NEW YORK STATE OF OPPORTUNITY. | Department of Environmental Conservation

SCHOHARIE CREEK

Biological Stream Assessment

September 9, 2015

STREAM BIOMONITORING UNIT

425 Jordan Rd, Troy, NY 12180
P: (518) 285-5627 | F: (518) 285-5601 | alexander.smith@dec.ny.gov

NEW YORK STATE OF OPPORTUNITY. | Department of Environmental Conservation

BIOLOGICAL STREAM ASSESSMENT

Schoharie Creek
Greene County, New York
Mohawk River Drainage Basin

Survey date: September 9, 2015
Report date: February 2, 2017

Elizabeth A. Mosher
Alexander J. Smith
Brian Duffy
Diana L. Heitzman
Jeff Lojpersberger

Stream Biomonitoring Unit
Bureau of Water Assessment and Management
Division of Water
NYS Department of Environmental Conservation
Albany, New York

For additional information regarding this report please contact:

Alexander J. Smith, PhD
New York State Department of Environmental Conservation
Stream Biomonitoring Unit
425 Jordan Road, Troy, NY 12180
alexander.smith@dec.ny.gov
ph 518-285-5627
fx 518-285-5601

Table of Contents

Stream: Schoharie Creek

River Basin: Mohawk River

Reach: Hunter, NY

Background

Biological monitoring of the Schoharie Creek was conducted at each of three sampling locations September 9, 2015 at the request of New York State Department of Environmental Conservation (NYSDEC) Region 4 staff. The biological assessment was conducted to address water quality concerns related to a sewage treatment plant discharge at Camp Machne Tashbar (CMT) in the area of Platte Cove, NY. The objective of the survey was to document any impacts of the discharge on biological communities through comparison of samples collected upstream and downstream of the discharge. NYSDEC, Division of Water, Region 4 became interested in documenting in-stream water quality conditions after receiving correspondence from stakeholders in the local community in 2014 concerning potential elevated levels of fecal coliforms downstream of the CMT discharge (Appendix I).

To characterize water quality and assess any impacts to aquatic life, benthic macroinvertebrate communities were collected via traveling kick sample from riffle areas at each location. Methods used are described in detail in the Standard Operating Procedure: Biological Monitoring of Surface Waters in New York State, SOP#208-16 (NYSDEC, 2016). The contents of each sample were field-inspected to determine major groups of organisms present, and then preserved in alcohol for laboratory inspection of 100-specimen subsamples from each site. Biological assessment of water quality was conducted through calculation of benthic macroinvertebrate community metrics including the Biological Assessment Profile (BAP) score for riffle communities. Expected variability in the results of benthic macroinvertebrate community samples is presented in Smith and Bode (2004).

Results and Conclusions

1. Water quality in this reach of Schoharie Creek is fully supporting of aquatic life. Biological assessment of water quality indicates non-impacted conditions at all three sites.

2. The data suggest that there are no impacts on water quality due to the CMT discharge at the time of this survey.

Discussion

Schoharie Creek, a main tributary to the Mohawk River, is located to the west of the Hudson River (Figure 1). The headwaters of Schoharie Creek begin in Indian Head Mountain, 7.5 miles southeast of Hunter Mountain. The creek continues north for approximately 93 miles until its confluence with the Mohawk River at Fort Hunter just west of Amsterdam. The Schoharie Creek watershed covers approximately 927 square miles and accounts for approximately 1/3 of the Mohawk River watershed. Based on the 2011 national land cover data, land use in the watershed is 75% natural (forest, shrub lands, wetlands, open water), 20% is agricultural (pasture and crops) and only 5% of the watershed is developed. The majority of the developed land is within and surrounding the towns of Cobleskill and Schoharie.

In October of 2014, the SBU was approached by DEC Region 4 Division of Water staff interested in a survey of the immediate reach of the Camp Machne Tashbar (CMT) wastewater treatment plant (WWTP) (Appendix I). The inquiry was prompted due to an unusually high measurement of bacteria just downstream of the CMT plant discharge (Menzie, 2014). There were concerns raised by local stakeholders as to citizens' health and safety, and water quality in the Schoharie Creek as a whole in this area. In response, the SBU conducted a biological assessment on September 9th, 2015 at three locations on the Schoharie Creek, including one historical site (Table 1). Two sites were selected to bracket the CMT discharge to capture any effects; SCHO-87.0 (above) and SCHO-86.6 (below) (Figure 2a). The third site was selected farther downstream (SCHO-82.9), to capture any lasting effects of the discharge on the creek (Figure 2b).

Previously collected biological assessment data exists for SCHO-82.9 from 1989 and was assessed as non-impacted. Multiple historical sites (river miles 79.0, 81.0 and 83.3) in the sample area were most recently assessed as slightly-impacted in 2011, 2011 and 2000, respectively. These findings suggest that this reach, although slightly altered from the natural state, has historically been fully supporting of aquatic life.

Results of the current survey suggest all three sites are non-impacted and fully supporting of aquatic life (Figure 3); an assessment consistent with the most recent historical data available at the time. Overall, water quality increased moving downstream, with data suggesting station 89.0 having slightly decreased water quality compared to the two lower sites, although still non-impacted (Figure 3). Had the CMT discharge been negatively affecting water quality, the opposite would be expected. The nutrient biotic index for phosphorus (NBI-P), a measure of community response to phosphorus, is slightly impacted both immediately above and below the discharge. This is the most significant metric pulling the BAP score down for the upper two sites. NBI-P is in the non-impacted range downstream at station 82.9. The taxa found at each site in this assessment can be found in Table 4. All habitat data (Figure 5, Table 3) reflect natural stream conditions, supporting the non-impacted assessment. Substrate observations (Figure 4, Table 2) are typical of a headwater stream, dominated by rubble and course gravel. Physical and chemical parameters measured at each sampling location are within a normal range for a non-impacted stream in a healthy watershed (Table 5).

The data suggest there is no measureable impact on the biological community of the Schoharie Creek as a result of discharge from the Camp Machne Tashbar WWTP and this creek is fully supportive of aquatic life. Phosphorus levels, most likely the result of nonpoint sources in the watershed, should be routinely monitored at the two upper sites to see if the low NBI-P can be substantiated.

Literature Cited

Menzie, C. 2014. Updated Report on Enteric Bacteria from Machne Tashbar WWTP Entering the Schoharie Creek, 7 pages.

NYSDEC, 2016. Standard Operating Procedure: Biological Monitoring of Surface Waters in New York State. NYSDEC SOP #208-16. Division of Water, NewYork State Department of Environmental Conservation, 625 Broadway, Albany, New York, 177 pages.
Can be found on NYSDEC Biomonitoring Webpage

Smith, A. J., and R. W. Bode. 2004. Analysis of Variability in New York State Benthic Macroinvertebrate Samples. Division of Water, NewYork State Department of Environmental Conservation, 625 Broadway, Albany, New York, Technical Report, 43 pages.

Figure 1. Overview map, Schoharie Creek watershed and 2015 sampling locations.

