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Dear Dr. Young and Mr. Sweeney:

Enclosed is the DEP Response to NYSDOH/EPA Comments on the 2014 Water Quality Annual Report submitted July 31, 2015, in accordance with the Revised 2007 Filtration Avoidance Determination (FAD).

As always, if you have any questions about these comment responses or other aspects of the City's watershed protection efforts, please do not hesitate to contact me.

Sincerely,

David S. Warne
Assistant Commissioner

DEP Response to NYSDOH/USEPA Comments on the FAD Deliverable Report
Submitted July 31, 2015
2014 Watershed Water Quality Annual Report
Response Date October 30, 2015

5.1 Watershed Monitoring Program

The 2014 Watershed Water Quality Annual Report (the Report) is a comprehensive summary of the monitoring, modeling, and research conducted by NYCDEP pursuant to its watershed protection program. The Report also describes the scientific studies being conducted in the watershed, both by NYCDEP staff and through other professional research collaborations. The list of peer-reviewed publications included in the Report attests to the quality of this research.

NYC's Catskill-Delaware System continues to supply water that meets all regulatory requirements. The work invested by DEP's staff to help ensure that NYC's water supply continues to meet these requirements is evidenced by the volume and breadth of data and information provided in this report.

DEP Response:

Comment noted.

NYSDOH/EPA have the following additional comments/questions on this report:

In the Executive Summary (page xvii), the first sentence of the second paragraph should include "future research" as an endpoint for water quality samples. This data helps to identify the water quality trends and research niches for DEP.

DEP Response:

Comment noted. We will mention "future research" in future reports.

In Section 1.1.2, NYSDOH/EPA note that two fixed-depth buoys were deployed on Kensico Reservoir in 2014, in addition to four existing sites. Also noted is the deployment of two under-ice buoys at Ashokan Reservoir. We commend DEP for the addition of the Ashokan under ice buoys with expansion to also collect trophic data for DBP modeling efforts, and look forward to a similar deployment in Kensico Reservoir to help better understand under ice turbidity plumes.

DEP Response:

Comment noted.

On page 17, in paragraph 2, the text refers to "higher than normal" turbidity in the Schoharie Reservoir. Figure 3.1 shows boxplots for the period 2004 to 2013. However, on page 15, "normal" for reservoir storage is defined as the period 1991 to 2013. What is the period that defines normal in Section 3.1?

DEP Response:

"Normal" refers the long-term median (2004-2013), which was used as a reference point for comparison with the annual (2014) median. To clarify, we would rephrase as follows: "In 2014, median turbidity in the Catskill System's Schoharie Reservoir

was about 69% higher than the long-term median for the period of 2004-2013 (Figure 3.1)."

Figure 3.1 on page 18 shows the annual median turbidity in NYC water supply reservoirs. Note that the SWTR filtration avoidance criterion for turbidity (5 NTU) applies to samples collected at the entry point immediately prior to the first point of disinfection.

On page 18, "large (<1.0 inches) rain events" should be corrected to be "(>1.0 inches)".

DEP Response:

We acknowledge that the 5 NTU criterion does not apply directly to the ambient level for these water bodies and included it as a reference line to compare with what is required at the entry just prior to disinfection. In future reports, we will change the figure caption to read: "The dashed line represents the standard for source waters as a reference." We will correct the typographical error for rainfall and re-post the online report with a notification of the correction.

On page 20, in paragraph 1, the text states that in 2014 there were no exceedances of the Part 703 standard for total coliform during the sampling season. However, Table 3.3 indicates that the standard was exceeded in Croton Falls, Diverting, and Schoharie Reservoirs. Data presented in Appendix B support the report of exceedances in Diverting and Schoharie Reservoirs, but not Croton Falls. Please clarify this information.

DEP Response:

Data as presented in Appendix B are correct with the exception of two entries for Croton Falls, where the "Percentage > Standard" should be 12.5% for August and October. Because both the median and more than 20% of the sample values must exceed their respective values for the reservoir class, Croton Falls does not exceed the Part 703 standard for total coliform. Table 3.3 requires one correction for Croton Falls: "Number of months that exceeded the standard/months of data" should be reduced from 2/8 to 0/8. However, as the reviewers pointed out (and as reported in Table 3.3 and Appendix B), the text should be amended to read: "In 2014, Diverting and Schoharie reservoirs exceeded the Part 703 standard for total coliform during the sampling season (Table 3.3)."

