parameters monitored and the number of samples. The minimum, maximum, and average result for each parameter analyzed are also included in all tables.

Table 4-2 Summary of Prior River Water Quality Monitoring/Analysis Performed by UWNY

EVENT	SITE	PARAMETERS	FREQUENCY	PERIOD SAMPLED	SAMPLE COLLECTION NOTES
1. Quarterly Sampling Events					
	Sites 1, 2, & 4	VOCs/SVOCs, Pest., PCBs, TCDD	Single event	Apr 2007	High & Low tide, 3 depths
		Radionuclides	Single event	Apr 2007	High & Low tide, 3 depths
	Site 3	VOCs/SVOCs, Pest., PCBs, TCDD	Quarterly (2 qtrs)	Apr & Jun 2007	High & Low tide, 3 depths
		Radionuclides	Quarterly (2 qtrs)	Apr & Jun 2007	High & Low tide, 3 depths
	Site 5	VOCs/SVOCs, Pest., PCBs, TCDD	Quarterly (4 qtrs)	Jun 2007 - May 2008	High & Low tide, 3 depths
		Radionuclides	Quarterly (4 qtrs)	Jun 2007 - May 2008	High & Low tide
		EDCs/PPCPs	Quarterly (4 qtrs)	Jun 2007 - May 2008	High & Low tide
2. Monthly Sampling Events					
	Sites 1, 2, & 4	Metals & Nutrients	Monthly (2 mths)	Apr & May 2007	High & Low tide, 3 depths
		Crypto & Giardia	Single event	May 2007	High & Low tide
	Site 3	Metals & Nutrients	Monthly (4 mths)	Apr-Jul 2007	High & Low tide, 3 depths
		Crypto & Giardia	Monthly (3 mths)	May-Jun 2007	High & Low tide
	Site 5	Metals & Nutrients	Monthly (12 mths)	Jun 2007-May 2008	High & Low tide, 3 depths
		Crypto & Giardia	Monthly (12 mths)	Jun 2007-May 2008	High & Low tide
3. Weekly Sampling Events					
	Site 1	Field Parameters	Weekly	Apr-Jun 2007	Depth profiling
		Conv. Param, Select Ions, & Bacteria	Weekly	Apr-Jun 2007	3 depths
	Sites 2, 3, & 4	Field Parameters	Weekly	Apr-Aug 2007	Depth profiling
		Conv. Param, Select Ions, & Bacteria	Weekly	Apr-Aug 2007	3 depths
	Site 4S	Field Parameters	Weekly	Aug 2007-May 2008	Depth profiling
	Site 5	Field Parameters	Weekly	Aug 2007-May 2008	Depth profiling
		Conv. Param, Select Ions, & Bacteria	Weekly	Aug 2007-May 2008	3 depths
4. Continuous Reading Water Quality Buoy (Sonde)		pH, Temp, Conductivity, Salinity, DO, & Turbidity	Continuous hrly readings	Installed Mar 2008 (ongoing)	Removed during winter icing (mid Dec-Mar, typ)

4.1.1.2 Parameter Detections

The results of the water quality monitoring are summarized in the following analyte groups.

Organic Compounds

With the exception of four volatile and semi-volatile organic compounds, all other organic contaminants were not detected at any of Hudson River monitoring sites, as indicated in Tables 1A and 2A of Appendix B. The four organic compounds detected were Benzene, Methylene Chloride, Toluene and Dioxin (2,3,7,8-TCDD). While Dioxin and Benzene were only detected once, Methylene Chloride and Toluene were detected 8 and 11 times, respectively.

Pesticides/PCBs/EDCs and Pharmaceuticals

According to Tables 1A and 2A of Appendix B, no pesticides or polychlorinated biphenyls (PCBs) monitored during the 2007-2008 Hudson River water quality monitoring program were detected at any of the five sampling locations. There were 17 endocrine-disrupting compounds (EDCs) detected in the samples.

Metals and Inorganic Ions

Metals detected in the Hudson River throughout the 2007 to 2008 water quality monitoring period included aluminum, boron, iron, lead, manganese, nickel, potassium and zinc. Fluoride was detected three times.

Conventional Parameters

Nitrogen species including ammonia, nitrate, nitrite and total nitrogen were all detected, as indicated in Tables 1A and 2A of Appendix B. Table 3 of Appendix B provides a summary of conventional parameters monitored and detected at the 5 sites. Conventional parameters presented in Table 3 include pH, salinity, conductivity, temperature, total dissolved solids (TDS), total organic carbon (TOC), and turbidity.

Pathogens/Microbiological Parameters

Total coliform in the 2007-2008 Hudson River sampling was detected within the range of 2 to 2,420 cfu/100 mL with an average of 759 cfu/100 mL (Table 1A of Appendix B).

4.1.2 Sonde Water Quality Buoy Data

Generally from March and April 2008 to July 2011, Hudson River water quality has been monitored continuously by a water quality buoy (Sonde) located within the vicinity of the proposed intake location. The data collected yields tidal and daily variation of water quality throughout the spring, summer and fall seasons. It should be noted that the buoy is removed from the water during winter months due to the impacts of icing on the river.

4.1.2.1 Parameters Monitored

The Sonde water quality buoy logs hourly water quality data near the proposed intake location. As indicated in Table 3 of Appendix B, the following parameters are monitored:

- pH;
- Temperature;
- Conductivity;
- Salinity; and
- Turbidity.

4.1.3 Pilot Study Water Quality Data

While not required by the New York State Department of Health (NYSDOH) or New York State law, UWNY has voluntarily constructed a temporary water testing and treatment facilitylocated on Carol Avenue within the West Haverstraw Business Park. The water quality sampling and modeling conducted and the testing being performed, referred to as the "Pilot Study," allows UWNY to continue the process of gathering information on Hudson River water quality, but on a continuous basis. The Pilot Study draws water from the Hudson River in the vicinity of the location proposed for the Project, and analyzes it and uses it to conduct engineering studies of treatment processes that can be employed for Hudson River water. Use of the Pilot Study will provide additional information on ambient water quality, treatment methods (such as the sequencing of treatment processes to result in the highest quality potable water while optimizing the treatment cost), and volumes of waste and reverse osmosis (RO) concentrate streams generated by the treatment processes throughout the range of water quality conditions. This information will allow refinement of the treatment processes and sequencing of treatment to provide information for the detailed design of the Proposed Project.

Water quality data has been collected from the pilot plant for raw water, throughout the water treatment process, and for the RO influent, permeate and concentrate (brine). Tables 1B and 2B of Appendix B include summaries of the raw water quality as well as RO influent and concentrate laboratory data collected from December 2010 through July 2011. Sampling frequencies varied based on analyte group and are detailed below.

4.1.3.1 Parameters Analyzed and Frequency

As mentioned above, several water quality parameters were analyzed both continuously and at varying frequencies throughout the treatment process. The following summarizes the analyte groups and monitoring frequencies:

Laboratory/Field Parameters

- Volatile Organic Compounds (VOC's) – monthly;
- Semi-volatile Organic Compounds (SVOC's) - monthly;
- Pesticides - monthly;
- PCB's - monthly;
- EDC's/ pharmaceutical (PPCP's) - monthly;
- Metals/Inorganic parameters - monthly and weekly;
- Conventional parameters - weekly; and
- Pathogens/Microbiological parameters – twice monthly.

Continuously Monitored Parameters

- Conductivity, pH, Temperature, and Turbidity.

4.1.3.2 Parameter Detections

The results of the raw water quality monitoring for the Pilot Study are summarized in the following analyte groups.

Organic Compounds

According to Tables 1B and 2B of the appendix, the only organic compound detected in the raw water was methylene chloride, which was detected twice. Bromodichloromethane, Bromoform, Carbon Disulfate, Chloroform, Dibromochloromethane, Methylene Chloride, Styrene and Xylenes were detected between 1 and 2 times in the RO influent and concentrate.

Pesticides/PCBs

As indicated in the appended table, no pesticides or PCB Aroclors monitored at the pilot were detected in the raw water on any occasion. Delta-BHC and Gamma-BHC were detected once and twice, respectively in the RO concentrate. PCB Congeners were detected in the pilot raw water, RO influent and RO concentrate. Of the 27 Congeners analyzed, 12 were detected primarily in the raw water and RO concentrate. These included PCB 101 (BZ), PCB 105 (BZ) (RO concentrate only), PCB 118 (BZ))RO concentrate only), PCB 18 (BZ), PCB 183 (BZ), PCB 28 (BZ), PCB 44 (BZ), PCB 49 (BZ), PCB 52 (BZ), PCB 66 (BZ), PCB 8 (BZ), and PCB 90 (BZ).

EDCs and Pharmaceuticals

Tables 1B and 2B of Appendix B indicate that 20 of the 39 EDCs/Pharmaceuticals analyzed were detected in the raw water of the Pilot Study, Acetaminophen, Azithromycin, Benzo(a)pyrene, Caffeine, Carbamazepine, Cotinine, Diltiazem, Fluoranthene, Fluoxetine, Gemfibrozil, Ibuprofen, Lincomycin, Naphthalene, Naproxen, Phenanthrene, Pyrene, Sulfamethoxazole, Triclosan, Trimethoprim and Tylosin. The detections of the above mentioned EDCs averaged within the range of 0.7 and 160 ng/L. It should be noted that each of these parameters was previously analyzed and not detected using EPA method 625 for SVOCs.

Metals and Inorganic Ions

Several metals were detected in the raw water, RO influent and RO concentrate of the HWSP pilot facility. The metals detected include Aluminum, Arsenic, Barium, Boron, Calcium, Hexavalent Chromium, Copper, Iron, Lead, Magnesium, low level Mercury, Manganese, Nickel, Potassium, Silver, Sodium, Strontium, Vanadium and Zinc. Bromide, Chloride, Fluoride, Hexane Extractables (Oil and Grease), Perchlorate and Sulfate were also detected in the raw water, RO influent and RO concentrate.

Conventional Parameters

According to Tables 1B and 2B, nitrogen species including Algae, Alkalinity, Chlorophyll, Conductivity, DOC, Ammonia, Nitrate, Nitrite, Total Phosphorous, Orthophosphate, Total Nitrogen, TKN, TDS, TOC, TSS and UV 254 were all detected either in the raw water, RO influent or RO concentrate. A comparison of the conventional parameters monitored and presented in Table 3 of the appendix include pH, salinity, conductivity, temperature, TDS, TOC, and turbidity.

Radionuclides

According to Tables 1B and 2B, Gross Alpha, Gross Beta, Radium-226, Radium-228, Tritium and Uranium were all detected in the either in the raw water, RO influent and RO concentrate. Gross Beta appeared to be the most detected of all the radionuclides, having 9 detections in the raw water, 7 in the RO influent, and 11 in the RO concentrate. The majority of the other radionuclides were detected less than 5 times throughout the pilot study. Strontium-90 was detected twice in the RO concentrate.

Pathogens/Microbiological Parameters

Cryptosporidium was detected once at 0.05 oocysts/l, while *Giardia* was detected 6 times within the range of 0.05 and 0.55 cysts/l in the raw water. Total coliform was detected within the range of 140 to 11,000 cfu/100 mL, at an average of 1,700 cfu/100 mL in the raw water. It was detected at an average of 285 and 120 in the RO influent and RO concentrate, respectively. HPC was detected in both the RO influent and RO concentrate at average quantities of 360 and 3,000 cfu/ml, respectively.

