble is karstic. This means that a portion of the groundwater flow within it occurs in conduits that are able to rapidly transmit groundwater and contaminants to offsite receptors, often with little or no dilution of contaminants. Up-gradient of the development/waste site an elongate sinkhole demonstrates the karstic nature of the groundwater flow system that the applicant has failed to recognize. Elsewhere in the Inwood marble, streams sink into the subsurface. Both sinkholes and sinking streams document the presence of underlying conduits that conduct groundwater flow and contaminants. Hydrogeologic, topographic and structural controls constrain groundwater flow within the Inwood marble (HydroQuest Figure 3) and down-gradient of the site area until it discharges in a zone of low hydraulic head. This must be the Bronx River. The attached GIS maps illustrate this. The karst aquifer enables onsite contaminants to migrate rapidly offsite in the groundwater flow system.

The applicant has documented a southerly groundwater flow direction within the site area. Groundwater is not stagnant, it moves down-gradient to areas of lower elevation. Thus, groundwater flow occurs into the site from the north, through the site, and off-site to receptors that have not been identified. Again, the ultimate nearby receptor must be the Bronx River. If the proposed development site were to be capped, covered, and built upon - this would preclude further site investigation and characterization and would preclude contaminant removal should this be determined to be the best remedial action.

Down-gradient Contaminant Receptors have Not been Identified

Contaminants migrating down-gradient from the Marbledale Road waste site may adversely impact receptors along the subsurface flow path in addition to the water quality of the Bronx River. A large school is present within an expansive sinkhole situated above or within the karst aquifer (Figure 3). Depending on the physical setting of the school building, it is possible that volatile organic chemicals from the waste site may vaporize into the school building. Approving the proposed development in the absence of completion of an EIS may preclude viable remedial options. Considering the large scale of the waste site, it is critical to address the whole hydrologic picture, not just site-specific details.

It is important to know if the school building has experienced settlement issues and if contaminated groundwater has entered the foundation if one is present. Similarly, if the foundation is sufficiently deep to have intersected karstic portions of the aquifer system, it is important to know if volatile organic contaminants known to be present in the quarry waste site (e.g., acetone, benzene, chloroform, dichlorodifluoromethane, isopropylbenzene, xylenes, methylcyclohexane, tetrachloroethene, trichloroethene) volatilize into school air where inhalation and children's health could be an issue. This same issue pertains to other buildings along the down valley karstic flow path. The distance between the Marbledale waste site (i.e., Former Marble Quarry Landfill; Site code: C360143) and the school is about 1.1 miles, a very short distance for potential conduit flow under a high hydraulic gradient. Advancing motel and restaurant development under the guise of a CND would remove the ready potential to remediate the waste site via contaminant removal or hydraulic containment means. .

Karst hydrologists recognize that a few wells placed in carbonate bedrock may provide little or no hydrologic information relative to flow dynamics present in rapid flow portions of karst aquifers. Karst-specific hydrologic testing and analysis is needed both onsite and offsite to characterize karst aquifers. There is a complete lack of karst information provided in the RIR or even relative to the conceptual hydrologic flow system present. Again, advancing a CND without any knowledge of the true hydrogeologic flow system and its receptors would be ill-advised.

While it is beyond the scope of this letter to fully address the karstic hydrogeologic setting the waste site lies within, HydroQuest has provided three GIS maps that document the topographic, geologic, structural, and hydrogeologic controls that constrain and govern groundwater flow adjacent to and beneath the waste site being considered for development (color HydroQuest Figures 1, 2, and 3; attached). These maps document and portray the correct watershed the waste site lies within, geologic and structural controls governing groundwater flow, the presence of an active karst aquifer underlying the site, and the most likely zone of contaminant discharge into the Bronx River. All these factors and potential adverse environmental impacts (e.g., to water quality and ecosystems) must be properly assessed as part of a comprehensive environmental impact assessment.