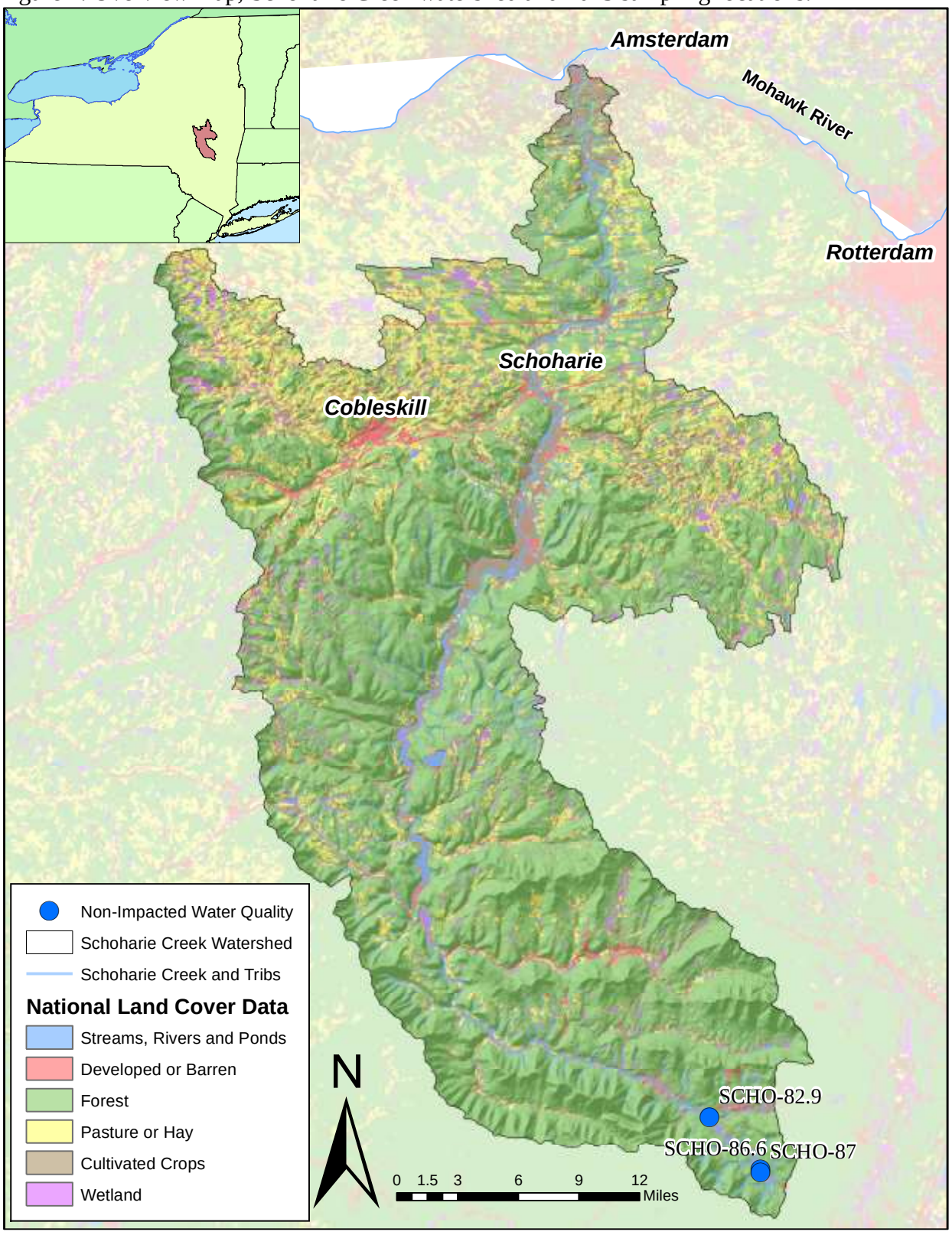


Figure 2a. Site location map, Schoharie Creek, Stations SCHO-86.6 and SCHO-87.0, and the discharge point of the Camp Machne Tashbar WWTP.

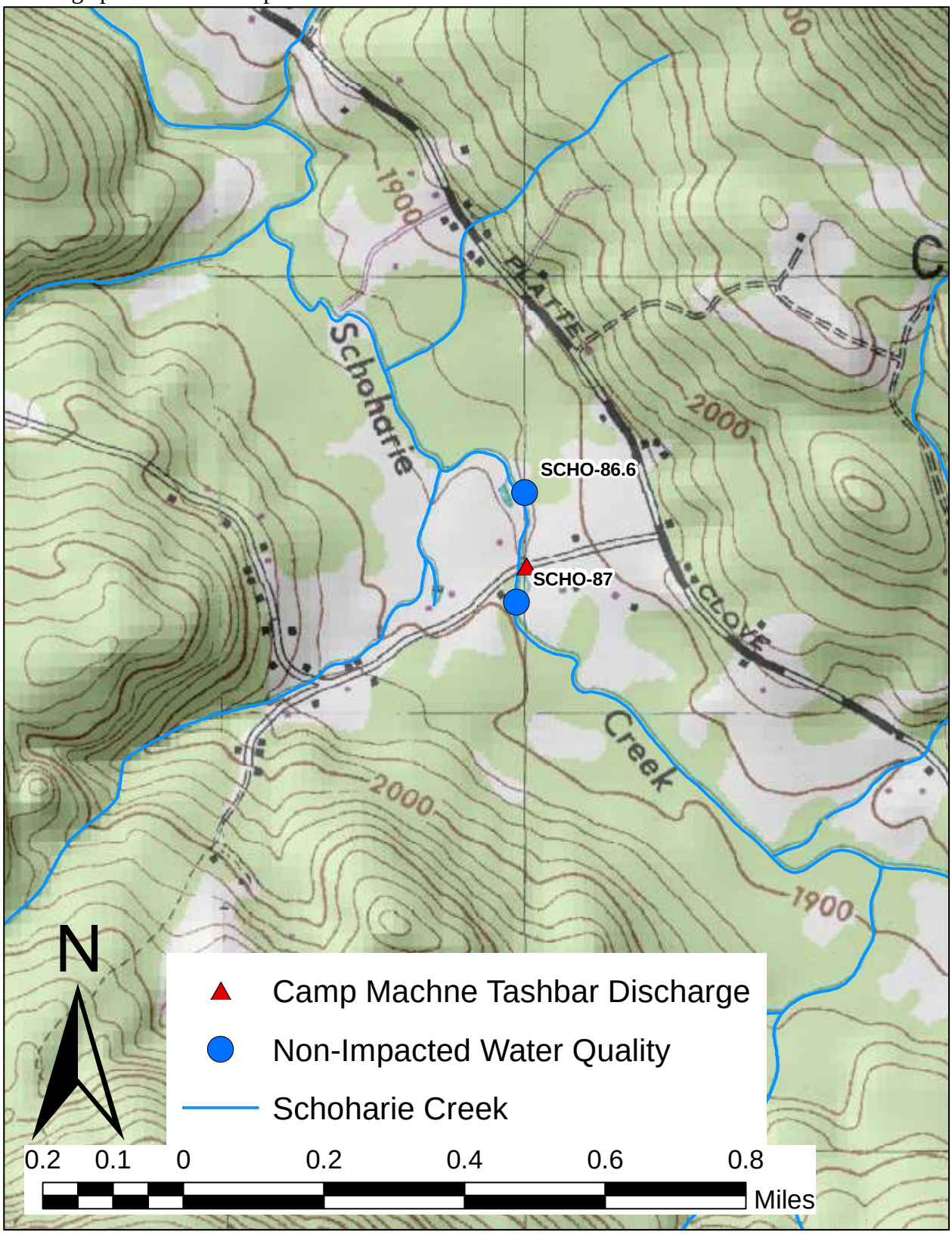


Figure 2b. Site location map, Schoharie Creek, Station SCHO-82.9.