4.1.4 Water Quality Data Comparison

4.1.4.1 Appendix B Tables 1A and 2A Summary

Tables 1A and 2A provide a summary of Hudson River Water Quality Data where Pilot Study data appears to be consistent with the historical Hudson River data gathered in 2007 and 2008. VOCs and SVOCs were detected infrequently in either data set. Pesticides and PCB results indicated no detections historically or in the Pilot Study raw water. Metals and conventional parameters were detected both historically and currently under the Pilot Study, at comparable minimum, maximum and average values. Total coliform was detected and averaged at 759 cfu/100 mL and 1,700 cfu/mL during 2007 and 2008 sampling and under the Pilot Study, respectively.

4.1.4.2 Appendix B Table 3 Summary

Table 3 provides a summary of conventional parameters monitored in the Hudson River both historically, continuously with the water quality buoy, and under the Pilot Study. The pH range appears to fall within the range of approximately 6.7 to 8.4, at an average of near 7.35-7.6 for both historical and Pilot Study raw water data. While the average data is similar for historical and the Sonde water quality buoy data, the salinity range for historical data peaks slightly higher than that of the Sonde water quality buoy data, which is likely due to the availability of data during summer months. Historical data indicates a range of 0.1 to 14.5 ppt (average of 2.8 ppt), while the Sonde water data indicates a range of 0.1 to 8.3 ppt (average of 2.2 ppt). The Pilot Study indicates a range of 0.1 to 4.5 ppt, with an average of 1.1 ppt in the raw water and RO influent. The RO concentrate has a salinity of between 0.5 and 29.5 ppt, at an average of 6.5 ppt. The raw water temperature range was consistent throughout each data set, ranging from a minimum of between 0.4 to 5.9 degrees Celsius, to a maximum of 25.4 to 30.0 degrees Celsius. Hudson River water TDS for historical and Pilot Study raw water data was within the range of 6 to 11,000 mg/L, and 74 to 4,340 mg/L, respectively. TDS in the RO influent and concentrate was within the range of 80 to 4,800 mg/L and 728 to 28,800 mg/L, respectively. TOC detected in the Hudson River water for historical and Pilot Study raw water data was between 1.0 to 4.7 mg/L and 2.6 to 3.7 mg/L, respectively. RO influent TOC was detected at between 1.4 and 2.2 mg/L, while RO concentrate TOC was detected at between 3.6 and 34.5 mg/L. Hudson River water turbidity during the 2007 and 2008 monitoring program ranged between 0.8 and 69.0 NTU. The Sonde water quality buoy detected a range of 0.1 and 155.8 NTU for turbidity. The Pilot Study raw water detected between 2.3 and 99.8 NTU of turbidity in the raw water and 0.02 and 0.26 NTU turbidity in the RO influent.

4.1.4.3 Conclusion

It appears that Pilot Study data, Water Quality Buoy (Sonde) data, and historical data attained from UWNY's 2007-2008 sampling program are generally consistent in classifying Hudson River water quality.

4.1.5 Hydrodynamic Modeling Results

Potential issues for drinking water from any source can include the presence of radionuclides, PCBs, and EDCs/ PPCPs. Hydrodynamic modeling conducted by HydroQual, Inc. indicated that upstream dredging (approximately 100 miles from the proposed intake structure) conducted for the Hudson River PCBs Superfund Site would result in future PCB concentrations in the vicinity of the intake structure at levels far below the maximum safe drinking water standards (i.e., "maximum contaminant levels", or MCLs). The results of this modeling conclude that point and non-point discharges to the Hudson River within a 25-mile radius of the intake structure would not adversely affect the suitability of the Hudson River as a water supply source. Similarly, modeling at the intake structure indicates that discharge of the water treatment plant's reverse osmosis effluent (RO concentrate) through the Haverstraw Joint Regional Sewage Treatment Plant (JRSTP) effluent outfall, and the discharge of other residual waste streams to the influent of the JRSTP, would not adversely affect the quality of the surface water at the intake structure for the Proposed Project. The standard water treatment processes proposed as part of the Haverstraw Water Supply Project would be used to meet or exceed drinking water standards established by the U.S. Environmental Protection Agency (USEPA) and the NYSDOH. Further details on the hydrodynamic modeling are included in Appendix C.

4.1.6 Municipalities Utilizing the Hudson River as a Water Supply

The Hudson River is currently being used as a drinking water source by more than 20 municipalities. The public water supplies from the Hudson River that serve at least 1,000 people include the City and Town of Poughkeepsie, the Town of Lloyd, the Village of Wappingers Falls, the Town of Hyde Park, the Town of Esopus, the Village and Town of Rhinebeck, the Town of Halfmoon, the Village and Town of Waterford, and the Town of Queensbury, and the City of Glens Falls. In addition, water from the Hudson River has been used by the City of New York at Chelsea, New York during past drought emergencies.

Numerous industrial and commercial entities, which are listed below in Table 4-3, also utilize the Hudson River (south of Troy) as a source of water supply.

Table 4-3
Hudson River Water Industrial and Commercial Uses

59th Street Steam Station	Dinsmore G.C.	Mirant Bowline
AMRI Rensselaer	Holcim (US) Inc.	Athens Generating
ASR, Inc.	IBM Hudson Valley Research Park	Roseton Generating Station
Bethlehem Energy Recovery	IBM Poughkeepsie	Wheelabrator Westchester
Clover-Leaf Nursery	Indian Point 2 & 3	World Financial Center
Danskammer Generating Station	Lafarge Building Materials	

4.2 Water Quantity

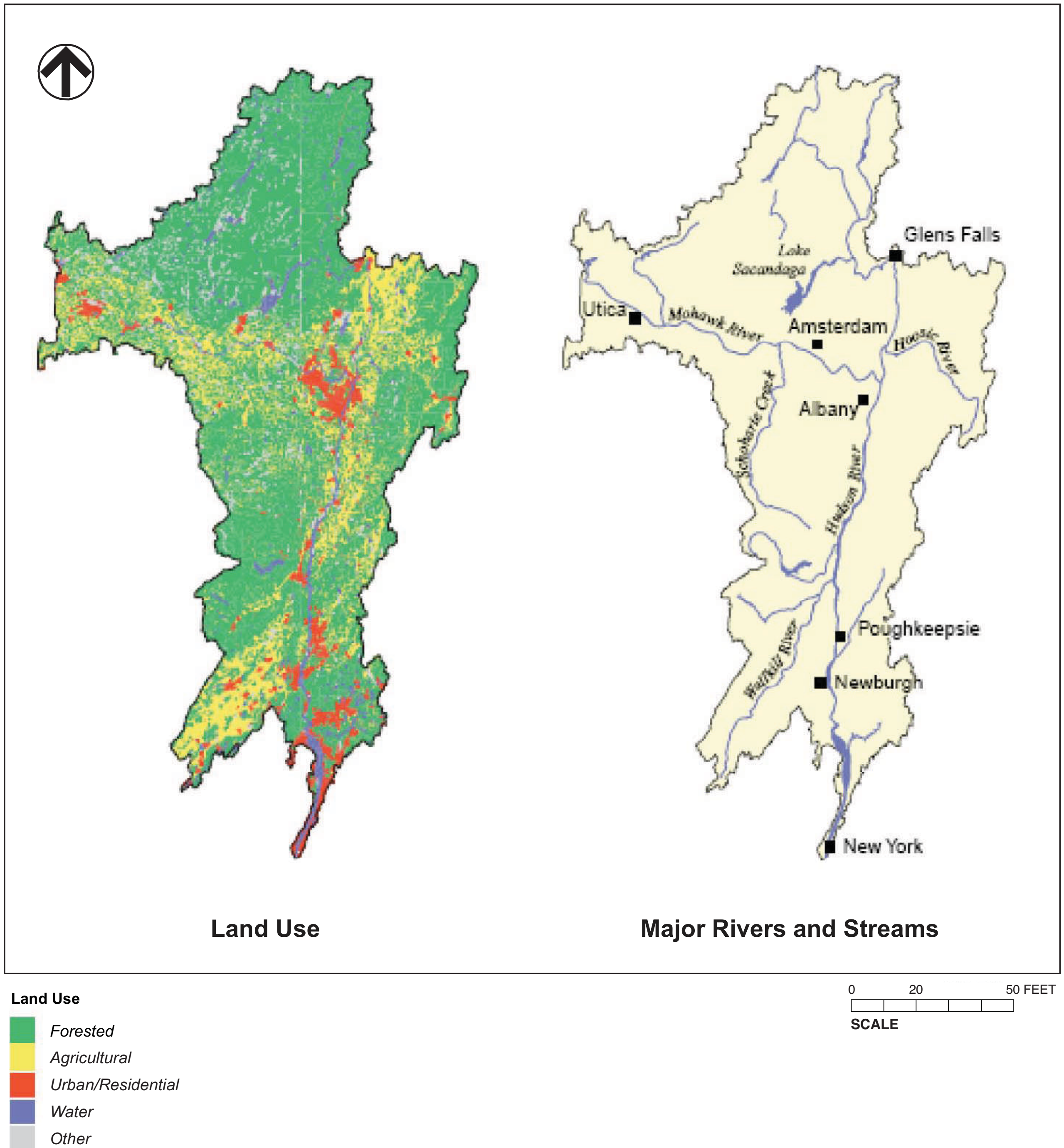
The proposed Haverstraw Water Supply Project would introduce a new surface water source to the Rockland County water supply system, the Hudson River. Unlike the reservoirs, smaller rivers, and groundwater sources that currently supply UWNY's system in Rockland County, the Hudson River—by virtue of its size and connection to the Atlantic Ocean, as discussed below—is far less affected by local drought conditions. For this reason, and for most efficient plant operation, UWNY proposes to operate the Haverstraw Water Supply Project at or close to its design capacity, to provide a steady source of clean water regardless of changes in the hydrologic cycle elsewhere in Rockland County

4.2.1 Hudson River Hydrology

The Hudson River originates at Lake Tear of the Clouds in the Adirondack Mountains and flows south 507 kilometers (315 miles) to its confluence with Upper New York Bay. The Hudson River drainage basin covers 33,835 square kilometers (13,064 square miles) and drains parts of New York, Vermont, New Jersey, Massachusetts, and Connecticut. It is divided into three major sub-basins: the Upper Hudson River ("Upper Hudson," 11,987 square kilometers or 4,628 square miles), the Mohawk (8,972 square kilometers or 3,464 square miles), and the Lower Hudson (12,876 square kilometers or 4,971 square miles). The Proposed Project is located in the Lower Hudson. At Troy, north of Albany, the river is joined by the Mohawk River, the major tributary of the Hudson River, and the flow nearly doubles. Land cover within the Hudson River basin is approximately 62 percent forest, 25 percent agriculture, 8 percent urban and residential, 2.6 percent open water, and the remaining is miscellaneous. Land cover within the Lower Hudson is about 55 percent forest, 29 percent agriculture, and 13 percent urban (see Figure 4-2).

The Lower Hudson is a partially mixed estuary due to mixing of freshwater with water from the Atlantic Ocean. The river is tidally affected as far as the Federal Dam near Troy, which is 153 river miles upstream of the mouth of the Hudson at the Battery in New York City. The flow in the estuary can be in either direction depending on the tidal conditions and the seasons, which influence freshwater flow. The mixing of freshwater and ocean water results in brackish water in the lower reach of the estuary. The salinity and its vertical mixing or lack thereof (stratification) vary significantly with tides, season, and weather. Semi-diurnal tides (i.e., two high tides and two low tides occur each day) affect salinity and mixing, particularly in the lower stretches of the river.