Site Capping, Air Quality and Potential Volatile Organic Inhalation Risk

Site capping may increase health risks associated with inhaling volatile organic compounds. Under the present development plans increased vapor concentrations may result and increase inhalation exposure to people in buildings near the site as well as to the surrounding community. It has been suggested that capping and covering the site, along with monitoring, is sufficient "*remediation*" such that site development can proceed. Tables of soil vapor analyses show that assorted volatile organics are present in high concentrations. Examples include 1,2 dichlorotetrafluoroethane (142,000 ug/m^3), benzene (68.6 ug/m^3), dichlorodifluoromethane (107,000 ug/m^3), isopropylalcohol (1,010 ug/m^3), trichlorofluoromethane (6,180 ug/m^3), hexane (5,210 ug/m^3), cyclohexane (1,320 ug/m^3), and trichloroethylene (25.6 ug/m^3).

Site field work also documented elevated volatile vapors (greater than 20 parts per million) in three test borings at depth. The highest PID readings were observed at test boring TB-6 at a depth of 56 to 60 feet below ground surface with concentrations ranging from 230 ppm to 287 ppm (HydroEnvironmental Solutions).

Depending on the material used to cap the waste site, different impacts are possible. However, even if an impermeable cover is used to reduce infiltration of rainfall and snowmelt, contaminants would still migrate off site. As depicted on HydroQuest Figure 3, groundwater flow within soils and the Inwood marble aquifer occurs from up-gradient of the site, through the site, and to receptors down-gradient of the site. The site area comprises only a small portion of the flow route, thus capping the site will have little impact towards reducing contaminant transport offsite.

And if indeed a truly impermeable cap is used, significant adverse impacts are possible. In particular, organic vapors from the contaminated soil may seek the nearest avenue of escape which is likely to be the new motel and restaurant, as well as nearby existing buildings. This impact must be evaluated by air experts (which I am not). Under the present plans it is foreseeable for increased vapor concentrations to increase inhalation exposure to people in buildings near the site as well as to the surrounding community.

Alternate Options

Completion of an Environmental Impact Statement would provide the opportunity to evaluate other project site options not positioned over a massive chemical waste disposal site. One important aspect of completing an EIS that incorporates public review and comment is the Alternate options section. This SEQR item provides for assessment of other development options, potential plan modification, and the no action alternative. It allows for evaluation of potential risks associated with each alternate option. For this project, an alternatives analysis should evaluate other potential sites where chemical exposure and contaminant risk are far less than building over a former large-scale waste disposal site. A key question that begs answering relative to the Marbledale Road site is: *Why would anyone intentionally elect to construct a potential profit-making enterprise over a chemically-laden waste site where health concerns exist when other far cleaner locations could be considered*?

As stated at the July 21, 2015 Tuckahoe Planning Board meeting, the overarching principle in zoning and planning is the protection of public safety, health and welfare. The Marbledale Road waste site poses potential health and safety risks to the community and to outside visitors who might avail themselves of project facilities. It is in the Village's best interest to require the project applicant to address alternate site options.

Failure to conduct a full EIS would not constitute the "*hard look*" contemplated by SEQRA and certainly would not allow alternate options to be evaluated. Again, one might ask if it makes sense to develop a large-scale hotel and restaurant atop an unlined waste site which might unnecessarily expose the community to contaminants, at least in the absence of completion of a health risk assessment.