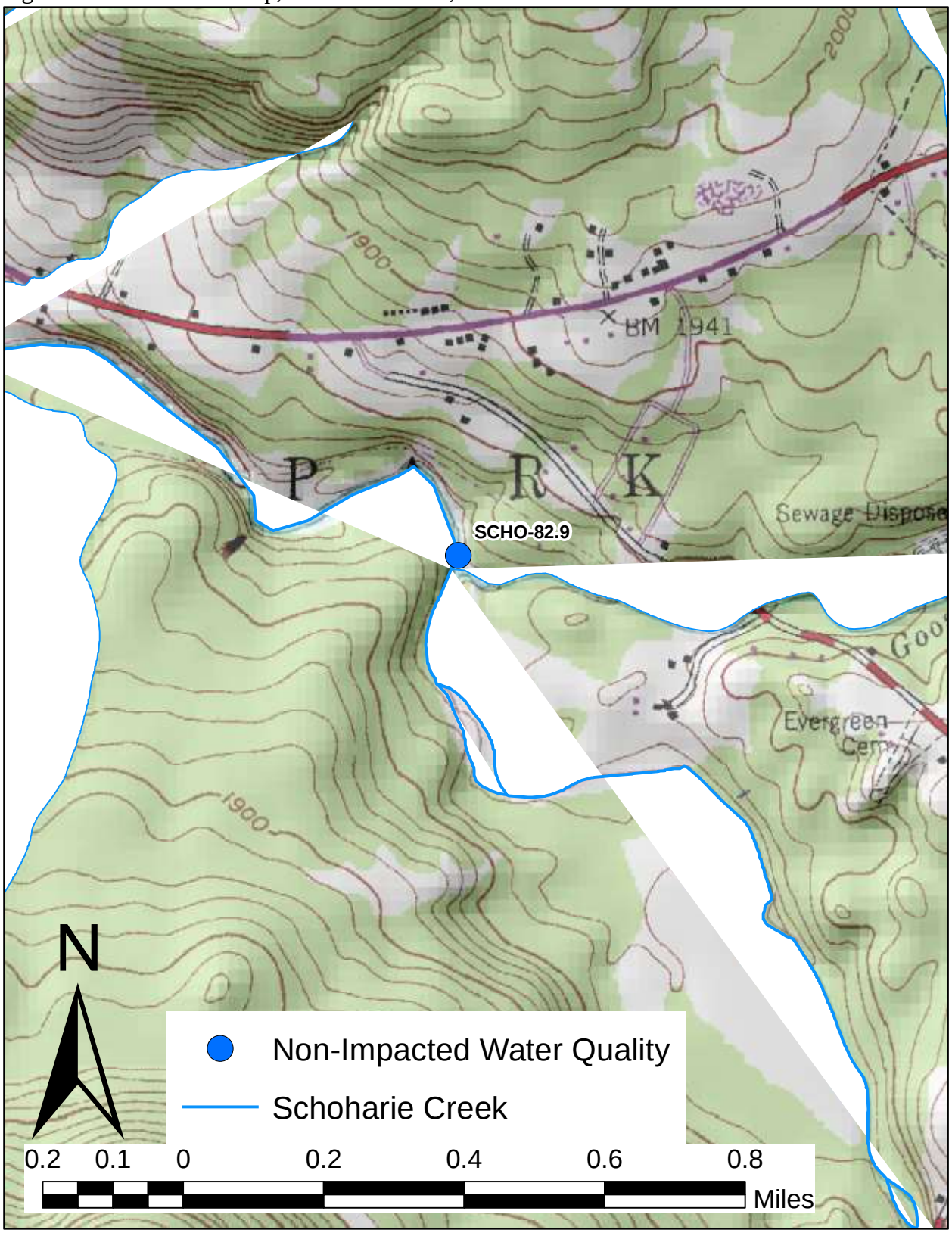


Table 1. Survey locations on Schoharie Creek, 2015.

SCHO-82.9 Below Tannersville, NY
50 above confluence with Gooseberry Creek
Latitude: 42.18706
Longitude: -74.16479

SCHO-86.6 Elka Park, NY
Bunny Lane, off CR 16
Latitude: 42.14928
Longitude: -74.11612

No Photo Available
for SCHO-86.6

SCHO-87.0 Elka Park, NY
Dale Lane, off CR 16
Latitude: 42.14702
Longitude: -74.11637

Figure 3. Biological Assessment Profile (BAP) of index values, Schoharie Creek, 2015. Values are plotted on a normalized scale of water quality. The BAP represents the mean of the five values for each site, representing species richness (Spp), Ephemeroptera, Plecoptera, Trichoptera richness (EPT), Hilsenhoff's Biotic Index (HBI), Percent Model Affinity (PMA), and the Nutrient Biotic Index for phosphorus (NBI-P). See NYSDEC SOP#208-16 (NYSDEC, 2016) for a more complete explanation of biological assessment metrics.

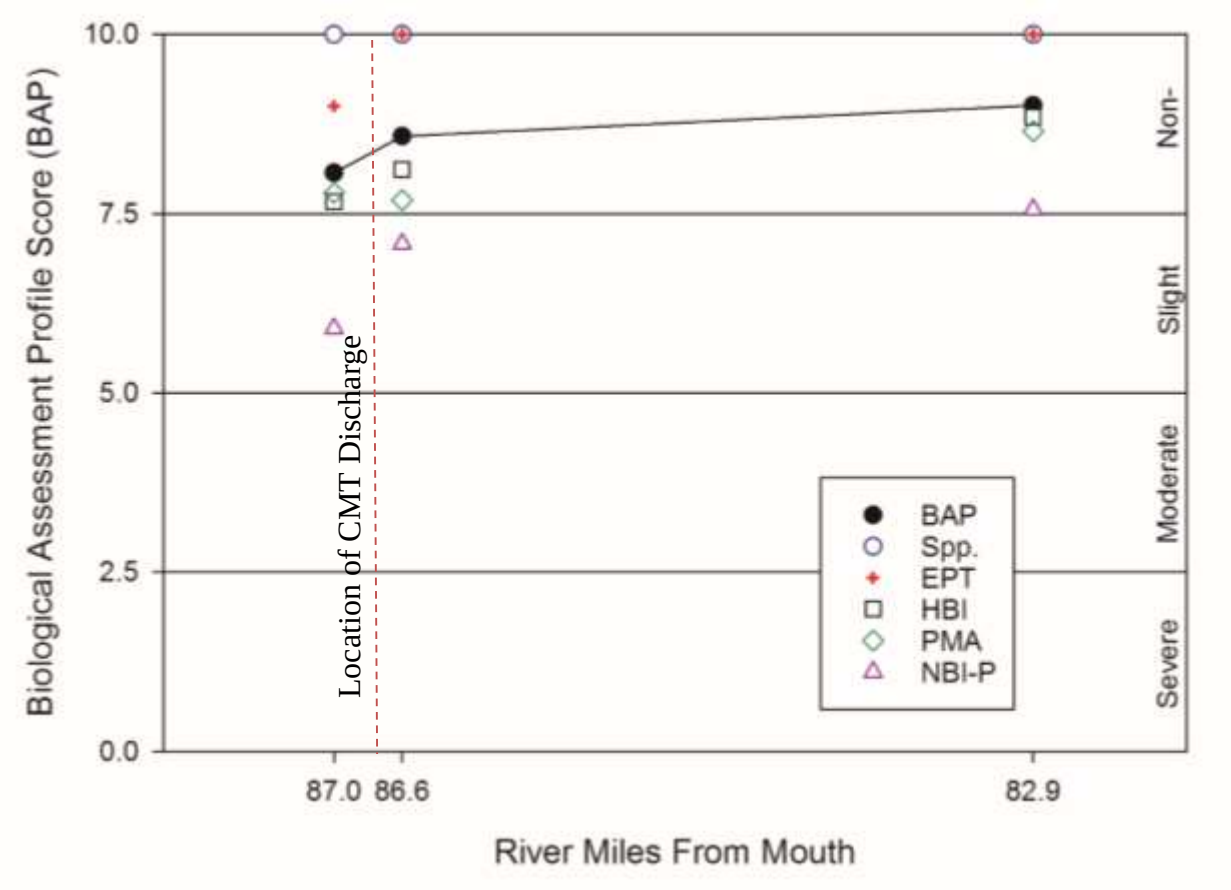


Figure 4. Pebble count analysis from Schoharie Creek, 2015.