The average annual flow of the Hudson River at Green Island, which is just downstream of its confluence with the Mohawk, as gauged from 1947 through 2006 by the U.S. Geological Survey (USGS) (USGS Gauge No. 1358000) is approximately 14,000 cubic feet per second (cfs). Freshwater flow in the Hudson varies seasonally



Source: Black & Veatch Corporation, Reference: USGS, 1998

Figure 4-2

Hudson River Watershed Showing Land Use, Major Rivers and Streams

with the highest rates typically in the spring when rainfall combines with snowmelt particularly in the Upper Hudson.

The average depth of the river varies from 16 feet at Haverstraw Bay to 35 feet at the Battery. The width of the river is largest at Haverstraw Bay (17,000 feet or 3.2 miles) and decreases downriver. Haverstraw Bay has extensive shallow areas (less than 15 feet deep at mean lower low water [MLLW]). The bay deepens in the navigation channel which is maintained at a depth of about 35 feet (New York State Department of State [NYSDOS] Undated, Coastal Fish and Wildlife Habitat Rating Form—Haverstraw Bay). Channel depths within the study area range from 18 to about 61 feet at MLLW (National Oceanic and Atmospheric Administration [NOAA] Chart 12343, Edition 19, 10/1/2005). The mean tidal range, defined as the difference between high water and low water surface elevations, in the Hudson River at Haverstraw is 2.9 feet; spring tidal range, which coincides with the full and new moon, is 3.4 feet. Average maximum flood current is 0.4 meters per second (m/s), or 1.3 fps/0.8 knots, and the average maximum ebb current is 0.7 m/s (2.3 fps/1.4 knots). The greater ebb velocity is attributable to the freshwater flow, which yields a net flow to the Battery and beyond it through New York Bay.[2]

4.2.2 Minisceongo Creek Hydrology

The Minisceongo Creek flows out of the Ramapo Mountains to its confluence with the Hudson River just southeast of the proposed Intake Site. The Water Treatment Plant Site and the raw water transmission main route options are located within the Minisceongo Creek watershed. The north branch of the Minisceongo Creek originates in the Palisades Interstate Park and the south branch originates about two miles south of the Mt. Ivy Swamp, near the Village of New Hempstead. The branches meet at Letchworth Village. Except for the reach of stream in Letchworth Village, and several small impoundments on the stream, the Minisceongo has a moderate gradient and the streambed is characterized by stones (gravel to large rocks). The average stream flow for the period of October 1960 through September 1963 at USGS Gauge No. 01374480 (Minisceongo Creek at Thiells, New York), northwest of the Town of Haverstraw, where the drainage area is 15.1 square miles (39.1 square kilometers), is 23.1 cfs.[3]

4.2.3 Project Effect on Water Quality

The ultimate daily production capacity of the new water treatment plant would be 7.5 mgd. Initial estimates show that approximately 33 percent of the raw water flow would be consumed within the treatment process. Therefore, the phased minimum firm daily raw water capacity would range from 3.4 to 10 mgd.

The amount of water withdrawn for the Proposed Project would represent a minute fraction of the total freshwater flow of the Hudson River as it passes the Intake Site.

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[2] Referenced from Tides and Currents Pro software, except for spring tidal range which was obtained from Reed's Nautical Almanac.

[3] USGS http://waterdata.usgs/nwis/ dv/?referred_module=sw

According to USGS estimates, the annual mean flow rate of freshwater in the river as it passed Poughkeepsie in the years 1995 through 2004 ranged from a low of 12,000 cfs (5,385,970 gpm) to a high of 26,700 cfs (11,983,800 gpm). This does not account for the additional effect of saline water associated with tidal activity.

4.3 Key Drinking Water Regulations

Drinking water is federally regulated to minimum standards by the USEPA under the authority of the Safe Drinking Water Act (SDWA). The SDWA was established by Congress in 1974 to protect human health by regulating the nation's public drinking water supply. The SDWA was extensively amended in 1986 and again in 1996. In New York, the NYSDOH enforces these regulations in general. These regulations are adopted and, in some cases, made more restrictive by the NYSDOH.

A primary focus of the SDWA is to set national contaminant-based drinking water standards, including both primary and secondary standards. Primary drinking water standards are intended to address adverse health effects and consist of maximum contaminant level goals (MCLGs), which are non-enforceable goals, and MCLs, which are enforceable limits set as close to MCLGs as practical, considering cost and feasibility of attainment. Secondary drinking water standards address general public welfare, such as the odor or appearance of drinking water, and are also non-enforceable. "Contaminant" is defined by the SDWA to include any physical, chemical, biological, or radiological substance.

Originally, the SDWA focused primarily on treatment as the means of providing safe drinking water at the tap. The 1996 amendments greatly enhanced the existing law by recognizing source water protection, operator training, funding for water system improvements, and public information as important components of safe drinking water. This approach helps to ensure the quality of drinking water from the source to the customer's tap.

Under the SDWA, all public water systems are subject to the drinking water standards, enforced as MCLs for particular contaminants. A "public water system" as defined by USEPA is one that provides piped water for human consumption and has at least 15 service connections or regularly serves at least 25 persons. Regulations require these systems to meet MCLs and/or to use certain treatment techniques to protect against adverse health effects. Regulations include prescribed testing, recordkeeping, reporting, and timely notification of failure to meet applicable drinking water standards.

The current primary and secondary drinking water regulations are listed in **Table 4-4**. Each category of contaminant in Table 2-6 is discussed below with respect to occurrence and relevance to this project.

Table 4-4
National Primary Drinking Water Regulations

Microorganisms	MCLG[1] (mg/L)[2]	MCL or TT[1] (mg/L)[2]	Potential Health Effects from Ingestion of Water	Sources of Contaminant in Drinking Water
Cryptosporidium	as of 01/01/02: zero	as of 01/01/02: TT [3]	Gastrointestinal illness (e.g., diarrhea, vomiting, cramps).	Human and animal fecal waste.
Giardia lamblia	zero	TT[3]	Gastrointestinal illness (e.g., diarrhea, vomiting, cramps)	Human and animal fecal waste
Heterotrophic plate count (HPC)	n/a	TT[3]	HPC has no health effects, but can indicate how effective treatment is at controlling microorganisms.	HPC measures a range of bacteria that are naturally present in the environment.
Legionella	zero	TT[3]	Legionnaire's Disease, commonly known as pneumonia.	Found naturally in water; multiplies in heating systems.
Total Coliforms (including fecal coliform and *E. Coli*)	zero	5.0%[4]	Used as an indicator that other potentially harmful bacteria may be present[5].	Coliforms are naturally present in the environment; fecal coliforms and E. coli come from human and animal fecal waste.
Turbidity	n/a	TT[3]	Turbidity is a measure of the cloudiness of water. It is used to indicate water quality and filtration effectiveness (i.e., whether disease-causing organisms are present). Higher turbidity levels are often associated with higher levels of disease-causing microorganisms such as viruses, parasites, and some bacteria. These organisms can cause symptoms such as nausea, cramps, diarrhea, and associated headaches.	Soil runoff
Viruses (enteric)	zero	TT[3]	Gastrointestinal illness (e.g., diarrhea, vomiting, cramps).	Human and animal fecal waste.

Table 4-4 (continued)

Disinfectants & Disinfection Byproducts	**MCLG[1] (mg/L)[2]**	**MCL or TT[1] (mg/L)[2]**	**Potential Health Effects from Ingestion of Water**	**Sources of Contaminant in Drinking Water**
Bromate	as of 01/01/02: zero	as of 01/01/02: 0.010	Increased risk of cancer.	Byproduct of drinking water disinfection.
Chloramines (as Cl_2)	as of 01/01/02: MRDLG=4[1]	as of 01/01/02: MRDL=4.0[1]	Eye/nose irritation; stomach discomfort, anemia.	Water additive used to control microbes.
Chlorine (as Cl_2)	as of 01/01/02: MRDLG=4[1]	as of 01/01/02: MRDL=4.0[1]	Eye/nose irritation; stomach discomfort.	Water additive used to control microbes.
Chlorine dioxide (as ClO_2)	as of 01/01/02: MRDLG=0.8[1]	as of 01/01/02: MRDL=0.8[1]	Anemia; infants and young children: nervous system effects.	Water additive used to control microbes.
Chlorite	as of 01/01/02: 0.8	as of 01/01/02: 1.0	Anemia; infants and young children: nervous system effects.	Byproduct of drinking water disinfection.
Haloacetic acids (HAA5)	as of 01/01/02: n/a[6]	as of 01/01/02: 0.060	Increased risk of cancer.	Byproduct of drinking water disinfection.
Total Trihalomethanes (TTHMs)	none[7] ---------- as of 01/01/02: n/a[6]	0.10 ---------- as of 01/01/02: 0.080	Liver, kidney, or central nervous system problems; increased risk of cancer.	Byproduct of drinking water disinfection.

Inorganic Chemicals	**MCLG[1] (mg/L)[2]**	**MCL or TT[1] (mg/L)[2]**	**Potential Health Effects from Ingestion of Water**	**Sources of Contaminant in Drinking Water**
Antimony	0.006	0.006	Increase in blood cholesterol; decrease in blood glucose.	Discharge from petroleum refineries; fire retardants; ceramics; electronics; solder.
Arsenic	none[7]	0.01 as of 1/23/06	Skin damage; circulatory system problems; increased risk of cancer.	Erosion of natural deposits; runoff from glass and electronics production wastes.
Asbestos (fiber >10 micrometers)	7 million fibers per liter	7 MFL	Increased risk of developing benign intestinal polyps.	Decay of asbestos cement in water mains; erosion of natural deposits.
Barium	2	2	Increase in blood pressure.	Discharge of drilling wastes; discharge from metal refineries; erosion of natural deposits.

Table 4-4 (continued)

Inorganic Chemicals	MCLG[1] (mg/L)[2]	MCL or TT[1] (mg/L)[2]	Potential Health Effects from Ingestion of Water	Sources of Contaminant in Drinking Water
Beryllium	0.004	0.004	Intestinal lesions.	Discharge from metal refineries and coal-burning factories; discharge from electrical, aerospace, and defense industries.
Cadmium	0.005	0.005	Kidney damage.	Corrosion of galvanized pipes; erosion of natural deposits; discharge from metal refineries; runoff from waste batteries and paints.
Chromium (total)	0.1	0.1	Some people who use water containing chromium well in excess of the MCL over many years could experience allergic dermatitis.	Discharge from steel and pulp mills; erosion of natural deposits.
Copper	1.3	TT[8]; Action Level=1.3	Short term exposure: Gastrointestinal distress. Long term exposure: Liver or kidney damage. People with Wilson's Disease should consult their personal doctor if their water systems exceed the copper action level.	Corrosion of household plumbing systems; erosion of natural deposits.
Cyanide (as free cyanide)	0.2	0.2	Nerve damage or thyroid problems.	Discharge from steel/metal factories; discharge from plastic and fertilizer factories.
Fluoride	4.0	4.0	Bone disease (pain and tenderness of the bones); Children may get mottled teeth.	Water additive which promotes strong teeth; erosion of natural deposits; discharge from fertilizer and aluminum factories.
Lead	zero	TT[8]; Action Level=0.015	Infants and children: Delays in physical or mental development. Adults: Kidney problems; high blood pressure.	Corrosion of household plumbing systems; erosion of natural deposits.
Mercury (inorganic)	0.002	0.002	Kidney damage.	Erosion of natural deposits; discharge from refineries and factories; runoff from landfills and cropland.