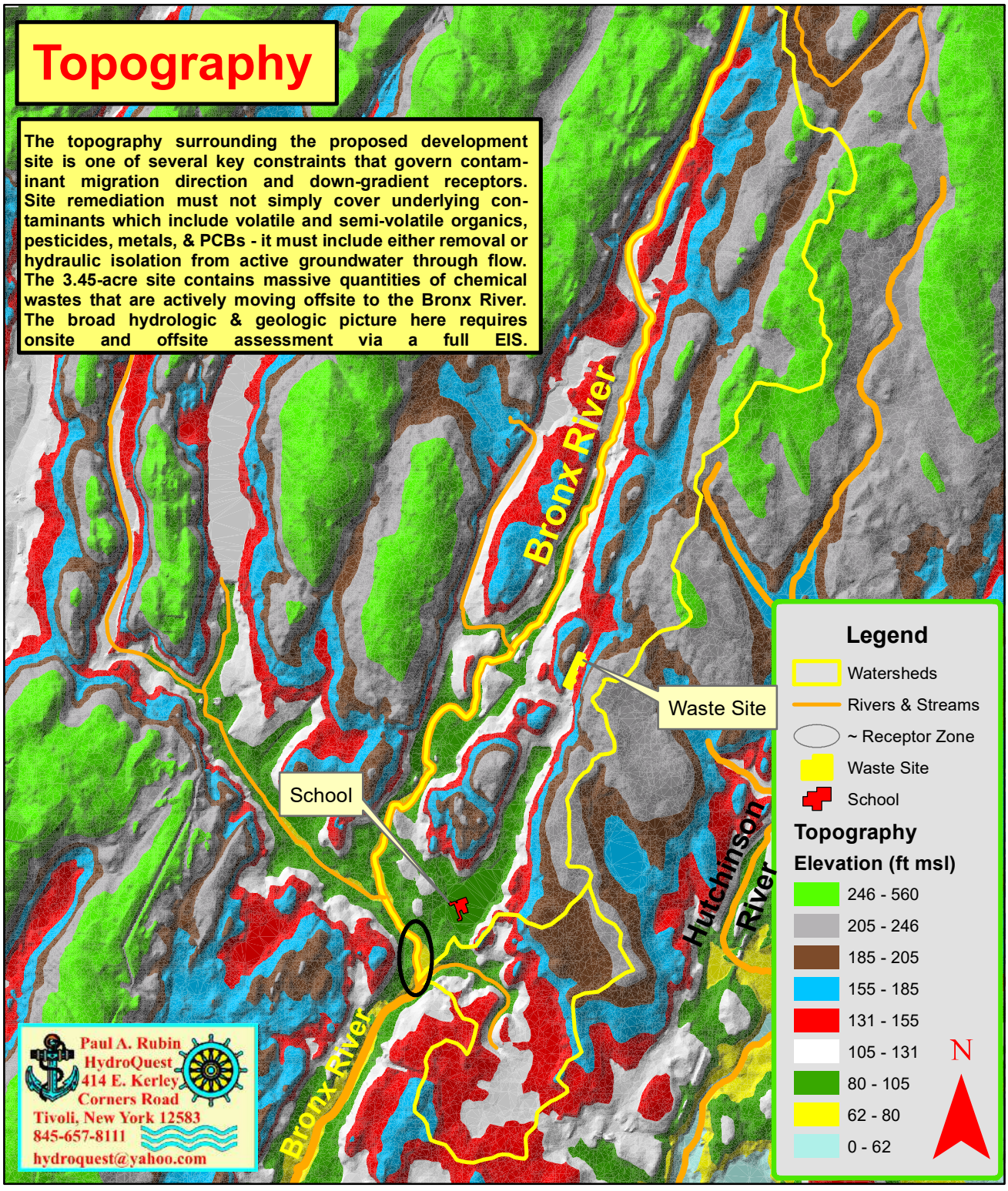
Thank you for considering our comments. If we can provide further clarification or information, please contact me.

Sincerely yours,

Paul A. Rubin
Hydrogeologist

Topography

The topography surrounding the proposed development site is one of several key constraints that govern contaminant migration direction and down-gradient receptors. Site remediation must not simply cover underlying contaminants which include volatile and semi-volatile organics, pesticides, metals, & PCBs - it must include either removal or hydraulic isolation from active groundwater through flow. The 3.45-acre site contains massive quantities of chemical wastes that are actively moving offsite to the Bronx River. The broad hydrologic & geologic picture here requires onsite and offsite assessment via a full EIS.