On page 22, the text in paragraph 2 uses the terms "normal" and "historical", but it is not clear as to the time period being referenced.

DEP Response:

Evaluation of 2014 medians are referred to as "normal" when they are close to the long-term ("historical") median for the period from 2004-2013. We will explicitly state this in future reports. Note that the figure referenced in the text indicates that the 2014 annual 75th percentile is compared to annual 75th percentile from the 2004-2013 period.

Section 3.4 provides a discussion of phosphorus-restricted basin assessments. While NYSDOH/EPA agree with DEP's decision to keep Schoharie and Ashokan reservoirs off the phosphorus restricted basin list, the reasoning for this decision should be better presented in the report. Rather than just attributing the increase in the five-year running average to the extreme weather in 2011, the lack of phytoplankton response to the increased phosphorus should be

discussed as well. This could be done through comparisons between Carlson Trophic State Index (TSI) values calculated based on chlorophyll, Secchi depth, and total phosphorus to illustrate that turbidity caused a shift from phosphorus limitation to light limitation. Alternatively, this could be done by discussing the deviations from the OECD relationships (Janus et al. 2014).

DEP Response:

The reasons for keeping Schoharie and Ashokan reservoirs off the phosphorus-restricted basin list is explained in Appendix C. Appendix C discusses phosphorus bound to particulates, shading, and low chlorophyll response as the rationale for exemption from restricted status. It is DEP's intention to use the OECD standard lines to diagnose these relationships in future reports and discussions.

On page 29, the text in paragraph 4 uses the terms "normal" and "historical", but it is not clear as to the time period being referenced.

DEP Response:

Refer to the previous explanation; same as above comment pertaining to p. 22.

On page 29, in paragraph 5, the report refers to "… the relatively low TP concentrations observed in the Croton System in 2014. Does this include Cross River and Croton Falls?

DEP Response:

Cross River and Croton Falls were part of the evaluation. The generalization "most" was made because 9 out of 12 Croton System reservoirs had 2014 median TP concentrations below the long-term (2004-2013) median. Median TP concentrations for West Branch, Croton Falls, and East Branch reservoirs for 2014 were above their respective long-term medians.

In Sections 3.6 through 3.9, NYSDOH/EPA would like to see a more detailed discussion of the elevated chlorophyll levels found in some EOH reservoirs that were attributed to nitrogen rather than phosphorus. This could likely be done using the same tools mentioned in the comment on Section 3.4. The sources of increased nitrogen should also be evaluated and discussed more fully for both reservoirs and stream sites. For example, the benchmark exceedances for the Delaware stream sites were not explained (page 42). An ammonia spike in February and March at Michael's Brook was attributed to a WWTP located upstream (page 43). Please provide additional detail regarding the suspected source of ammonia and any follow up activities to investigate and mitigate the source.

DEP Response:

We will consider alternative methods for assessing chlorophyll–nutrient relationships in the future to help explain the observed patterns we see in the reservoirs. One additional approach beyond those mentioned in the comment and response to Section 3.4 is to compare mass N:P ratios. While the nutrient content of phytoplankton varies with environmental conditions and between species and seasons, a general guideline is that mass N:P ratios above 17 are indicative of P-limitation, ratios below 10 are indicative of N-limitation, and ratios from 10-17 suggest co-limitation. We use a variety of approaches in data exploration to examine changes in nutrient concentration and seasonality in both streams and reservoirs.

For nitrogen in particular, climate influences, forest species composition and health, and insect outbreaks, are among the considerations in evaluating changes in nitrogen. Some of this evaluation is approached through our ongoing analysis of water quality trends.