Table 4-4 (continued)

Inorganic Chemicals	MCLG[1] (mg/L)[2]	MCL or TT[1] (mg/L)[2]	Potential Health Effects from Ingestion of Water	Sources of Contaminant in Drinking Water
Nitrate (measured as Nitrogen)	10	10	"Blue baby syndrome" in infants under six months - life threatening without immediate medical attention. Symptoms: Infant looks blue and has shortness of breath.	Runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural deposits.
Nitrite (measured as Nitrogen)	1	1	"Blue baby syndrome" in infants under six months - life threatening without immediate medical attention. Symptoms: Infant looks blue and has shortness of breath.	Runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural deposits.
Selenium	0.05	0.05	Hair or fingernail loss; numbness in fingers or toes; circulatory problems.	Discharge from petroleum refineries; erosion of natural deposits; discharge from mines.
Thallium	0.0005	0.002	Hair loss; changes in blood; kidney, intestine, or liver problems.	Leaching from ore-processing sites; discharge from electronics, glass, and pharmaceutical companies.

Organic Chemicals	MCLG[1] (mg/L)[2]	MCL or TT[1] (mg/L)[2]	Potential Health Effects from Ingestion of Water	Sources of Contaminant in Drinking Water
Acrylamide	zero	TT[9]	Nervous system or blood problems; increased risk of cancer.	Added to water during sewage/wastewater treatment.
Alachlor	zero	0.002	Eye, liver, kidney or spleen problems; anemia; risk of cancer.	Runoff from herbicide used on row crops.
Atrazine	0.003	0.003	Cardiovascular system problems; reproductive difficulties.	Runoff from herbicide used on row crops.
Benzene	zero	0.005	Anemia; decrease in blood platelets; increased risk of cancer.	Discharge from factories; leaching from gas storage tanks and landfills.
Benzo(a)pyrene (PAHs)	zero	0.0002	Reproductive difficulties; increased risk of cancer.	Leaching from linings of water storage tanks and distribution lines.
Carbofuran	0.04	0.04	Problems with blood or nervous system; reproductive difficulties.	Leaching of soil fumigant used on rice and alfalfa.

Table 4-4 (continued)

Organic Chemicals	MCLG[1] (mg/L)[2]	MCL or TT[1] (mg/L)[2]	Potential Health Effects from Ingestion of Water	Sources of Contaminant in Drinking Water
Carbon tetrachloride	zero	0.005	Liver problems; increased risk of cancer.	Discharge from chemical plants and other industrial activities.
Chlordane	zero	0.002	Liver or nervous system problems; increased risk of cancer.	Residue of banned termiticide.
Chlorobenzene	0.1	0.1	Liver or kidney problems.	Discharge from chemical and agricultural chemical factories.
2,4-D	0.07	0.07	Kidney, liver, or adrenal gland problems.	Runoff from herbicide used on row crops.
Dalapon	0.2	0.2	Minor kidney changes.	Runoff from herbicide used on rights of way.
1,2-Dibromo-3-chloropropane (DBCP)	zero	0.0002	Reproductive difficulties; increased risk of cancer.	Runoff/leaching from soil fumigant used on soybeans, cotton, pineapples, and orchards.
o-Dichlorobenzene	0.6	0.6	Liver, kidney, or circulatory system problems.	Discharge from industrial chemical factories.
p-Dichlorobenzene	0.075	0.075	Anemia; liver, kidney or spleen damage.	Discharge from industrial chemical factories.
1,2-Dichloroethane	zero	0.005	Increased risk of cancer.	Discharge from industrial chemical factories.
1,1-Dichloroethylene	0.007	0.007	Liver problems.	Discharge from industrial chemical factories.
cis-1,2-Dichloroethylene	0.07	0.07	Liver problems.	Discharge from industrial chemical factories.
trans-1,2-Dichloroethylene	0.1	0.1	Liver problems.	Discharge from industrial chemical factories.
Dichloromethane	zero	0.005	Liver problems; risk of cancer.	Discharge from pharmaceutical and chemical factories.

Table 4-4 (continued)

Organic Chemicals	MCLG[1] (mg/L)[2]	MCL or TT[1] (mg/L)[2]	Potential Health Effects from Ingestion of Water	Sources of Contaminant in Drinking Water
1,2-Dichloropropane	zero	0.005	Increased risk of cancer.	Discharge from industrial chemical factories.
Di(2-ethylhexyl) adipate	0.4	0.4	General toxic effects or reproductive difficulties.	Leaching from PVC plumbing systems; discharge from chemical factories.
Di(2-ethylhexyl) phthalate	zero	0.006	Reproductive difficulties; liver problems; increased risk of cancer.	Discharge from rubber and chemical factories.
Dinoseb	0.007	0.007	Reproductive difficulties.	Runoff from herbicide used on soybeans and vegetables.
Dioxin (2,3,7,8-TCDD)	zero	0.00000003	Reproductive difficulties; increased risk of cancer.	Emissions from waste incineration and other combustion; discharge from chemical factories.
Diquat	0.02	0.02	Cataracts.	Runoff from herbicide use.
Endothall	0.1	0.1	Stomach and intestinal problems.	Runoff from herbicide use.
Endrin	0.002	0.002	Nervous system effects.	Residue of banned insecticide.
Epichlorohydrin	zero	TT[9]	Stomach problems; reproductive difficulties; risk of cancer.	Discharge from industrial chemical factories; added to water during treatment process.
Ethylbenzene	0.7	0.7	Liver/kidney problems.	Discharge from petroleum refineries.
Ethylene dibromide	zero	0.00005	Stomach problems; reproductive difficulties; increased risk of cancer.	Discharge from petroleum refineries.
Glyphosate	0.7	0.7	Kidney problems; reproductive difficulties.	Runoff from herbicide use.
Heptachlor	zero	0.0004	Liver damage; increased risk of cancer.	Residue of banned termiticide.
Heptachlor epoxide	zero	0.0002	Liver damage; increased risk of cancer.	Breakdown of heptachlor.

Table 4-4 (continued)

Organic Chemicals	MCLG[1] (mg/L)[2]	MCL or TT[1] (mg/L)[2]	Potential Health Effects from Ingestion of Water	Sources of Contaminant in Drinking Water
Hexachlorobenzene	zero	0.001	Liver or kidney problems; reproductive difficulties; increased risk of cancer.	Discharge from metal refineries and agricultural chemical factories.
Hexachlorocyclopentadiene	0.05	0.05	Kidney or stomach problems.	Discharge from chemical factories.
Lindane	0.0002	0.0002	Liver or kidney problems.	Runoff/leaching from insecticide used on cattle, lumber, gardens.
Methoxychlor	0.04	0.04	Reproductive difficulties.	Runoff/leaching from insecticide used on fruits, vegetables.
Oxamyl (Vydate)	0.2	0.2	Slight nervous system effects.	Runoff/leaching from insecticide used on apples, potatoes/ tomatoes.
Polychlorinated biphenyls (PCBs)	zero	0.0005	Skin changes; thymus gland problems; immune deficiencies; reproductive or nervous system difficulties; increased risk of cancer	Runoff from landfills; discharge of waste chemicals.
Pentachlorophenol	zero	0.001	Liver or kidney problems; increased risk of cancer.	Discharge from wood preserving factories.
Picloram	0.5	0.5	Liver problems.	Herbicide runoff.
Simazine	0.004	0.004	Problems with blood.	Herbicide runoff.
Styrene	0.1	0.1	Liver, kidney, and circulatory problems.	Discharge from rubber and plastic factories; leaching from landfills.
Tetrachloroethylene	zero	0.005	Liver problems; increased risk of cancer.	Discharge from factories and dry cleaners.
Toluene	1	1	Nervous system, kidney, or liver problems.	Discharge from petroleum factories.
Toxaphene	zero	0.003	Kidney, liver, or thyroid problems; increased risk of cancer.	Runoff/leaching from insecticide used on cotton and cattle.
2,4,5-TP (Silvex)	0.05	0.05	Liver problems.	Residue of banned herbicide.
1,2,4-Trichlorobenzene	0.07	0.07	Changes in adrenal glands.	Discharge from textile finishing factories.

Table 4-4 (continued)

Organic Chemicals	MCLG[1] (mg/L)[2]	MCL or TT[1] (mg/L)[2]	Potential Health Effects from Ingestion of Water	Sources of Contaminant in Drinking Water
1,1,1-Trichloroethane	0.20	0.2	Liver, nervous system or circulatory problems.	Discharge from metal degreasing sites and other factories.
1,1,2-Trichloroethane	0.003	0.005	Liver, kidney, or immune system problems.	Discharge from industrial chemical factories.
Trichloroethylene	zero	0.005	Liver problems; increased risk of cancer.	Discharge from petroleum refineries.
Vinyl chloride	zero	0.002	Increased risk of cancer.	Leaching from PVC pipes; discharge from plastic factories.
Xylenes (total)	10	10	Nervous system damage.	Discharge from petroleum factories; discharge from chemical factories.

Radionuclides	MCLG[1] (mg/L)[2]	MCL or TT[1] (mg/L)[2]	Potential Health Effects from Ingestion of Water	Sources of Contaminant in Drinking Water
Alpha particles	none[7] ---------- as of 12/08/03: zero	15 picocuries per Liter (pCi/L)	Increased risk of cancer.	Erosion of natural deposits.
Beta particles and photon emitters	none[7] ---------- as of 12/08/03: zero	4 millirems per year	Increased risk of cancer.	Decay of natural and man-made deposits.
Radium 226 and Radium 228 (combined)	none[7] --------- as of 12/08/03: zero	5 pCi/L	Increased risk of cancer.	Erosion of natural deposits.
Uranium	as of 12/08/03: zero	as of 12/08/03: 30 ug/L	Increased risk of cancer, kidney toxicity.	Erosion of natural deposits.

Notes
[1] Definitions:

Maximum Contaminant Level (MCL) - The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to MCLGs as feasible using the best available treatment technology and taking cost into consideration. MCLs are enforceable standards.
Maximum Contaminant Level Goal (MCLG) - The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety and are non-enforceable public health goals.

Maximum Residual Disinfectant Level (MRDL) - The highest level of a disinfectant allowed in drinking water. There is convincing evidence that addition of a disinfectant is necessary for control of microbial contaminants.
Maximum Residual Disinfectant Level Goal (MRDLG) - The level of a drinking water disinfectant below which there is no known or expected risk to health. MRDLGs do not reflect the benefits of the use of disinfectants to control microbial contaminants.
Treatment Technique - A required process intended to reduce the level of a contaminant in drinking water.

[2] Units are in milligrams per liter (mg/L) unless otherwise noted. Milligrams per liter are equivalent to parts per million.

[3] USEPA's surface water treatment rules require systems using surface water or groundwater under the direct influence of surface water to (1) disinfect their water, and (2) filter their water or meet criteria for avoiding filtration so that the following contaminants are controlled at the following levels:

- *Cryptosporidium*: 99% removal/inactivation
- *Giardia lamblia*: 99.9 percent removal/inactivation
- Viruses: 99.99 percent removal/inactivation
- *Legionella*: No limit, but USEPA believes that if Giardia and viruses are removed/ inactivated, *Legionella* will also be controlled.
- Turbidity: Filtration systems must achieve a filtered water turbidity level of less than or equal to 0.3 NTU for 95 percent of measurements taken each month, and less than or equal to 1.0 NTU at all times. Water utilities are required to record the effluent turbidity of individual filters every 15 minutes. For any individual filter that has a measured turbidity level greater than 1.0 NTU in two consecutive measurements taken 15 minutes apart, a report of the filter number, the turbidity measurement, and the date(s) on which the filter exceeded this limit must be included. In addition, a profile on the individual filter must be maintained and reported to the State, depending on the measurement of NTU that exceeded the limit.
- HPC: No more than 500 bacterial colonies per milliliter.