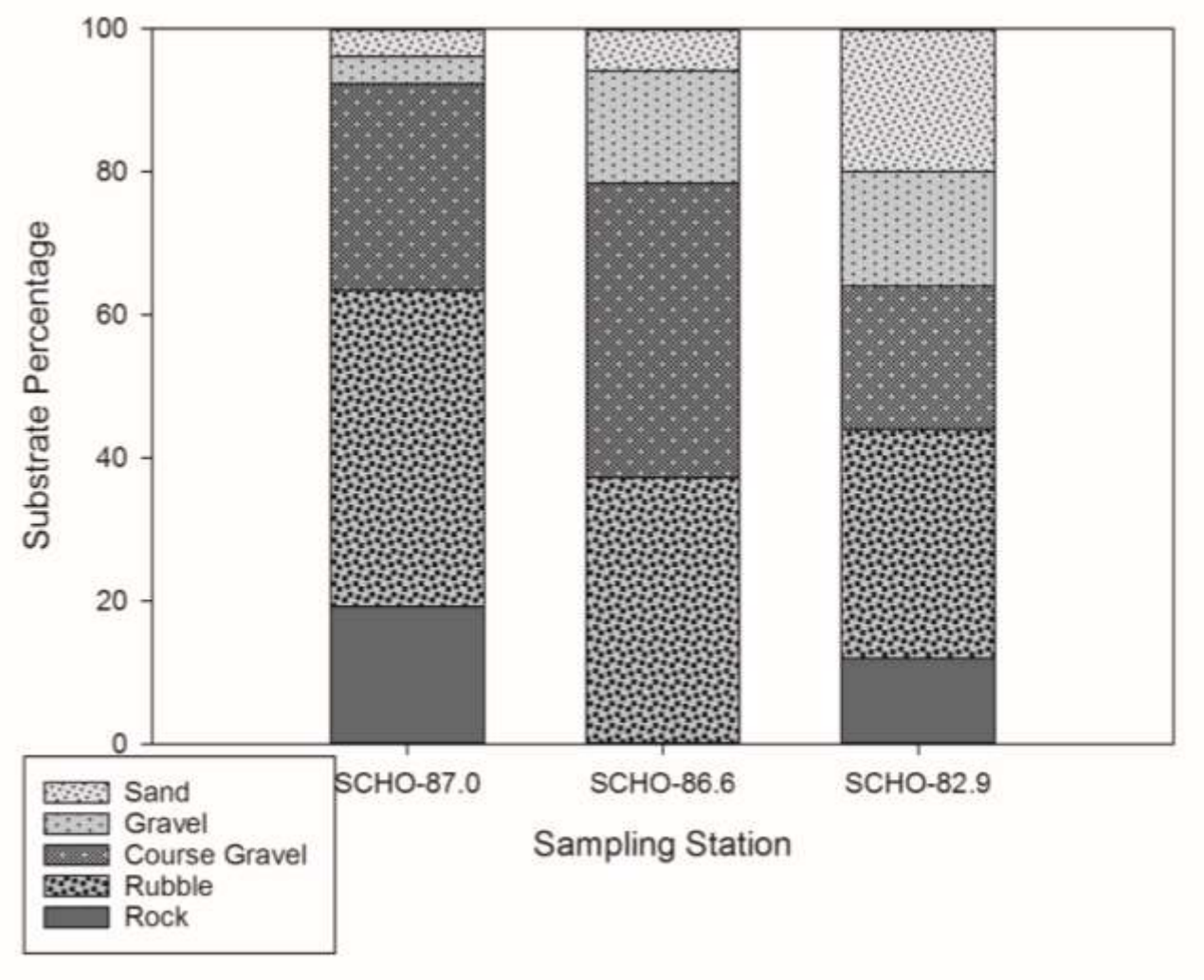


Table 2. Summary of substrate particle sizes recorded from pebble counts in Schoharie Creek, 2015. Values are calculated as a proportion of the total from a random count of 100 pebbles in the stream reach. Coarse Gravel is abbreviated as C. Gravel.

Station	Silt	Sand	Gravel	C. Gravel	Rubble	Rock	Bedrock
SCHO-87.0	0.0	3.8	3.8	28.8	44.2	19.2	0.0
SCHO-86.6	0.0	5.9	15.7	41.2	37.3	0.0	0.0
SCHO-82.9	0.0	20.0	16.0	20.0	32.0	12.0	0.0

Figure 5. Habitat assessment scores for each sampling location on Schoharie Creek, 2015.

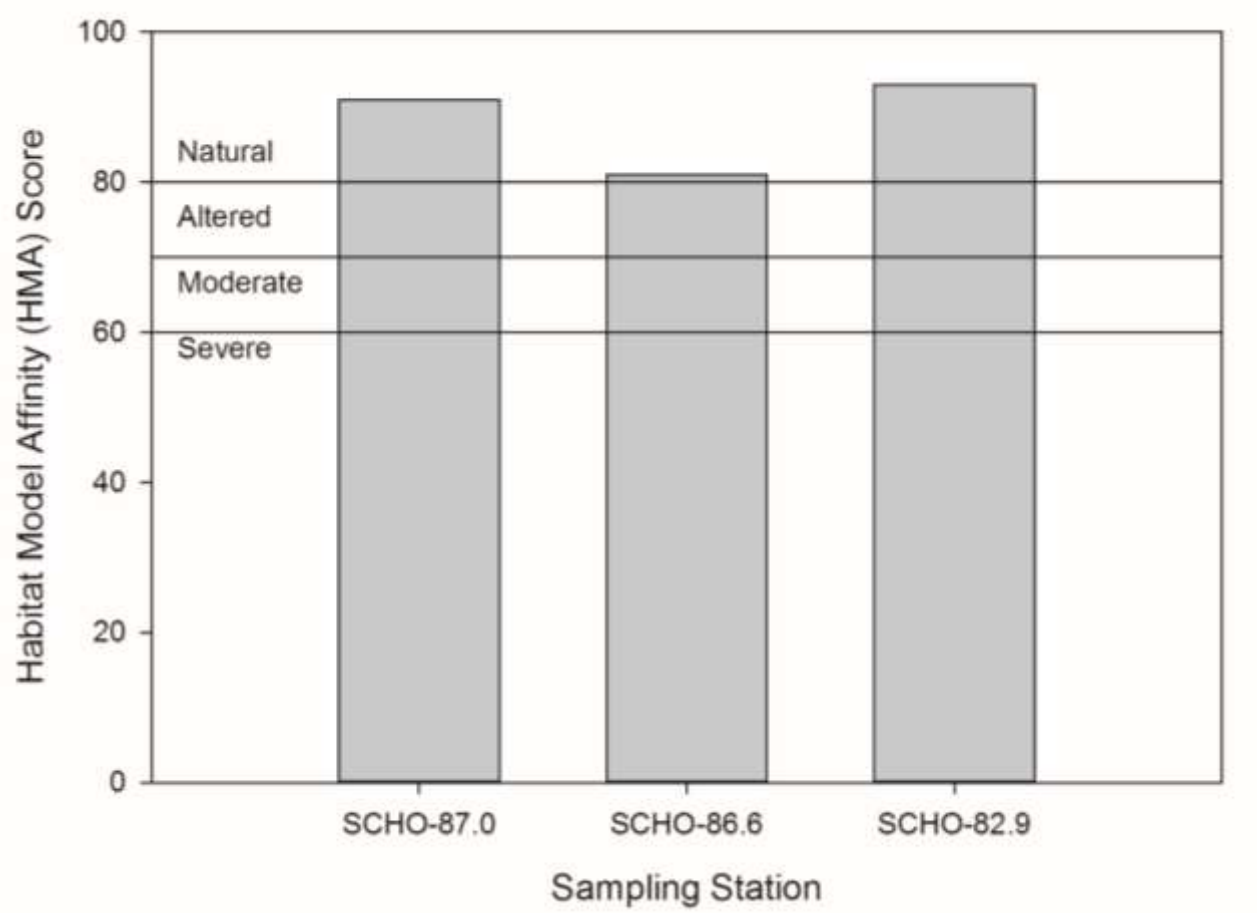


Table 3. Summary of physical habitat attribute scores* used in calculating the Habitat Model Affinity (Figure 4) at locations on Schoharie Creek, 2015.