Wastewater Treatment Plants are covered under other reports such as the NYCDEP WWTP Inspection Program. The site in Michael's brook is MIKE2 and the upstream plant is Carmel SD#2 STP. The inspection report for the plant during that time period did not show any violations so the source of the high ammonia is not definitively known. The inspection report is as follows:

Facility: Carmel Sewer District #2

Basin	SPDES	Inspected	Seasonal WWTP	Report Sent to Owner
Croton Falls	NY0031356	Yes	No	Yes

Comments: **None.**

Inspections: **On March 6, 2014, staff performed a Quarterly Inspection. Items rated less than (S) satisfactory are indicated below:**

Item: 'D7.0 Microfiltration System' received a rating of Marginal with comments: 'Cold temperatures in waste stream'.

On May 21, 2014, staff performed a Quarterly Inspection. Items rated less than (S) satisfactory are indicated below:

Item: 'E1. Disinfection U/V' received a rating of Marginal with comments: 'Units are due for new bulbs.'

SPDES Permit Exceedance(s)

None.

Enforcements

None.

Miscellaneous

None.

On page 33, in paragraph 3, the report states that 3 fecal coliform samples exceeded the benchmark of 20 fecal coliform/100 mL (4% of samples collected) in Ashokan-West Basin. Were these exceedances associated with stormwater and/or snow melt run off events?

DEP Response:

A runoff event with a cumulative rainfall of 1.85 inches on 5/15-16 and peak streamflow at the USGS Esopus Creek at Coldbrook gage of 11,200 cfs on 5/17 occurred just prior to the elevated fecal coliform counts on 5/20 at site 2 in Ashokan West Basin, the reservoir sampling site nearest to the inflow from Esopus Creek.

Table 3.9 on page 36 does not list a major inflow stream sample site for Croton Falls Reservoir – is there such a site for Croton Falls Reservoir? Does the WESTBR7 site upstream from Boyd Corners Reservoir also serve as the major inflow stream sample site for West Branch Reservoir?

DEP Response:

Croton Falls consists of three basins.

Basin 1, the largest of Croton Falls' three basins, holds 70% of the reservoir's total volume and receives water from the West Branch of the Croton River as it flows down from the West Branch Reservoir. There is a sample from the West Branch Release, but this would not be indicative of the Croton Falls watershed. Basin 1 also receives input from a smaller tributary which brings water from Lake Gilead, one of three controlled lakes that are part of the Croton System. Basin 2 holds 26% of the reservoir's volume and receives water from the City's Middle Branch Reservoir, as it flows from the Middle Branch Reservoir, and again there is a sample from the Middle Branch Release.

Basin 2 is also connected to the nearby Diverting Reservoir via a channel and dividing weir and water usually passes freely between the two reservoirs.

Basin 3, the smallest basin, receives most of its water from a single stream, Michael's Brook, and there is a sample site on Michael's Brook. With the three basins and multiple inputs, there is no site that would serve as the major inflow stream that is reflective of the Croton Falls watershed.

The WESTBR7 site drains about 49% of the Boyd's Corners' watershed area.

Figure 3.7 on page 37 shows the locations of major inflow stream water quality sampling sites and USGS gage stations. The East-of-Hudson area of the map should be enlarged, or provided as a separate figure, as it is difficult to interpret.

DEP Response:

DEP will revise the EOH map in the future to provide better depiction of the sites mentioned.

In Section 3.9, stream water quality benchmarks are provided. The chloride annual mean concentration for the West Branch Reservoir Release (WESTBRR) was 23.7 mg/L in 2014. This elevated level is attributed to the predominant operational mode (float) of the reservoir. In 2013, the concentration of 17.7 mg/L was also attributed to the operational mode. Previous annual reports have shown increasing chloride concentrations since at least 2011 (10.5 mg/L). The primary source of chloride to this watershed is reported to be road salt. Has DEP considered efforts to reduce the use of road salt, or the expansion of alternative deicing methods?

DEP Response:

The increasing chloride trend was attributed to the operational status of West Branch in recent years but additional factors may also be important such as the frequency of deicer application and the annual amount used. Chloride patterns can also be difficult to interpret because of the relatively long residence time of chloride in the watersheds. It may take many years for one application of salt to be completely flushed from the system.