[4] No more than 5.0 percent samples total coliform-positive in a month. (For water systems that collect fewer than 40 routine samples per month, no more than one sample can be total coliform-positive). Every sample that has total coliforms must be analyzed for fecal coliforms. There may not be any fecal coliforms or *E. coli*.

[5] Fecal coliform and *E. coli* are bacteria whose presence indicates that the water may be contaminated with human or animal wastes. Disease-causing microbes (pathogens) in these wastes can cause diarrhea, cramps, nausea, headaches, or other symptoms. These pathogens may pose a special health risk for infants, young children, and people with severely compromised immune systems.

[6] Although there is no collective MCLG for this contaminant group, there are individual MCLGs for some of the individual contaminants:

- Trihalomethanes: bromodichloromethane (zero); bromoform (zero); dibromochloromethane (0.06 mg/L). Chloroform is regulated with this group but has no MCLG.
- Haloacetic acids: dichloroacetic acid (zero); trichloroacetic acid (0.3 mg/L). Monochloroacetic acid, bromoacetic acid, and dibromoacetic acid are regulated with this group but have no MCLGs.

[7] MCLGs were not established before the 1986 Amendments to the Safe Drinking Water Act. Therefore, there is no MCLG for this contaminant.

[8] Lead and copper are regulated by a Treatment Technique that requires systems to control the corrosiveness of their water. If more than 10% of tap water samples exceed the action level, water systems must take additional steps. For copper, the action level is 1.3 mg/L, and for lead is 0.015 mg/L.

[9] Each water system must certify, in writing, to the state (using third-party or manufacturer's certification) that when acrylamide and epichlorohydrin are used in drinking water systems, the combination (or product) of dose and monomer level does not exceed the levels specified, as follows:

- Acrylamide = 0.05% dosed at 1 mg/L (or equivalent).
- Epichlorohydrin = 0.01% dosed at 20 mg/L (or equivalent).

National Secondary Drinking Water Regulations

National Secondary Drinking Water Regulations (NSDWRs or secondary standards) are non-enforceable guidelines regulating contaminants that may cause cosmetic effects (such as skin or tooth discoloration) or aesthetic effects (such as taste, odor, or color) in drinking water. USEPA recommends secondary standards to water systems but does not require systems to comply as summarized in **Table 4-5**. However, states may choose to adopt them as enforceable standards.

Table 4-5
National Secondary Drinking Water Standards

Contaminant	Secondary Standard
Aluminum	0.05 to 0.2 mg/L
Chloride	250 mg/L
Color	15 (color units)
Copper	1.0 mg/L
Corrosivity	Noncorrosive
Fluoride	2.0 mg/L
Foaming Agents	0.5 mg/L
Iron	0.3 mg/L
Manganese	0.05 mg/L
Odor	3 threshold odor number
pH	6.5-8.5
Silver	0.10 mg/L
Sulfate	250 mg/L
Total Dissolved Solids	500 mg/L
Zinc	5 mg/L

Microorganisms

Conventional coagulation/clarification/filtration and chlorine disinfection meets all current federal requirements for control of microorganisms. However, recent regulations are more restrictive with respect to *Cryptosporidium*.

Disinfectants and Disinfection By-products (D/DBPs)

The RO and granular activated carbon (GAC) processes will remove the majority of the DBP pre-cursors, thereby minimizing DBP formation. The DBP formation potential of RO and GAC treated water will be evaluated as part of the Pilot Study.

Inorganic Chemicals

Compliance should be achievable with membrane filtration and reverse osmosis.

Organic Chemicals

The selected process (microfiltration/ultrafiltration, RO, and GAC) provides a multi-barrier approach for removal of organic chemicals. Contaminant removal will be demonstrated in the Pilot Study.

Radionuclides

Except for one sample, all radionuclides in the water quality sampling were below MCLs. The one exception, was a gross beta level of 62 pCi/L in one sample from Site 5. The treatment process will remove most radionuclides, except for tritium.

4.3.1 Current Regulations

Under the 1996 SDWA Amendments, the USEPA developed several regulations that became effective in late 1990's and early 2006 and will affect the HWSP. These regulations are the Interim Enhanced Surface Water Treatment Rule (IESWTR), Stage 1 D/DBPR, Stage 2 D/DBPR, the Long Term Stage 1 Enhanced Surface Water Treatment Rule (LT1ESWTR), the Long Term Stage 2 Enhanced Surface Water Treatment Rule (LT2ESWTR), Filter Backwash Recycling Rule (FBRR), Ground Water Rule, and the Lead and Copper Rule (LCR) revisions.

4.3.1.1 IESWTR and LT1ESWTR Turbidity Requirements

As part of the IESWTR, promulgated in 1998, turbidity can be measured in two ways: combined filter effluent (CFE) and individual filter effluent (IFE). As of January 1, 2002, where population served is equal or greater than 10,000 people, the CFE value recorded at least every 4 hours must not exceed 0.3 NTU in at least 95 percent of the measurements taken each month. The LT1ESWTR subsequently applied this limit to smaller surface water systems. Additionally, the CFE level of representative samples must not exceed 1.0 NTU at any time. The most significant change in the monitoring requirements is that the utility is required to record the IFE every 15 minutes. In addition to the past reporting and record keeping requirements, the utility is required to report turbidity measurements within 10 days after the end of each month. Information in this report must include the following:

- The total number of CFE measurements taken during the month.
- The number and percentage of CFE measurements taken during the month, which are less than or equal to the 95 percent limit.
- The date and value of any CFE measurements taken during the month, which exceed 1.0 NTU for systems using conventional filtration treatment or direct filtration, or which exceed the maximum level set by the state.
- The IFE monitoring conducted and any follow-up actions taken for exceedances during the month.

Utilities must maintain their record keeping for the above requirements for a minimum of three years. The additional IFE follow-up and reporting requirements include:

- For any IFE recordings greater than 1.0 NTU in two consecutive measurements taken 15 minutes apart, a report of the filter number, the turbidity value, the date(s) on which the filter exceeded the limit and the cause (if known) must be reported to

NYSDOH. In cases where cause for an exceedance is unknown, a profile on the individual filter must be produced within 7 days and reported to NYSDOH.

- For any IFE recordings greater than 1.0 NTU in two consecutive measurements taken 15 minutes apart at the same filter for 3 months in a row, filter self-assessment should be conducted within 14 days and a report of the filter number, the turbidity value, the date(s) on which the filter exceeded the limit, and the produced filter self-assessment must be reported to NYSDOH.
- If two consecutive IFE recordings exceed 2.0 NTU and were taken 15 minutes apart at the same filter for 2 months in a row, a comprehensive performance evaluation (CPE) must be performed within 30 days and the CPE report must be submitted to NYSDOH within 90 days. In addition, a report including the filter number, turbidity value and the date(s) on which the filter exceeded the limit shall be submitted to NYSDOH by the 10th of the following month.

4.3.1.2 Stage 1 D/DBPR MCLs for Disinfection By-Products

The Stage 1 D/DBPR, which intended to reduce the levels of disinfectants and disinfection by-products (DBPs) in drinking water supplies, became effective in February 1999. Under the D/DBPR, two groups of chlorinated DBPs – total trihalomethanes (TTHMs) and five haloacetic acids (HAA5) - are regulated in two stages. In Stage 1, USEPA set MCLs of 80 µg/L and 60 µg/L, as annual averages, for TTHMs and HAA5, respectively. Compliance is defined on the basis of a running annual average (RAA) of quarterly averages of all samples. Monitoring requirements for systems serving 10,000 people or more include collection of four water samples from the distribution system per quarter per treatment plant. The sampling locations should be representative of the average residence time in the distribution system with at least 25 percent of the samples to be taken at locations that represent the maximum residence time of water. For systems monitoring quarterly, if the RAA of quarterly averages covering any consecutive four-quarter period exceeds the MCL, the system is in violation of the MCL and must notify the public, in addition to reporting to the State.

In addition, MRDLs in the distribution system were established for chlorine (4 mg/L), chloramines (4 mg/L), and chlorine dioxide (0.8 mg/L). **Table 4-6** provides the final MRDLGs and MRDLs. **Table 4-7** includes the MCLs and MCLGs for the disinfection byproducts.

4.3.1.3 Total Organic Carbon (TOC) Removal

The Stage 1 D/DBPR also requires that utilities achieve specific TOC removals to control DBP precursors. The amount of TOC that must be removed is dependent upon the alkalinity and TOC concentration of the raw water. Table 2-10 shows the percent removal of TOC that is required under this Rule. Percent removal is measured upstream of the point of primary disinfection. Thus, if chlorine is not added until after the filters for chlorine contact time, then the TOC of the filtered water may be compared to the TOC of the raw water to calculate TOC removal.

Table 4-6
Stage 1 MRDLGs and MRDLs for Disinfectants

Parameter	MRDLG (mg/L)	MRDL (mg/L)	Compliance Based On	Routine Monitoring
Chlorine	4.0	4 (as free Cl_2)	RAA	TCR sampling
Chloramines	4.0	4 (as combined Cl_2)	RAA	TCR sampling
Chlorine Dioxide	0.8	0.8 (as ClO_2)	Sample results collected on two consecutive days	Daily at entry point

Table 4-7
Stage 1 MCLGs and MCLs for Disinfection By-Products

Parameter	MCLG (mg/L)	MCDL (mg/L)	Compliance Based On	Routine Monitoring
Chlorite	0.8	1.0	Average of each 3-sample set*	Daily at entry point, monthly in distribution system
Bromate	0	0.010	RAA	Monthly at entry point
TTHMs	n/a	0.080	RAA	4/plant/qtr
HAAs(5)	n/a	0.060	RAA	4/plant/qtr
Chloroform	0	n/a	-	-
Bromodichloromethane	0	n/a	-	-
Dibromochloromethane	0.06	n/a	-	-
Bromoform	0	n/a	-	-
Dichloroacetic acid	0	n/a	-	-
Trichloroacetic acid	0.3	n/a	-	-

Notes:
*A set of samples collected for chlorite on the same day in the distribution system at the following sites: one at the first customer served, one at a representative site and one at the water's maximum residence time.

The TOC removal requirements would most likely be met with a combination of pretreatment, RO, and GAC.

Table 4-8
TOC Percent Removal

Source-Water TOC (mg/L)	Source-Water Alkalinity (mg/L as $CaCO_3$)		
	<60	60-120	>120
> 2.0-4.0	35	25	15
> 4.0-8.0	45	35	25
> 8.0	50	40	30

The Stage 1 D/DBPR provides exemptions for enhanced coagulation. The key exemptions are:

1. Source or treated water TOC running average is below 2.0 mg/L
2. TTHM < 40 ppb, HAAs < 30 ppb, and use only free chlorine
3. Source water specific ultraviolet absorbance (SUVA) ≤ 2.0 L/mg•m running annual average
4. Finished water SUVA ≤ 2.0 L/mg•m

4.3.1.4 Disinfection Profiling/Benchmarking

Under the IESWTR, a utility must monitor daily for a period of 12 consecutive calendar months to determine the total logs of *Giardia lamblia* inactivation for each day of operation based on the published CT99.9 values throughout the entire treatment plant. Additionally, any utility that uses either chloramines or ozone for primary disinfection must also calculate the logs inactivation for viruses using a method approved by NYSDOH.