Station	Epi. Cover	Embed.	Vel/Dep Reg.	Sed. Dep.	Flow Satus	Chan. Alt.	Rif. Freq.	Bank Stab.	Bank Veg.	Rip. Width
SCHO-87	19	19	15	15	14	17	16	18	18	20
SCHO-86.6	16	14	17	15	9	18	9	15	16	20
SCHO-82.9	18	18	18	16	10	18	18	18	18	18

* The following attributes are ranked on a scale from 0 (poor) - 20 (optimal). Epi. Cover = Epifaunal substrate cover, Embed. = Embeddedness, Vel/Dep Reg. = Velocity Depth Regime, Sed. Dep. = Sediment Deposition, Flow Status = Channel Flow Status, Chan. Alt. = Channel Alteration, Rif. Freq. = Riffle Frequency, Bank Stab. = Bank Stability, Bank Veg. = Bank Vegetative Cover, Rip. Width = Riparian Corridor Width. Values of 10 or below are highlighted to identify those parameters ranked as marginal or poor.

Table 4. Macroinvertebrate species and numbers collected in Schoharie Creek, 2015.

Genus species	Location- River mile		
	SCHO-87.0	SCHO- 82.9	SCHO-86.6
Acentrella sp.	1		
Acentrella turbida			1
Acroneuria abnormis		6	
Agnetina capitata		3	
Alloperla sp.	4		4
Atherix sp.		2	
Bezzia sp.			1
Boyeria sp.	1	1	3
Cambarus sp.	1	2	
Ceratopsyche morosa	3	1	
Ceratopsyche slossonae	2		5
Ceratopsyche sparna	2		4
Cheumatopsyche sp.	3	5	
Chimarra aterrima?			2
Cricotopus bicinctus	3		
Cricotopus vierriensis	3	3	1
Dicranota sp.	4		2
Dolophilodes sp.	1	2	3
Dugesia sp.	2		
Ephemerella rotunda	2	13	
Ephemerella sp.	3		
Eukiefferiella sp.		1	
Ferrissia sp.		1	
Helicopsyche borealis		1	
Hexatoma sp.	4	4	8
Hydropsyche betteni	5		3
Hydroptila sp.		1	
Isonychia sp.	2	4	3
Leucrocuta sp.		1	
Leuctra sp.		1	
Maccaffertium ithaca		2	
Maccaffertium vicarium	4		8
Micropsectra dives gr.	7	9	8
Nais bretscheri	3		
Nais sp.	3		4
Nais variabilis		1	
Nigronia serricornis	2	3	2
Oecetis sp.		1	
Ophiogomphus sp.		6	
Optioservus sp.	6		1
Orthocladius dubitatus		2	
Paragnetina immarginata			1
Paraleptophlebia sp.	1	1	1
Parametriocnemus sp.	8		6
Paratanytarsus sp.	2		

Genus species	Location- River mile		
	SCHO-87.0	SCHO- 82.9	SCHO-86.6
Pisidium sp.	1		
Polypedilum aviceps	5		12
Polypedilum flavum		1	2
Potthastia gaedii gr.		3	
Pristinella sp.			1
Psephenus herricki		3	
Psilotreta sp.			1
Pteronarcys biloba	2	1	2
Rheotanytarsus exiguus gr.	1	1	
Rhyacophila torva		4	1
Simulium sp.	1	1	1
Stenacron sp.			1
Stenelmis crenata		5	
Sublettea coffmani		1	
Tanytarsus glabrescens gr.	1		
Tanytarsus sp.			1
Thienemannimyia gr. spp.	1	1	2
Tvetenia vitracies	2	2	1
Undetermined Enchytraeidae			1
Undetermined Lumbriculidae	4	1	2
Undetermined Orthocladiinae	2		

Table 5. Summary of field measured physical and chemical attributes from each sampling location on Schoharie Creek, 2015.

Station	Depth (m)	Width (m)	Current (cm/sec)	Embed. (%)	Temp. (°C)	Conduct. (µs/cms)	pH	DO (mg/L)	DO Sat. (%)
SCHO-87	0.1	9	63	40	22.38	42	6.34	9.55	109.4
SCHO-86.6	0.1	2	63	40	23.5	53	6.19	7.78	91.7
SCHO-82.9	0.2	9	42	50	22.6	50	5.76	9.27	107.1

Appendix I: Request for Assessment

Charles Menzie, Ph.D.
Platte Clove Rd.
Elka Park, NY 12427

October 19. 2014

Planning and Town Boards
Town of Hunter New York

Re: ***Updated Report on Enteric Bacteria from Machne Tashbar WWTP Entering the Schoharie Creek***

Dear Planning and Town Boards:

This report supplements my previous report submitted in September 2014. In that report, I indicated that there were some additional analyses forthcoming. This current report includes some of those results. The analyses of viruses had been put off until next year.

This report also will provide you with some perspective on the meaning of the numbers presented for fecal coliform. I mention this because I did receive feedback from NYC DEP that the numbers are not of concern to NYDEP for the drinking water supply. I interpret this as meaning either:

a) That NYDEP judges that the people of New York City are not at appreciable risk from this one wastewater treatment plant because of distance and dilution; and/or
b) There is a lack of understanding of the significance of the numbers.

The email from Deborah Degraw of NYCDEP to Roy Silver is provided below:

> From: **Degraw, Deborah** <DDegraw@dep.nyc.gov>
> Date: Mon, Oct 6, 2014 at 4:52 PM
> Subject: RE: Response to C. Menzie Stream Survey
> To: roy silver <roydsilver@gmail.com>
>
> Mr. Silver,
>
> The sample results in Mr. Menzie's report, Figure 5, at the Dale Rd Bridge, did not match the first laboratory report. Mr. Menzie sent another report with the same work order number, no change to dates or times, but one number was changed.

DEP has no additional questions regarding the report and no further review is required as the findings do not cause concern for water quality in the New York City Water Supply System.

Deborah D

(O) 845 340-7214 | (M) 347 461-1203 ddegraw@dep.nyc.gov

Because the numbers obtained from my analysis clearly indicate a release, I conclude that Ms. Degraw's statement is in reference to the constituency she is charged to protect, namely the populace of New York City and not people that might come in contact with pathogens near the source of the wastewater treatment plant, i.e., the residents of Platte Clove and summer visitors. As I show in this report, the numbers should cause concern on the part of officials responsible for the health of local individuals and the health of the Schoharie. The results strongly indicate that a hold should be placed on advancing the approval of a Transportation Corporation that can be expanded to further increase the bacterial and viral load to the creek.

Sincerely,

Charles Menzie, Ph.D.

Updated Report on Enteric Bacteria from Machne Tashbar WWTP Entering the Schoharie Creek

Overview of Methods

These have been described in my previous report and are not repeated here. The updated report includes analyses for *Clostridium,* an indicator of human wastewater.