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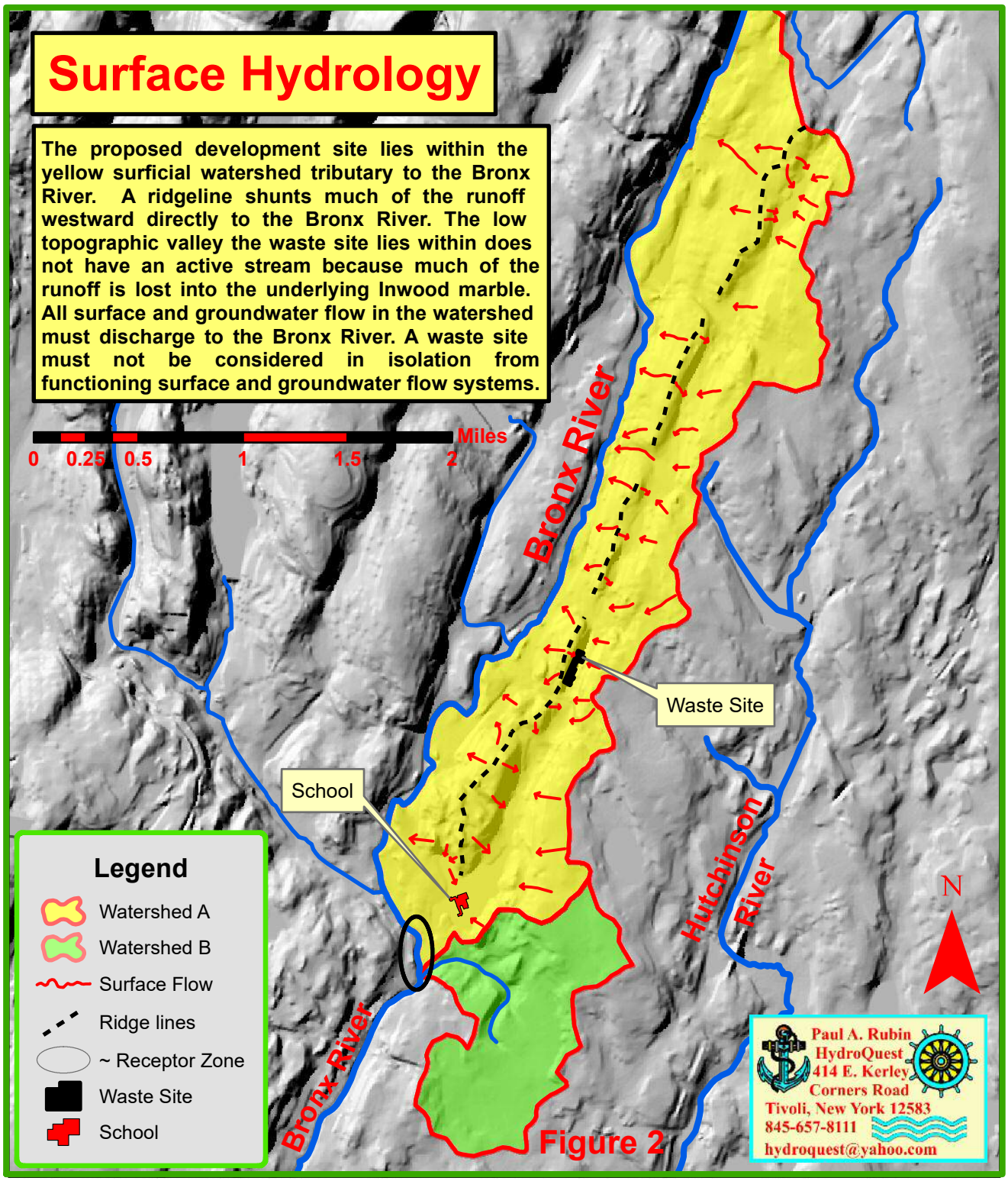
0 0.25 0.5 1 1.5 2 Miles