If a system is modifying its disinfection practices to comply with the new regulations, it must calculate their disinfection benchmark by determining the lowest average monthly *Giardia lamblia* inactivation in each year of profiling data. They must also determine the average *Giardia lamblia* inactivation for each calendar month for each year of profiling data.

4.3.1.5 Stage 2 D/DBPR MCLs and MCLGs for Disinfection Byproducts

The final Stage 2 D/DBPR, as promulgated in January 2006, is designed to reduce DBP occurrence peaks in the distribution system based on changes to compliance monitoring provisions. Compliance monitoring is preceded by an Initial Distribution System Evaluation (IDSE) to find the worst-case distribution system sample points. These locations will then be used by the systems as the sampling sites for Stage 2 DBP rule compliance monitoring. The number of compliance monitoring sites is determined by the population served and the source water type. Compliance is defined on the basis of a locational running annual average (LRAA) of TTHMs and

HAA5. Compliance must be met at each monitoring location, instead of system-wide using the RAA under the Stage 1 D/DBPR. The Stage 2 D/DBPR will limit all sample points in the distribution system to RAA of 80 μg/L TTHMs and 60 μg/L of HAA5.

4.3.1.6 LT2ESWTR *Cryptosporidium* Treatment Details

The LT2ESWTR was released simultaneously with Stage 2 DBPR on January 4, 2006 to address concerns about risk tradeoffs between pathogens and DBPs.

In order to have an extra barrier to *Cryptosporidium*, additional removal/inactivation capabilities like UV are recommended as soon as affordable in the future. Level of treatment required based on LT2ESWTR is listed as follows:

- If the average *Cryptosporidium* concentration is between 0.075/L and 1.0/L, then 1 log treatment is required.
- If the average *Cryptosporidium* concentration is between 1/L and 3/L, then 2 log treatment is required with at least 1 log being by ozone, chlorine dioxide, UV, membranes, bag/cartridge filters, or in-bank filtration.
- If the average *Cryptosporidium* concentration is over 3.0/L, then 2.5 log treatment is required with at least 1 log being by ozone, chlorine dioxide, UV, membranes, bag/cartridge filters, or in-bank filtration.

Cryptosporidium removal/inactivation requirements listed in final Rule are as follow:

- Watershed Control Program: 0.5 log credit and reductions in cysts as measured.
- Alternative sources such as intake relocation: credit based on measured drop in cysts.
- Pretreatment: Days of raw water storage and pre-settling with coagulant get 0.5 log credit. Weeks of raw water storage and in-bank filtration get 1 log credit.
- Improved treatment: Monthly CFE turbidity of 0.15 NTU or less 95 percent of the time gets extra 0.5 log credit. Monthly IFE turbidity of 0.15 NTU or less 95 percent of the time with no individual filters greater than 0.3 NTU in two consecutive days get an extra 0.5 log credit. Slow sand filters and membranes get greater than 2.5 log credit.
- Improved disinfection with chlorine dioxide, ozone, and UV.

4.3.1.7 Filter Backwash Recycling Rule (FBRR)

FBRR published on June 8, 2001 applies to all systems that use surface water or groundwater under the influence of surface water, employ conventional or direct filtration, and recycle one or more of the following:

- Spent filter backwash water.
- Thickener supernatant.

- Liquids from dewatering processes.

Per FBRR, the utility has to report the following to NYSDOH:

- Intent to recycle in writing.
- A plant schematic showing the origin of all recycle flows, hydraulic conveyance used to transport the recycle flows, and location where they are recycled back into the plant.
- Details of typical recycle flow, design flow for the WTP, and State-approved operating capacity.

In addition, the systems must collect and retain on file the following:

- A copy of the recycle notification form.
- A list of all recyle flows and the frequency at which they are returned.
- Average and maximum backwash flow rates through the filters and the average and maximum duration of the filter backwash process, in minutes.
- Typical filter run length and a written summary of how filter run length is determined.
- If applicable, the type of treatment provided for the recycle stream before it enters the conventional process.
- If applicable, data about the physical dimensions of the recycle treatment units, typical and maximum hydraulic loading rates, etc.

4.3.1.8 Ground Water Rule (GWR)

USEPA promulgated the final GWR in October 2006 that applies to all public water supply (PWS) systems that use groundwater. The rule also applies to systems that mix surface and groundwater and if the groundwater is added directly to the distribution system and provided to consumers without equivalent surface water treatment.

Major components of the final GWR include:

- Periodic sanitary surveys to identify the significant deficiencies. The initial survey is to be completed by December 31, 2012 for all community water systems.
- Source water monitoring to test for *E. coli*, enterococci, or coliphage in the sample.
- Corrective actions to rectify significant deficiency or source water fecal contamination.
- Compliance monitoring to ensure that the treatment technology installed is able to meet 99.99 percent inactivation or removal of viruses.

4.3.1.9 Lead and Copper Rule Revisions

On January 12, 2000, the USEPA published minor revisions to the 1991 Lead and Copper Rule (LCR). The purpose of the Lead and Copper Rule Minor Revisions (LCRMR) is to eliminate unnecessary requirements, streamline and reduce reporting burden, and promote consistent national implementation. In some cases, USEPA has added language, which clarifies requirements and corrects oversights in the original rule. These revisions do not affect the lead or copper MCLGs, the action levels (ALs), or the basic regulatory requirements of the rule.

Additional changes to the LCR were prepared on July 18, 2006 (USEPA, 2006). Relevant changes include requiring water systems to:

- Provide advanced notification to the primacy agency or intended changes in treatment or source water that could increase corrosion of lead.
- Provide a notification of tap water monitoring results for lead to owners and/or occupants of homes and buildings that are part of the utility's sampling program.

The USEPA is also proposing to change the content of the message to be provided to consumers, how the materials are delivered to consumers, and the timeframe in which materials must be delivered after a lead AL exceedance.

In the proposed revisions in June 2006, the USEPA requires PWSs to provide advanced notification to the state primacy agency of intended changes in treatment or source water that could increase corrosion of lead. The primacy agency must approve the planned changes using a process that will allow them and the PWSs to take as much time as needed to consult about potential problems.

4.3.1.10 Total Coliform Rule Revisions

On July 14, 2010, the EPA published proposed revisions to the Total Coliform Rule (TCR). Last updated in 1989, the TCR establishes requirements for monitoring and treatment of pathogens, including distribution system monitoring. Key elements of the proposed rule changes include the following:

- Eliminates the MCL and MCLG for total coliform and replaces it with an MCL and MCLG of zero for E. coli.
- Establishes a treatment technique requirement for total coliform and E. coli as an indicator of a potential pathway of contamination into the distribution system. Exceedances trigger the need to perform an assessment for sanitary defects.
- Ties monitoring requirements to contamination risk and system performance.
- Modifies violations and public notification requirements based on the new MCL and treatment technique requirements.

4.3.2 Compliance with Current Regulations

The water treatment plant will provide treatment that meets or exceeds the applicable rules and regulations outlined above and in accordance with NYSDOH requirements, including the *Recommended Standards for Water Works* (also known as the *Ten State Standards*).

Appendix A

Appendix A
United Water New York Water Supplies – Montly Water Production, 2000 - 2010