Results and Discussion

Analyses have been completed for total coliform, fecal coliform, *E. coli,* and *Clostridium perfringens*. The updated report from BAL Laboratories is included as Attachment 1. The following figures present the results for total and fecal coliform and *Clostridium perfringens* in the sediments of the Schoharie Creek above and below the Machne Tashbar WWTP outfall.

Figure 1
Densities of total coliform in Schoharie Creek sediments upstream and downstream of the Machne Tashbar WWTP outflow
(three samples at each location)

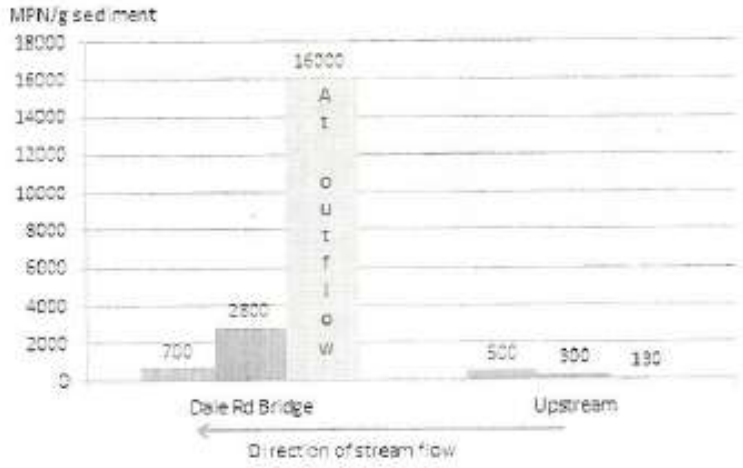


Figure 2
Densities of fecal coliform in Schoharie Creek sediments upstream and downstream of the Machne Tashbar WWTP outflow
(three samples at each location)

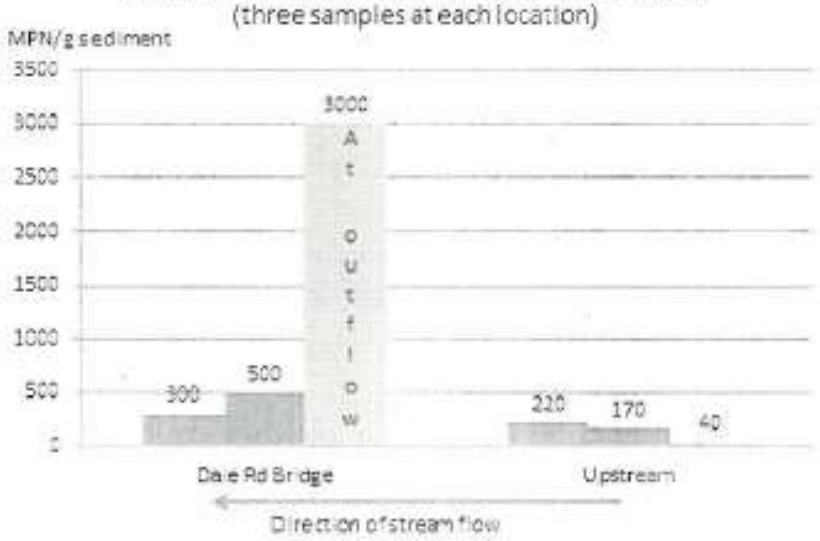
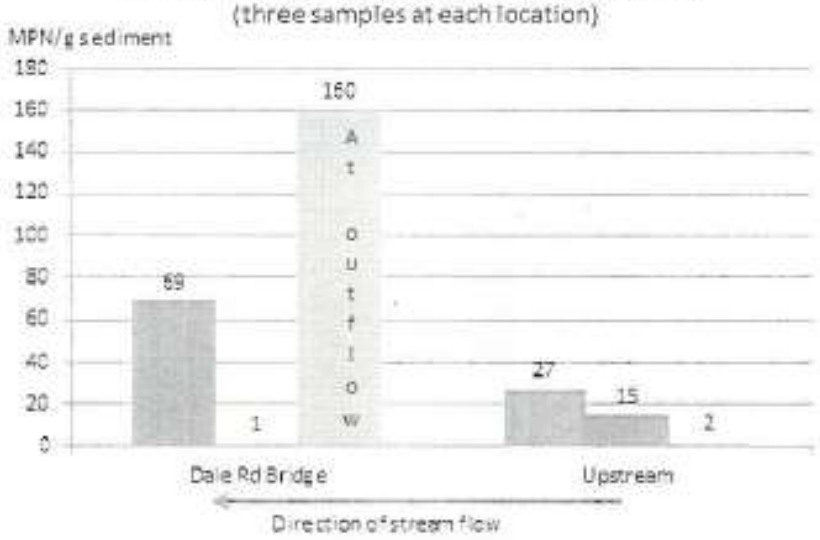


Figure 3
Densities of *Clostridium* in Schoharie Creek sediments upstream and downstream of the Machne Tashbar WWTP outflow
(three samples at each location)



As the results clearly show, the outflow from the Machne Tashbar WWTP is causing an increase in total and fecal coliform and *Clostridium* in the sediments of the Schoharie Creek. The results presented in Attachment 1 indicate that *E. coli* is the fecal coliform that is present. While coliform bacteria can result from non-human sources, the results indicate that the increased densities of these bacteria in

the sediments immediately downstream from the Machne Tashbar WWTP outflow are of human origin. The main concern about the presence of such organisms is that they are a signal that other pathogenic microbes have a likelihood of being present as well. These more pathogenic organisms are more difficult to measure which is why laboratories and state and federal environmental health agencies rely upon measurements of total and fecal coliform bacteria.

What do the numbers mean?

Most individuals are familiar with bacterial numbers in wastewater expressed in terms of concentration in water and there are values for judging health risks. The numbers presented in my report should not be confused with those numbers. Instead, I have collected samples to determine whether releases of pathogenic bacteria and viruses are occurring as a result of the treatment plant. I did not rely upon single grab samples of water as is common. This is the only type of sampling that has been performed at the plant under the permit. Instead, I sampled the sediments in the Schoharie at the plant outflow as these provide a longer-term memory of what has passed by the treatment plant and entered the Schoharie.

The data I have collected indicate that pathogenic bacteria and viruses are being released into the creek. To provide you with some insight into the meaning of the sediment numbers, I chose two cases. Each is described below.

Case 1: Levels of Fecal Coliform in Gowanus Canal Sediments

The Gowanus Canal in Brooklyn received periodic wastewater from the City of New York as a result of Combined Sewer Overflows. Basically, whenever there is a substantial rain, the city's sewer system cannot handle the load, and a portion is shunted to the canal in raw form. A video of such an event can be viewed at http://www.youtube.com/watch?v=HzWOOqPAEgs. This situation is very different from that at Machne Tashbar but serves to indicate that the Gowanus Canal gets polluted from raw sewage and that the values for fecal coliform in the sediments reflect such pollution. The New York Department of Health has stated that[1]:

---

[1] Public Comment Draft PUBLIC HEALTH ASSESSMENT. NYS Department of Health. 2014. GOWANUS CANAL CITY OF NEW YORK BOROUGH OF BROOKLYN KINGS COUNTY, NEW YORK. February 1, 2014 EPA Facility ID: NYN000206222 Prepared by: New York State Department of Health Center for Environmental Health Under a Cooperative Agreement with The U.S. Department of Health & Human Services Agency for Toxic Substances and Disease Registry Atlanta, Georgia

Water in the Gowanus Canal periodically contains levels of fecal coliform bacteria that indicate an increased risk of illness from recreational contact with the water. Water from the Gowanus Canal contains microorganisms, such as coliform bacteria, and likely contains viruses and parasites (protozoas) that can make a person ill if they enter the body. There is increased risk of contracting diseases through swallowing or skin contact with these disease-causing agents.