Figure 1


Surface Hydrology
The proposed development site lies within the yellow surficial watershed tributary to the Bronx River. A ridgeline shunts much of the runoff westward directly to the Bronx River. The low topographic valley the waste site lies within does not have an active stream because much of the runoff is lost into the underlying Inwood marble. All surface and groundwater flow in the watershed must discharge to the Bronx River. A waste site must not be considered in isolation from functioning surface and groundwater flow systems.
0 0.25 0.5 1 1.5 2 Miles
Bronx River
Waste Site
School
Hutchinson River
Bronx River
N
Legend
Watershed A
Watershed B
Surface Flow
Ridge lines
~ Receptor Zone
Waste Site
School
Figure 2
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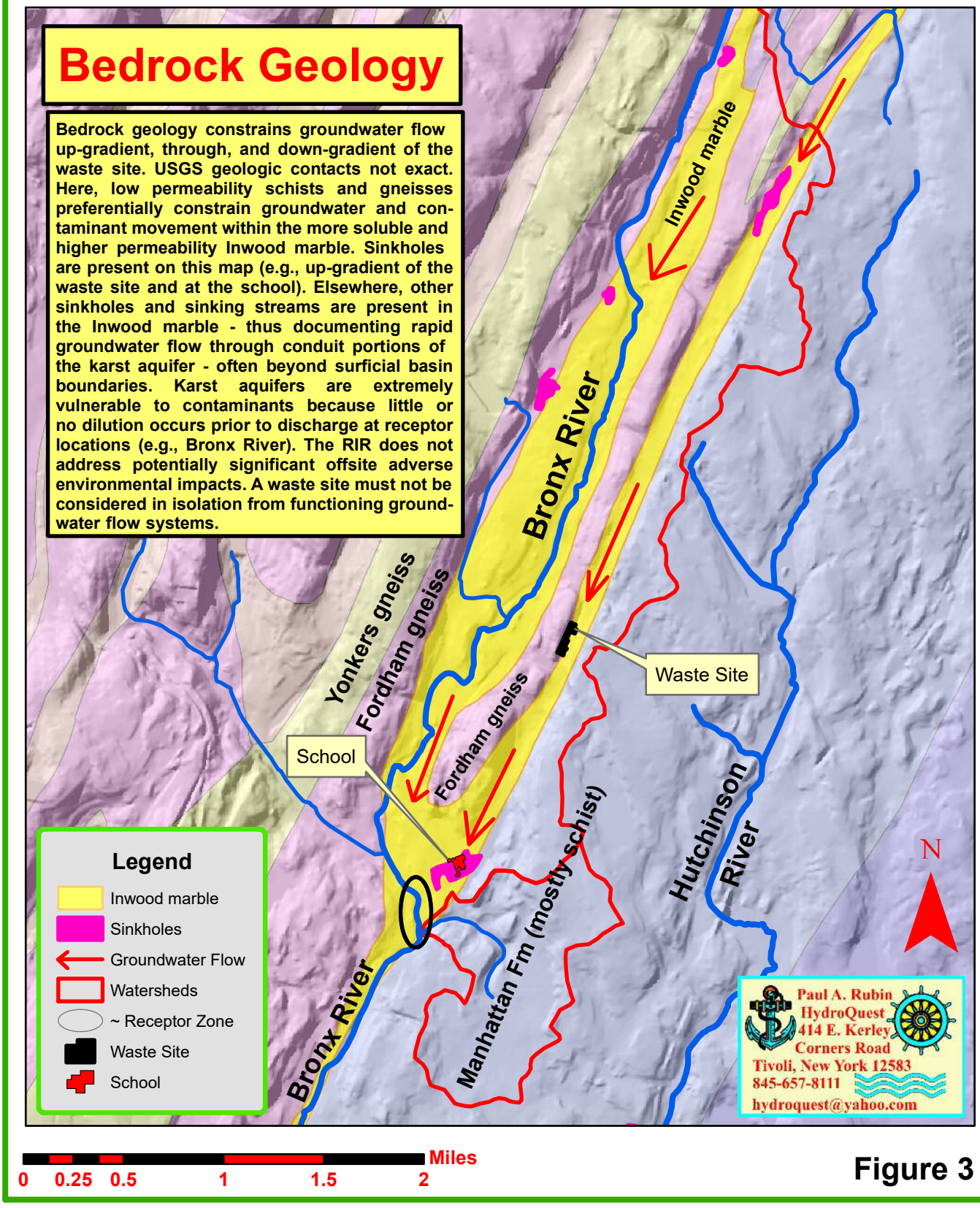
Bedrock Geology
Bedrock geology constrains groundwater flow up-gradient, through, and down-gradient of the waste site. USGS geologic contacts not exact. Here, low permeability schists and gneisses preferentially constrain groundwater and contaminant movement within the more soluble and higher permeability Inwood marble. Sinkholes are present on this map (e.g., up-gradient of the waste site and at the school). Elsewhere, other sinkholes and sinking streams are present in the Inwood marble - thus documenting rapid groundwater flow through conduit portions of the karst aquifer - often beyond surficial basin boundaries. Karst aquifers are extremely vulnerable to contaminants because little or no dilution occurs prior to discharge at receptor locations (e.g., Bronx River). The RIR does not address potentially significant offsite adverse environmental impacts. A waste site must not be considered in isolation from functioning groundwater flow systems.
Inwood marble
Bronx River
Yonkers gneiss
Fordham gneiss
Fordham gneiss
Waste Site
School
Hutchinson River
Manhattan Fm (mostly schist)
Bronx River
N
Legend
Inwood marble
Sinkholes
Groundwater Flow
Watersheds
~ Receptor Zone
Waste Site
School
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Miles
0 0.25 0.5 1 1.5 2

Figure 3