Month	2000		2001		2002*		2003		2004		2005		2006		2007		2008		2009		2010		Average		Average w/o 2002	
	Volume	% of Total	Volume	% of Total	Volume	% of Total	Volume	% of Total	Volume	% of Total	Volume	% of Total	Volume	% of Total	Volume	% of Total	Volume	% of Total	Volume	% of Total	Volume	% of Total	Volume	% of Total	Volume	% of Total
January	26.9		27.4		26.3		27.8		28.3		27.4		28.0		27.7		27.3		28.1		26.9		27.4		27.6	
Lake DeForest	8.2	30.3%	8.1	29.6%	8.6	32.6%	8.0	28.6%	9.0	31.9%	8.4	30.7%	7.3	26.1%	8.8	31.9%	5.6	20.6%	7.5	26.7%	7.5	27.8%	7.9	28.6%	7.8	28.4%
Ramapo Valley Well Field	5.8	21.9%	5.1	18.7%	3.6	13.6%	9.3	33.6%	8.0	28.2%	7.4	27.2%	7.6	26.0%	7.0	25.1%	8.7	32.0%	8.5	30.3%	9.7	36.1%	7.4	26.8%	7.7	28.1%
System Wells	12.8	47.6%	14.2	51.8%	14.1	53.6%	10.5	37.8%	11.3	40.0%	11.5	42.1%	12.8	45.8%	11.9	43.0%	13.0	47.5%	12.1	43.1%	9.7	36.2%	12.2	44.4%	12.0	43.5%
Letchworth Reservoirs	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Total	26.9	100.0%	27.4	100.0%	26.3	100.0%	27.8	100.0%	28.3	100.0%	27.4	100.0%	28.0	100.0%	27.7	100.0%	27.3	100.0%	28.1	100.0%	26.9	100.0%	27.4	100.0%	27.6	100.0%
February	28.0		26.4		25.2		28.3		27.9		27.3		28.4		28.9		27.3		28.1		26.6		27.5		27.7	
Lake DeForest	8.0	28.5%	8.0	30.3%	5.2	20.7%	8.0	28.2%	9.0	32.3%	9.3	33.9%	8.0	28.1%	8.5	29.3%	7.4	27.0%	7.3	26.1%	7.4	27.8%	7.8	28.4%	8.1	29.1%
Ramapo Valley Well Field	5.8	20.1%	4.2	15.9%	8.2	32.6%	8.8	31.3%	7.7	27.6%	8.5	31.1%	8.0	28.2%	7.4	25.6%	8.6	31.6%	8.4	29.7%	9.1	34.0%	7.7	28.0%	7.6	27.5%
System Wells	14.4	51.4%	14.2	53.8%	11.7	46.7%	11.4	40.5%	11.2	40.1%	9.5	35.0%	12.4	43.7%	13.0	45.1%	11.3	41.4%	12.4	44.1%	10.2	38.2%	12.0	43.6%	12.0	43.3%
Letchworth Reservoirs	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Total	28.0	100.0%	26.4	100.0%	25.2	100.0%	28.3	100.0%	27.9	100.0%	27.3	100.0%	28.4	100.0%	28.9	100.0%	27.3	100.0%	28.1	100.0%	26.6	100.0%	27.5	100.0%	27.7	100.0%
March	27.5		26.5		25.0		28.3		27.6		27.1		28.9		28.0		27.2		28.0		26.6		27.5		27.7	
Lake DeForest	7.9	28.6%	8.0	30.2%	4.4	17.6%	8.7	30.6%	9.3	33.2%	8.1	29.7%	8.0	27.6%	9.2	31.9%	7.2	26.5%	7.9	28.2%	7.3	27.1%	7.8	28.3%	8.1	29.2%
Ramapo Valley Well Field	5.9	21.3%	4.6	17.3%	9.9	39.6%	9.0	31.9%	7.5	27.0%	8.5	31.5%	8.8	30.6%	8.0	27.7%	8.6	31.7%	7.7	27.5%	9.5	35.4%	8.0	29.2%	7.8	28.2%
System Wells	13.7	49.9%	13.9	52.5%	10.7	42.7%	10.6	37.6%	11.1	39.9%	10.5	38.6%	12.0	41.7%	11.7	40.4%	11.4	41.7%	13.0	46.3%	10.1	37.6%	11.7	42.6%	11.8	42.6%
Letchworth Reservoirs	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Total	27.5	100.0%	26.5	100.0%	25.0	100.0%	28.3	100.0%	27.6	100.0%	27.1	100.0%	28.9	100.0%	28.0	100.0%	27.2	100.0%	28.0	100.0%	26.6	100.0%	27.5	100.0%	27.7	100.0%
April	27.0		26.9		25.1		27.7		28.1		28.4		30.0		28.8		29.0		28.0		27.2		27.6		28.1	
Lake DeForest	8.0	29.7%	8.0	29.8%	6.5	26.0%	8.9	32.1%	9.5	33.7%	8.1	28.7%	8.6	28.7%	9.2	32.1%	8.4	29.0%	7.3	26.0%	8.7	32.1%	8.3	29.8%	8.5	30.1%
Ramapo Valley Well Field	5.8	21.5%	6.8	25.3%	9.4	37.4%	9.0	32.5%	7.2	25.5%	8.7	30.5%	9.3	31.1%	8.5	29.5%	8.4	29.1%	8.3	29.5%	8.8	32.3%	8.2	29.4%	8.1	28.7%
System Wells	13.2	48.8%	12.1	45.1%	9.2	36.6%	9.8	35.3%	11.5	40.8%	11.6	40.8%	12.1	40.2%	11.1	38.4%	12.2	42.0%	12.5	44.5%	9.7	35.6%	11.3	40.8%	11.6	41.1%
Letchworth Reservoirs	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Total	27.0	100.0%	26.9	100.0%	25.1	100.0%	27.7	100.0%	28.1	100.0%	28.4	100.0%	30.0	100.0%	28.8	100.0%	29.0	100.0%	28.0	100.0%	27.2	100.0%	27.6	100.0%	28.1	100.0%
May	29.7		32.8		26.0		28.0		29.7		30.6		32.9		32.7		30.7		29.9		29.4		30.2		30.6	
Lake DeForest	9.5	32.1%	10.7	32.7%	7.2	27.9%	8.9	31.7%	9.7	32.8%	9.1	29.8%	9.8	29.9%	10.2	31.3%	9.6	31.2%	8.7	28.9%	9.2	31.4%	9.3	30.9%	9.5	31.1%
Ramapo Valley Well Field	5.8	19.6%	6.4	19.6%	9.9	38.3%	8.8	31.3%	7.3	24.4%	8.6	28.1%	9.3	28.3%	8.8	26.8%	8.4	27.4%	8.3	27.6%	7.1	24.3%	8.1	26.7%	7.9	25.7%
System Wells	14.4	48.3%	15.7	47.7%	8.8	33.8%	10.4	37.0%	12.7	42.7%	13.0	42.4%	13.7	41.8%	13.7	41.9%	12.4	40.4%	12.5	41.7%	12.7	43.3%	12.7	42.1%	13.1	42.8%
Letchworth Reservoirs	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.3	1.0%	0.5	1.5%	0.3	1.1%	0.1	0.3%	0.1	0.4%
Total	29.7	100.0%	32.8	100.0%	26.0	100.0%	28.0	100.0%	29.7	100.0%	30.6	100.0%	32.9	100.0%	32.7	100.0%	30.7	100.0%	29.9	100.0%	29.4	100.0%	30.2	100.0%	30.6	100.0%
June	32.1		32.9		26.1		29.2		32.2		36.4		33.5		36.4		34.2		29.8		34.8		32.9		33.3	
Lake DeForest	10.0	31.3%	10.8	33.0%	8.0	32.2%	9.4	32.1%	9.6	29.9%	12.6	34.7%	12.5	37.5%	14.6	38.0%	12.1	35.3%	11.5	38.5%	11.1	32.0%	11.2	34.1%	11.4	34.3%
Ramapo Valley Well Field	5.8	18.1%	6.2	18.8%	8.7	34.4%	8.9	30.5%	7.5	23.3%	7.8	21.4%	8.8	26.1%	7.4	19.1%	7.6	22.4%	8.0	26.9%	7.9	22.7%	7.8	23.7%	7.6	22.7%
System Wells	16.2	50.6%	15.8	48.2%	9.3	33.3%	10.9	37.4%	16.1	46.8%	16.0	43.9%	12.2	36.4%	15.7	41.0%	13.3	39.0%	9.2	30.8%	14.7	42.4%	13.5	41.1%	13.9	41.8%
Letchworth Reservoirs	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.7	1.9%	1.1	3.3%	1.1	3.8%	1.0	2.9%	0.4	1.1%	0.4	1.2%
Total	32.1	100.0%	32.9	100.0%	26.1	100.0%	29.2	100.0%	32.2	100.0%	36.4	100.0%	33.5	100.0%	36.4	100.0%	34.2	100.0%	29.8	100.0%	34.8	100.0%	32.9	100.0%	33.3	100.0%
July	32.8		34.2		30.0		33.3		33.6		35.5		35.7		37.2		35.3		30.6		37.3		34.1		34.5	
Lake DeForest	11.2	34.3%	11.6	33.8%	9.4	31.2%	10.5	31.6%	11.6	34.4%	12.6	35.5%	13.6	38.0%	14.9	40.1%	12.2	34.7%	11.9	38.8%	14.2	38.1%	12.2	35.6%	12.4	36.0%
Ramapo Valley Well Field	5.9	18.1%	6.4	18.7%	6.1	20.2%	7.9	23.6%	7.1	21.0%	6.5	18.3%	8.8	24.6%	5.2	14.0%	4.2	11.8%	8.3	27.2%	5.7	15.2%	6.6	19.2%	6.6	19.1%
System Wells	15.6	47.7%	16.2	47.5%	14.5	48.5%	14.8	44.6%	15.0	44.6%	16.4	46.1%	13.4	37.4%	15.7	42.0%	17.5	49.6%	9.4	30.8%	16.3	43.8%	15.0	43.9%	15.0	43.5%
Letchworth Reservoirs	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	1.4	3.8%	1.4	3.9%	1.0	3.4%	1.1	3.0%	0.4	1.3%	0.5	1.4%
Total	32.8	100.0%	34.2	100.0%	30.0	100.0%	33.3	100.0%	33.6	100.0%	35.5	100.0%	35.7	100.0%	37.2	100.0%	35.3	100.0%	30.6	100.0%	37.3	100.0%	34.1	100.0%	34.5	100.0%
August	29.8		36.2		29.1		31.4		31.4		37.5		37.0		35.7		33.8		30.5		34.7		33.4		33.8	
Lake DeForest	9.4	31.6%	12.0	33.1%	10.9	37.6%	9.7	30.9%	10.4	33.1%	14.6	39.0%	14.2	38.4%	14.0	39.1%	11.6	34.5%	11.6	38.1%	12.0	34.5%	11.9	35.5%	11.9	35.4%
Ramapo Valley Well Field	5.8	19.5%	5.9	16.2%	4.3	14.8%	8.0	25.7%	6.9	21.9%	5.1	13.6%	7.9	21.3%	6.6	18.5%	4.7	13.9%	7.0	22.8%	5.5	15.8%	6.1	18.4%	6.3	18.7%
System Wells	14.6	48.9%	18.4	50.8%	13.8	47.5%	13.6	43.5%	14.1	45.0%	17.8	47.5%	14.2	38.5%	13.7	38.5%	16.2	48.1%	10.8	35.4%	16.6	47.8%	14.9	44.7%	15.0	44.4%
Letchworth Reservoirs	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.7	1.8%	1.4	4.0%	1.2	3.5%	1.1	3.7%	0.7	1.9%	0.5	1.4%	0.5	1.5%
Total	29.8	100.0%	36.2	100.0%	29.1	100.0%	31.4	100.0%	31.4	100.0%	37.5	100.0%	37.0	100.0%	35.7	100.0%	33.8	100.0%	30.5	100.0%	34.7	100.0%	33.4	100.0%	33.8	100.0%

Appendix A
United Water New York Water Supplies – Montly Water Production, 2000 - 2010