As far as efforts to reduce road salt DEP has utilized the tool allowed for in the MOA that allows DEP to approve the use of EOH Water Quality Investment Program funds for projects that are not on the list of eligible projects. This has included projects in Putnam that may reduce the impacts from winter de-icing materials. The projects in this area include:

2011 – DEP approved Putnam County's request to procure a Vac-All truck for the Town of Carmel. This equipment assists in clearing catch basins of debris, including winter deicing material. Total cost was about $240K.

2011 – DEP approved Putnam County's request to procure a Pelican Street Sweeper. This allows the County to sweep up debris and excess road salt. Total cost was about $173K.

2005 – DEP approved Putnam County's request to procure computerized metering devices for ten (10) County highway department trucks for winter de icing operations. The equipment factors in vehicle speed and automatically applies the appropriate amount of de-icing product to the roadways. This will benefit the environment by eliminating excess deposition of de-icing material to road surfaces. Total cost was about $177K.

Section 3.9 discusses how operating West Branch Reservoir in predominately float mode has potentially negatively impacted water quality in the reservoir (e.g., increased productivity, lower dissolved oxygen, increased ammonia, as well as the increased chloride concentrations mentioned above). Figure 3.6 on page 35 indicates that 2014 data place West Branch Reservoir into the eutrophic category. Provide a brief discussion of the potential impacts that diminished water quality in West Branch Reservoir may have on DEP's flexibility to use this reservoir in the future.

DEP Response:

West Branch is a relatively small reservoir with a short residence time estimated to range from 8 to 18 days when on flow-through mode (i.e., when the bypass is closed). This means that any developing water quality deterioration can be diluted and water in the entire basin can be replaced by Delaware water in a short time. Due to the ability to control water residence time and therefore eutrophication in West Branch, DEP does not anticipate that modest changes in trophic condition will place any operational constraints on the system.

Section 3.10 discusses the results of stream biomonitoring in the NYC Watershed. NYSDOH/EPA commend DEP for its use of this tool, in conjunction with other water quality monitoring, to investigate potential sources of stream impairment, as well as to identify areas of improved stream health.

DEP Response:

Comment noted.

Table 4.1 on page 57 summarizes the Kensico water quality samples collected in 2014. The last line in the table refers to WWTP sampling. However, there is no discussion of these samples in Chapter 4. Please provide more information on the WWTP sample locations and analytes.

DEP Response:

The WWTP analyses relative to SPDES permit requirements are reported in separate semi-annual reports devoted to this purpose.

Table 4.2 on page 69 reports maximum dissolved oxygen concentrations for Kensico's perennial streams. Some of these values seem high for dissolved oxygen concentrations, in particular the record of 103.6 mg/L for N5-1. Please confirm these values.

DEP Response:

The 103.6 mg/L data point was investigated, and it was determined the probe malfunctioned, so the data point will be removed from the dataset. The actual maximum dissolved oxygen concentration for N5-1 in 2014 was 15.9 mg/L.

Section 4.5.2 provides a good, detailed description of sampling performed by DEP to assess the impact of a storm event on water quality in Kensico Reservoir. The results of this extensive investigation could help DEP identify potential sources of contamination to the reservoir. It is not clear from the report – was this investigation triggered by detection of an unusually high level of coliform or pathogens in the reservoir or just the incidence of an intense rainfall event? Has DEP subsequently learned anything more about the source of the human fecal biomarkers and the seep area at 38 Greenwood Lane? Does DEP plan to conduct similar investigations following future rain events?

DEP Response:

This investigation was triggered by the rainfall event. DEP has a protocol in place for storm sampling at Kensico Reservoir when the forecasted rainfall is predicted to approach or exceed 2 inches of rain.

DEP's regulatory staff visited the 38 Greenwood Lane site three times in the past year. The last visit to the site, July 1, 2015, DEP staff re-inspected the property following a heavy rain event. There was some surface water in the area and no sewage odor. DEP believes this seep to be of no concern, nor a source of contamination, but rather a natural seep and does not plan to inspect this area in the future. DEP will follow up with inspections as necessary in response to any possible detection of human markers in the future. Separately, staff reached out to Westchester County Department of Environmental Facilities (WCDEF) to check on any concerns regarding the sewer main. WCDEF reported they were not aware of any issues during the July storm. The lines are inspected and flushed annually, and video inspected every three years (last done December 2013). No problems were detected.