The sediments of Schoharie Creek off the outflow from Machne Tashbar had a fecal coliform level of 3,000 MPN/g of sediment and I use this as a benchmark for providing the Boards with scientifically sound perspective. To that end, I have included results of fecal coliform in the sediments of the Gowanus Canal presented in a recent report by the U.S. Environmental Protection Agency[2] for comparison with the 3,000 MPN/g number obtained for the Schoharie off the Machne Tashbar outflow (Figure 4).This level of fecal coliform in sediments is reflective of the more highly contaminated sediments in the Gowanus Canal as shown in Figure 4. The report on Gowanus notes that:

The highest fecal coliform concentrations were detected in the upper reach of the canal, where CSO impacts are most severe. High concentrations were also found in the lower canal near CSO outfall RH-031.

And,

Pathogens have been detected in surface sediments collected throughout the Gowanus Canal. Fecal coliform concentrations are highest in the upper reach of the canal adjacent to CSO outfalls.

[2] USEPA. 2012. Feasibility Study Report Addendum Gowanus Canal Brooklyn, New York Prepared for *U.S. Environmental Protection Agency Region 2* December 2012

Data from GEI, 2013a and 2013b

FIGURE 14a
Fecal Coliform Distribution in Surface Sediment - Upper Canal
Gowanus Canal, Brooklyn, New York

CH2MHILL.

Figure 4. Levels of fecal coliform in sediments ofm the Gowanus Canal. Note that the classification for highest degree of bacterial contamination begins at 3,000 MPN/g, the level of fecal coliform that was found off the outflow from the Machne Tashbar treatment plant.

Case 2. Levels of Fecal Coliform at a Site Experiencing a Known Sewage Spill

Malin et al. (2007)[3] reported on large municipal sewage spill in North Carolina. These scientists collected sediments from the affected water body and reported the following results:

Table 3
Sediment fecal coliform bacteria counts by date and station following the July 1, 2005 Hewletts Creek sewage spill (as CFU cm^{-3})

Station	10/31/04	1/28/05	7/6	7/11	7/15	7/22	8/2	8/11
MS-DOCK			0	0	23	0	0	11
SB-PGR	488	358	2740	526	5530	396	732	1890
MB-PGR			5110	1150	1450	777	457	80
NB-GLR	53	579	3510	442	991	663	1310	914

Samples collected 10/31/04 and 1/28/05 are shown as control (pre-spill) counts for comparison. Blank spaces indicate no data collected.

The unit CFU is roughly comparable to MPN used in my study. The investigators concluded that,

> *The relatively high fecal indicator levels in water and sediments within Hewletts Creek suggests ... these bacteria were retained."*
>
> And,
>
> *The fecal coliform in the4 sediments form a reservoir of viable fecal microbes that is available to enter the water column following a mixing/stirring event.*

The numbers of fecal coliform in the Schoharie off the Machne Tashbar are actually higher than those from this sewage spill when adjusted for area. To provide you with an indicaiton of the amount present in the Schoharie off the outflow, I have converted the data expressed in MPN/g to numbers of fecal coliform bacteria per square foot. Just imagine a child stepping into this stuff.

There are ~ 3,000 g of sediment in a square foot of area of Schoharie Creek assuming a depth into the sediment of ~1 inch. At a fecal coliform density of 3,000/g of sediment, each square foot of sediment in the creek at this location

[3] Malin et al. 2007. Marine Pollution Bulletin 54: 81-88.

contains 9,000,000 (nine million) fecal coliform bacteria as well as any other pathogens emitted by the Machne Tashbar treatment plant.

Implications for Health and for Approving Further Expansion that will Eventually Result from Approval of a Transportation Corporation

The implications of the results are as follows:

1. The Machne Tashbar WWTP is releasing human bacteria and likely human pathogens to the Schoharie Creek[4];
2. An increase in sewage from this WWTP will likely increase the discharge of these organisms;
3. The reach of the Schoharie immediately below the discharge has historically been used for primary and secondary contact recreation (swimming, kayaking, and fishing); in light of these results attention needs to be given to potential health risks currently presented by the WWTP discharge; as noted, this is a dynamic system and pathogens entering the Schoharie will be transported downstream possibly affecting other areas where residents utilize the creek for these recreational purposes;
4. The summer season for Machne Tashbar is now over but these results suggest that more in-depth studies of health risks are needed when the season resumes next summer; it is likely that the densities observed in my study will decrease during the fall and winter due to colder weather and the continual flushing of the stream.

[4] The work that has been conducted with sediments provides an indication that there is a history of discharges of viable human bacteria and possible associated pathogens from the Machne Tashbar WWTP; the full magnitude of the exposures is not currently known as the bacteria and pathogens are carried downstream; the obvious imprint of these discharges in the sediments however should be taken as an indication of exposures to human using the creek for primary or secondary recreation.

BAL Laboratory
The Microbiology Division of Thielsch Engineering, Inc.

Charles Menzie
Exponent
1800 Diagonal Rd., Suite 500
Alexandria, VA 22314

RE: Microbial Testing

Dear Charles Menzie:

We appreciate this opportunity to provide you with our analytical services. BAL Laboratory is committed to providing the highest quality service. Our dedication to each client includes responsiveness to emergencies, dependability, well-written reports and superior client services.

Enclosed is your data report for **Work Order Number C408228.** The invoice for this project is included with this report unless other arrangements have previously been made with the laboratory. Samples will be disposed of thirty days after the final report has been mailed. If you have any questions or concerns, please feel free to call our Customer Service Department. We value our continued relationship and look forward to hearing from you in the future.

Sincerely,

BAL Laboratory

Darlene Capuano
Laboratory Director

RI Laboratory License Number: A36
MA Laboratory License Number: M RI-M01

enclosure

Industrial Microbiology - Environmental Investigation - Biological and Specialty Analyses of Water and Wastes - Pollution Tracking and Source Determination - Monitoring Programs - Trend Assessments - Seafood Analyses - Drinking Water Quality - Biosolids and Compost Testing - Biofilter Assessment - Bioaerosol Monitoring - Corrosion Analysis

185 Frances Avenue, Cranston, RI 02910-2211 Tel: (401) 785-0241 Fax: (401) 785-2374 www.ballaboratory.com

BAL Laboratory

The Microbiology Division of Thielsch Engineering, Inc.

BAL LABORATORY

CERTIFICATE OF ANALYSIS

Client: Exponent
Client Project ID: Microbial Testing

Work Order Number: C408228
Date Received: 8/28/2014 9:10:00AM

Microbiology

Client Sample ID: Scohone 1
BAL Sample ID: C408228-01 **Matrix:** Solid **Sampled:** 08/27/14 14:00

Analyte	Result	Units	Analyzed	Analyst	Method
Count 1	2	colonies	09/11/14 10:30	BAM	EPA/600/95R/030
E. Coli	220	MPN/g	08/28/14 11:00	BAL	9221F
Fecal Coliform	220	MPN/g	08/28/14 11:00	BAL	9221E
Percent Solids	75	%	09/10/14 17:30	BAM	%S
Total Coliform	500	MPN/g	08/28/14 11:00	BAL	9221B
Count 2	3	colonies	09/11/14 10:30	BAM	EPA/600/95R/030
Count mean	2.0	colonies	09/11/14 10:30	BAM	EPA/600/95R/030
C. perfringens	23	colonies/g	09/16/14 17:12	BAM	EPA/600/95R/030
C. Perfringens	31	colonies/g dry	09/16/14 17:12	BAM	EPA/600/95R/030
Percent Water	25	%	09/10/14 17:30	BAM	N/A

Client Sample ID: Scohone 2
BAL Sample ID: C408228-02 **Matrix:** Solid **Sampled:** 08/27/14 14:10