Similar investigations of Kensico Reservoir will occur in the future based on predicted rainfall.

In Section 5, the discussion on pathogens should include information on matrix spike recoveries at keypoint sampling sites, either in aggregate for the year, broken down into each reporting section, or added to Tables 5.1, 5.2, and 5.9. This quality control information would help provide context for the reported pathogen detections and summary statistics.

DEP Response:

The matrix spike recovery data will be included in future reports.

NYSDOH/EPA commend DEP for the in-depth investigation, described in Section 5.4, into the source of elevated *Giardia* levels in the Manorkill, a tributary to Schoharie Reservoir. Systematic selection of sample sites enabled DEP to narrow down the location of the source of

Giardia cysts, which appears to be a pond and associated wildlife. This information will help DEP evaluate the risk posed by this source and DEP's options for mitigation, if necessary.

DEP Response:

Comment noted.

Information presented in Section 5.4 Watershed Streams might be enhanced by including graphic comparisons of pathogen levels detected in watershed streams each year.

DEP Response:

Comment noted.

Section 5.6 on page 104 discusses the Hillview Reservoir pathogen sampling. The information presented does not include the additional 20 samples collected between August and December 2014 as DEP investigated low pathogen recoveries in their standard 50-liter samples. This additional work included zero *Cryptosporidium* detections and seven *Giardia* detections.

DEP Response:

These 20 samples were examined with an un-validated version of the method (5x10L). It would not be appropriate to add this data to the routine data, which is meant to be a description of water quality status.

In Section 6, NYSDOH/EPA commend DEP for beginning the use of synthetic meteorology time series and "bottom up" approach to evaluate critical climate scenarios that may jeopardize the quantity or quality of water delivered to consumers.

DEP Response:

Comment noted.

Section 6.4 describes DEP's participation in the Water Utility Climate Alliance and the Piloting Utility Modeling Applications project with some of the nation's other largest water systems. NYSDOH/EPA commend DEP for its proactive efforts to explore the potential impacts of climate change on the delivery of sufficient quantities of high quality water. These alliances will provide an opportunity for DEP learn from the experience and expertise of others, while sharing the extensive knowledge gained from its own research and modeling efforts.

DEP Response:

Comment noted.

On page 115, the last sentence of the last paragraph states: "While there is a difference in the recoveries between the spring and fall samples, there is no significant difference between the overall means for the two methods [Method 1623 and the CC-IFA Method]." Is this referring to a difference in recovery for all samples between the spring and fall, or a difference in recovery between the two methods between the spring and fall? Please provide more information on why recoveries differed seasonally.

DEP Response:

This comment is referring to the difference in recoveries in spring and fall using both methods. The recoveries of the two methods were very similar within each season, and both had lower recovery in the fall compared to the spring. This

suggests that whatever is going on in the matrix to produce lower recovery in the fall is nearly equally impacting both methods. The matrix effect does not have any more impact on the infectivity method than it has on Method 1623. Specific reasons for differing recoveries according to season are speculation at this point.

Table 7.2 on page 116 shows spike recoveries in controls and Hillview matrix samples. Briefly describe the Hillview matrix, and why it may have led to slightly lower recoveries (7/10) when the spike dose was 1 oocyst.

DEP Response:

Similar to the last response, the details of what exactly causes the lower recoveries is speculation at this time.

Section 7.4 describes DEP's participation in the 2014 Global Lake Ecological Observation Network meeting, which provided instruction on ways to optimize use of the extensive high resolution data produced by DEP's ROBOMON monitoring buoys. NYSDOH/EPA again commend DEP for continuing to explore new and innovative ways to measure and evaluate the status of its water supply and impacts of its watershed protection programs.

DEP Response:

Comment noted.

DEP will also participate in GLEON17 during October 12-17, 2015 in Chuncheon, South Korea. GLEON provides an international forum for scientists using high-frequency data. This group is exceptional in that it provides sophisticated analytical software (in R software; at no cost), high-level expertise, and unparalleled opportunity to be involved in comparative studies on a global scale. Given these major benefits, DEP intends to participate in GLEON activities into the future. DEP appreciates the acknowledgement of effort to "explore new and innovative ways".