Analyte	Result	Units	Analyzed	Analyst	Method
Count 1	3	colonies	09/11/14 10:30	BAM	EPA/600/95R/030
E. Coli	170	MPN/g	08/28/14 11:00	BAL	9221F
Fecal Coliform	170	MPN/g	08/28/14 11:00	BAL	9221E
Percent Solids	79	%	09/10/14 17:30	BAM	%S
Total Coliform	300	MPN/g	08/28/14 11:00	BAL	9221B
Count 2	3	colonies	09/11/14 10:30	BAM	EPA/600/95R/030
Count mean	3.0	colonies	09/11/14 10:30	BAM	EPA/600/95R/030
C. perfringens	13	colonies/g	09/16/14 17:12	BAM	EPA/600/95R/030
C. Perfringens	16	colonies/g dry	09/16/14 17:12	BAM	EPA/600/95R/030
Percent Water	21	%	09/10/14 17:30	BAM	N/A

Client Sample ID: Scohone 3
BAL Sample ID: C408228-03 **Matrix:** Solid **Sampled:** 08/27/14 14:15

Analyte		Result	Units	Analyzed	Analyst	Method
Count 1	<	1	colonies	09/11/14 10:30	BAM	EPA/600/95R/030
E. Coli		40	MPN/g	08/28/14 11:00	BAL	9221F
Fecal Coliform		40	MPN/g	08/28/14 11:00	BAL	9221E
Percent Solids		82	%	09/10/14 17:30	BAM	%S

BAL LABORATORY

BAL Laboratory

The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client: Exponent
Client Project ID: Microbial Testing

Work Order Number: C408228
Date Received: 8/28/2014 9:10:00AM

Microbiology

Client Sample ID: Scohone 3
BAL Sample ID: C408228-03 **Matrix:** Solid **Sampled:** 08/27/14 14:15

Analyte		Result	Units	Analyzed	Analyst	Method
Total Coliform		**130**	MPN/g	08/28/14 11:00	BAL	9221B
Count 2		**1**	colonies	09/11/14 10:30	BAM	EPA/600/95R/030
Count mean		**1.0**	colonies	09/11/14 10:30	BAM	EPA/600/95R/030
C. perfringens		**2**	colonies/g	09/16/14 17:12	BAM	EPA/600/95R/030
C. Perfringens		**2.5**	colonies/g dry	09/16/14 17:12	BAM	EPA/600/95R/030
Percent Water		**18**	%	09/10/14 17:30	BAM	N/A

Client Sample ID: Scohone 4
BAL Sample ID: C408228-04 **Matrix:** Solid **Sampled:** 08/27/14 14:25

Analyte		Result	Units	Analyzed	Analyst	Method
Count 1	<	**1**	colonies	09/11/14 10:30	BAM	EPA/600/95R/030
E. Coli		**500**	MPN/g	08/28/14 11:00	BAL	9221F
Fecal Coliform		**500**	MPN/g	08/28/14 11:00	BAL	9221E
Percent Solids		**88**	%	09/10/14 17:30	BAM	%S
Total Coliform		**2800**	MPN/g	08/28/14 11:00	BAL	9221B
Count 2	<	**1**	colonies	09/11/14 10:30	BAM	EPA/600/95R/030
Count mean		**1.0**	colonies	09/11/14 10:30	BAM	EPA/600/95R/030
C. perfringens	<	**1**	colonies/g	09/16/14 17:12	BAM	EPA/600/95R/030
C. Perfringens		**1.1**	colonies/g dry	09/16/14 17:12	BAM	EPA/600/95R/030
Percent Water		**12**	%	09/10/14 17:30	BAM	N/A

Client Sample ID: Scohone 5
BAL Sample ID: C408228-05 **Matrix:** Solid **Sampled:** 08/27/14 14:35

Analyte		Result	Units	Analyzed	Analyst	Method
Count 1		**5**	colonies	09/11/14 10:30	BAM	EPA/600/95R/030
E. Coli		**3000**	MPN/g	08/28/14 11:00	BAL	9221F
Fecal Coliform		**3000**	MPN/g	08/28/14 11:00	BAL	9221E
Percent Solids		**78**	%	09/10/14 17:30	BAM	%S
Total Coliform		**16000**	MPN/g	08/28/14 11:00	BAL	9221B
Count 2		**7**	colonies	09/11/14 10:30	BAM	EPA/600/95R/030
Count mean		**6.0**	colonies	09/11/14 10:30	BAM	EPA/600/95R/030

185 Frances Avenue, Cranston, RI 02910-2211 Tel: (401) 785-0241 Fax: (401) 785-2374 www.ballaboratory.com
An Equal Opportunity Employer

BAL Laboratory

The Microbiology Division of Thielsch Engineering, Inc.

BAL LABORATORY

CERTIFICATE OF ANALYSIS

Client: Exponent
Client Project ID: Microbial Testing

Work Order Number: C408228
Date Received: 8/28/2014 9:10:00AM

Microbiology

Client Sample ID: Scohone 5
BAL Sample ID: C408228-05 **Matrix:** Solid **Sampled:** 08/27/14 14:35

Analyte	Result	Units	Analyzed	Analyst	Method
C. perfringens	140	colonies/g	09/16/14 17:12	BAM	EPA/600/95R/030
C. Perfringens	180	colonies/g dry	09/16/14 17:12	BAM	EPA/600/95R/030
Percent Water	22	%	09/10/14 17:30	BAM	N/A

Client Sample ID: Scohone 6
BAL Sample ID: C408228-06 **Matrix:** Solid **Sampled:** 08/27/14 14:45

Analyte	Result	Units	Analyzed	Analyst	Method
Count 1	7	colonies	09/11/14 10:30	BAM	EPA/600/95R/030
E. Coli	300	MPN/g	08/28/14 11:00	BAL	9221F
Fecal Coliform	300	MPN/g	08/28/14 11:00	BAL	9221E
Percent Solids	77	%	09/10/14 17:30	BAM	%S
Total Coliform	700	MPN/g	08/28/14 11:00	BAL	9221B
Count 2	7	colonies	09/11/14 10:30	BAM	EPA/600/95R/030
Count mean	7.0	colonies	09/11/14 10:30	BAM	EPA/600/95R/030
C. perfringens	60	colonies/g	09/16/14 17:12	BAM	EPA/600/95R/030
C. Perfringens	78	colonies/g dry	09/16/14 17:12	BAM	EPA/600/95R/030
Percent Water	23	%	09/10/14 17:30	BAM	N/A

185 Frances Avenue, Cranston, RI 02910-2211 Tel: (401) 785-0241 Fax: (401) 785-2374 www.ballaboratory.com
An Equal Opportunity Employer

BAL LABORATORY

BAL Laboratory

The Microbiology Division of Thielsch Engineering, Inc.

CERTIFICATE OF ANALYSIS

Client: Exponent
Client Project ID: Microbial Testing

Work Order Number: C408228
Date Received: 8/28/2014 9:10:00AM

Notes and Definitions

<	Less than the Method Detection Limit.
MF	Membrane Filtration
MPN	Most Probable Number
TNTC	Too Numerous to Count
dry	Sample results reported on a dry weight basis

185 Frances Avenue, Cranston, RI 02910-2211 Tel: (401) 785-0241 Fax: (401) 785-2374 www.ballaboratory.com
An Equal Opportunity Employer

Chain of Custody Form

CH08228 Expanent

Sample Identification	Sampling Date/time	Analyses requested
Exhaust 1	5/27/14 ~ 2 P.M.	Microbial
Exhaust 2	"	"
" 3	"	"
" 4	"	"
" 5	"	"
" 6	" ~ 3:45 PM	"

shipped on ice

Collected by: [signature] 5/27/14

Received by: [signature] 052814 0910 AM