Month	2000		2001		2002*		2003		2004		2005		2006		2007		2008		2009		2010		Average		Average w/o 2002	
	Volume	% of Total	Volume	% of Total	Volume	% of Total	Volume	% of Total	Volume	% of Total	Volume	% of Total	Volume	% of Total	Volume	% of Total	Volume	% of Total	Volume	% of Total	Volume	% of Total	Volume	% of Total	Volume	% of Total
September	**28.7**		**31.2**		**28.9**		**28.2**		**30.2**		**35.0**		**31.4**		**34.8**		**31.8**		**29.5**		**32.2**		**30.9**		**31.3**	
Lake DeForest	8.7	30.1%	10.1	32.4%	8.4	31.1%	8.7	31.1%	9.2	30.6%	14.2	40.6%	12.2	38.8%	13.0	37.5%	9.0	28.2%	11.8	40.0%	12.2	38.0%	10.7	34.6%	10.9	34.9%
Ramapo Valley Well Field	5.5	19.2%	4.1	13.0%	3.5	13.1%	8.0	28.5%	6.9	22.9%	3.8	10.8%	8.5	27.0%	5.5	15.8%	8.2	25.9%	7.0	23.8%	5.7	17.7%	6.1	19.6%	6.3	20.2%
System Wells	14.5	50.6%	17.0	54.6%	16.0	55.7%	11.4	40.5%	14.0	46.5%	17.0	48.6%	10.1	32.3%	15.4	44.2%	14.0	44.1%	9.5	32.3%	13.9	43.2%	13.8	44.7%	13.7	43.8%
Letchworth Reservoirs	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.6	1.9%	0.9	2.6%	0.6	1.8%	1.2	4.0%	0.3	1.1%	0.3	1.0%	0.4	1.1%
Total	28.7	100.0%	31.2	100.0%	28.9	100.0%	28.2	100.0%	30.2	100.0%	35.0	100.0%	31.4	100.0%	34.8	100.0%	31.8	100.0%	29.5	100.0%	32.2	100.0%	30.9	100.0%	31.3	100.0%
October	**27.0**		**28.3**		**25.9**		**28.8**		**27.8**		**29.3**		**29.1**		**30.6**		**28.2**		**26.6**		**28.9**		**27.9**		**28.0**	
Lake DeForest	8.0	29.7%	10.8	38.2%	7.1	27.3%	7.9	28.5%	7.8	28.6%	8.5	29.0%	11.5	39.6%	8.7	28.6%	8.5	29.9%	9.9	37.1%	7.1	26.5%	8.7	31.3%	8.9	31.7%
Ramapo Valley Well Field	5.5	20.2%	1.2	4.1%	4.4	16.9%	8.2	30.7%	6.9	25.1%	7.4	25.2%	7.2	24.9%	6.2	20.3%	6.4	22.7%	6.5	24.3%	8.6	32.0%	6.2	22.3%	6.4	22.9%
System Wells	13.5	50.0%	16.3	57.7%	14.4	55.8%	10.7	38.8%	12.9	46.3%	13.4	45.8%	9.9	34.0%	15.6	51.1%	13.4	47.4%	9.1	34.3%	11.1	41.3%	12.7	45.6%	12.6	44.9%
Letchworth Reservoirs	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.4	1.5%	0.0	0.0%	0.0	0.0%	1.1	4.3%	0.0	0.1%	0.1	0.5%	0.2	0.6%
Total	27.0	100.0%	28.3	100.0%	25.9	100.0%	28.8	100.0%	27.8	100.0%	29.3	100.0%	29.1	100.0%	30.6	100.0%	28.2	100.0%	26.6	100.0%	28.9	100.0%	27.9	100.0%	28.0	100.0%
November	**26.3**		**26.8**		**25.7**		**26.2**		**26.4**		**29.4**		**27.9**		**26.7**		**27.4**		**25.9**		**25.3**		**26.7**		**26.8**	
Lake DeForest	8.1	30.7%	10.6	39.7%	4.6	18.1%	7.6	29.0%	8.0	30.3%	5.6	19.2%	8.1	28.9%	3.7	14.0%	8.5	31.2%	8.7	33.6%	8.4	33.2%	7.5	27.9%	7.7	28.9%
Ramapo Valley Well Field	5.4	20.4%	1.1	4.3%	7.1	27.5%	8.1	31.0%	6.9	26.1%	10.1	34.5%	8.4	30.1%	8.7	32.6%	9.0	32.9%	6.7	25.9%	9.4	37.4%	7.4	27.6%	7.4	27.6%
System Wells	12.9	48.9%	15.0	56.0%	14.0	54.4%	10.5	40.0%	11.5	43.5%	13.6	46.3%	11.0	39.5%	14.3	53.4%	9.8	35.9%	9.8	37.7%	7.4	29.4%	11.8	44.1%	11.6	43.1%
Letchworth Reservoirs	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.4	1.6%	0.0	0.0%	0.0	0.0%	0.7	2.8%	0.0	0.0%	0.1	0.4%	0.1	0.4%
Total	26.3	100.0%	26.8	100.0%	25.7	100.0%	26.2	100.0%	26.4	100.0%	29.4	100.0%	27.9	100.0%	26.7	100.0%	27.4	100.0%	25.9	100.0%	25.3	100.0%	26.7	100.0%	26.8	100.0%
December	**26.6**		**26.5**		**26.8**		**27.2**		**26.7**		**29.0**		**27.9**		**26.6**		**27.2**		**25.9**		**26.2**		**27.0**		**27.0**	
Lake DeForest	8.1	30.4%	9.6	36.5%	6.7	25.0%	8.0	29.3%	8.1	30.3%	4.9	16.9%	8.1	28.9%	3.5	13.1%	8.8	32.4%	8.6	33.3%	7.7	29.5%	7.5	27.7%	7.5	27.9%
Ramapo Valley Well Field	5.0	18.7%	3.1	11.8%	9.1	34.0%	8.3	30.4%	6.9	25.9%	9.0	31.2%	6.5	23.3%	8.3	31.2%	9.2	33.7%	9.1	35.3%	9.4	35.8%	7.6	28.3%	7.5	27.7%
System Wells	13.5	50.9%	13.7	51.7%	11.0	41.1%	11.0	40.3%	11.7	43.8%	15.0	51.9%	13.1	46.8%	14.8	55.7%	9.2	33.9%	8.1	31.4%	9.1	34.7%	11.8	43.9%	11.9	44.2%
Letchworth Reservoirs	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.3	1.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.1%	0.0	0.1%
Total	26.6	100.0%	26.5	100.0%	26.8	100.0%	27.2	100.0%	26.7	100.0%	29.0	100.0%	27.9	100.0%	26.6	100.0%	27.2	100.0%	25.9	100.0%	26.2	100.0%	27.0	100.0%	27.0	100.0%
Yearly Average	**28.6**		**29.7**		**26.7**		**28.5**		**29.2**		**31.1**		**30.9**		**31.4**		**29.9**		**28.4**		**29.5**		**29.4**		**29.7**	
Lake DeForest	8.8	30.7%	9.9	33.3%	7.4	27.6%	8.7	30.4%	9.3	31.8%	9.7	31.2%	10.2	32.9%	9.9	31.4%	9.1	30.3%	9.3	32.9%	9.4	31.8%	9.2	31.3%	9.4	31.7%
Ramapo Valley Well Field	5.7	19.8%	4.6	15.5%	7.1	26.6%	8.5	29.9%	7.2	24.8%	7.6	24.5%	8.3	26.8%	7.3	23.2%	7.7	25.8%	7.8	27.5%	8.0	27.2%	7.3	24.6%	7.3	24.5%
System Wells	14.1	49.5%	15.2	51.3%	12.2	45.8%	11.3	39.6%	12.7	43.4%	13.8	44.4%	12.3	39.7%	13.9	44.2%	12.8	42.8%	10.7	37.6%	11.8	40.0%	12.6	43.5%	12.9	43.3%
Letchworth Reservoirs	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.2	0.7%	0.4	1.2%	0.4	1.3%	0.6	2.0%	0.3	1.0%	0.2	0.6%	0.2	0.6%
Total	28.6	100.0%	29.7	100.0%	26.7	100.0%	28.5	100.0%	29.2	100.0%	31.1	100.0%	30.9	100.0%	31.4	100.0%	29.9	100.0%	28.4	100.0%	29.5	100.0%	29.4	100.0%	29.7	100.0%

Appendix B

Table 1A - Summary of Historical Hudson River Water Quality
Laboratory Analytical Data, Clean Water Act Methods (40 CFR 136)

Haverstraw Water Supply Project

United Water New York

FRACTION/ GROUP	ANALYTE	ANALYTICAL METHOD NO.	REPORT LIMIT[1]	UNITS	HISTORICAL HUDSON RIVER WATER QUALITY DATA (2007-08, all sites)[2]					
					# Samp.	# Detect.	Concentration Detected			
							Min	Max	Avg	95%-ile
Metals										
	Aluminum, Total	E200.7	200	ug/L	40	35	250	3,100	890	2,480
	Aluminum, Total, Low Level	NA								
	Antimony	E200.7	60/10	ug/L	40	0	ND	ND	ND	NA
	Arsenic	E200.7	10/5	ug/L	40	0	ND	ND	ND	NA
	Barium	E200.7	200	ug/L	40	0	ND	ND	ND	NA
	Beryllium	E200.7	5/2	ug/L	40	0	ND	ND	ND	NA
	Boron	E200.7	50	ug/L	216	153	52	1,300	590	1,100
	Boron, Low Level	NA								
	Cadmium	E200.7	5	ug/L	40	0	ND	ND	ND	NA
	Calcium	E200.7	5000	ug/L	40	39	15,000	100,000	61,000	140,000
	Chromium	E200.7	10	ug/L	41	0	ND	ND	ND	NA
	Cobalt	NA								
	Copper	E200.7	25	ug/L	40	0	ND	ND	ND	NA
	Cyanide - Total	SM 4500 CN-E	0.01	mg/L	41	0	ND	ND	ND	NA
	Cyanide, Amenable	NA								
	Iron, Total	E200.7	100/150	ug/L	40	38	120	3,600	1,100	2,975
	Iron, Total, Low Level	NA								
	Lead	E200.7	5	ug/L	40	2	5.1	6	5.6	5.96
	Magnesium	E200.7	5000	ug/L	40	33	6,200	300,000	120,000	290,000
	Manganese, Total	E200.7	15	ug/L	41	39	31	130	66	111
	Manganese, Total, Low Level	NA								
	Mercury, Low Level	NA								
	Mercury	E245.1	0.2	ug/L	41	0	ND	ND	ND	NA
	Molybdenum	E200.7	9	ug/L	54	6	11.8	17.8	15.2	17.8
	Nickel	E200.7	4.5/40	ug/L	23	1	11	11	11	11
	Potassium	E200.7	5000	ug/L	40	28	6,900	200,000	83,000	180,000
	Selenium	E200.7	10/5	ug/L	40	0	ND	ND	ND	NA
	Silver	NA								
	Sodium	E200.7	5000	ug/L	40	39	12,000	3,000,000	1,000,000	3,000,000
	Strontium	NA								
	Thallium	E200.7	10	ug/L	40	0	ND	ND	ND	NA
	Vanadium	NA								
	Zinc	E200.7	20/30	ug/L	40	8	22	62	35	57.5
Select Inorganics/Ions										
	Bromide	E300	1/0.1	mg/L	216	165	0.08	27	9	19
	Chloride	E300	5/1	mg/L	216	213	12	40,000	1,900	4,500
	Fluoride	E300	0.2/0.1	mg/L	41	3	0.22	0.29	0.26	0.287
	Hexane Extractable Material, Silica Gel Treated - Oil And Grease (Nonpolar)	E1664A	5	mg/L	614	332	1.1	7	2.3	5.4
	Selenium	E200.7	5	ug/L						
	Sulfate	E300	1	mg/L	41	0	ND	ND	ND	NA
Conventional Parameters										
	Ammonia	SM4500_NH3_H	0.1	mg/L	69	5	1.3	1.9	1.64	1.88
	COD	NA								
	Nitrate	E300/SM4500B	0.1	mg/L	74	61	0.26	4.9	0.856	3.5
	Nitrite	E300/SM4500B	0.1	mg/L	71	34	0.011	0.16	0.044	0.16
	P, Total	SM4500-P-E	0.03	mg/L	71	32	0.1	0.24	0.160	0.229
	TKN	E351.2	0.5	mg/L	10	0	ND	ND	ND	NA
	TVS	NA								
	TVSS	NA								
Radionuclides										
	Gross Alpha	E900	1.2 to 3	pci/L	21	3	1.9	2.4	2.2	2.4
	Gross Beta	E900	0.88 to 3.2	pci/L	21	15	1.76	88	17.7	68.5
	Radium-226	E903.0	0.14 to 0.18	pci/L	19	0	ND	ND	ND	NA
Pathogens/Microbiologicals										
	Cryptosporidium	E1623	0.1	Oocysts/L	34	0	ND	ND	ND	NA
	Fecal Coliform	SM9221E	10/1	colf/100ml	216	179	10	900	110	401
	Giardia	E1623	0.1	Cysts/L	34	2	0.1	0.1	0.1	0.1
	Total Coliform	SM9222B	2/1	colf/100ml	216	213	2	2,420	759	2,419.2
	Escherichia Coli	9223	1	cfu/100mL	216	213	1	2400	110	472

Table 1A - Summary of Historical Hudson River Water Quality
Laboratory Analytical Data, Clean Water Act Methods (40 CFR 136)
Haverstraw Water Supply Project
United Water New York

FRACTION/ GROUP	ANALYTE	ANALYTICAL METHOD NO.	REPORT LIMIT[1]	UNITS	HISTORICAL HUDSON RIVER WATER QUALITY DATA (2007-08, all sites)[2]					
					# Samp.	# Detect.	Concentration Detected			
							Min	Max	Avg	95%-ile

Notes:
General - Blanks in the table indicate no analysis performed/no data available.
- All results are based on laboratory analyses performed by Test America, Inc.
[1] The Laboratory Reporting Limit is the lowest concentration that can be reliably measured within specified limits of precision and accuracy.
[2] Historical Hudson River water quality data was collected by United Water between 2007 and 2008.
[3] Water Quality models used for comparison are referenced in appended memo, SW-1.
(1) ND denotes not detected.
(2) NA denotes not applicable.
(3) BRL denotes below reporting limit.
[4] previously analyzed using EPA method 625 for Semi-Volatile Organic Compounds
[5] Please note that the Human Consumption of Fish classification H(FC) has more stringent guidelines than the Water Supply classification H(WS).
[6] Based on 5/26/11 meeting with NYSDEC, Acute ratio - 46:1, Chronic ratio - 131:1
[7] Based on assumption of 4 log removal of pathogens/microbiologicals during pretreatment

Table 1B - Summary of Pilot Water Quality Laboratory Analytical Data,
Clean Water Act Methods (40 CFR 136) (Raw Water, RO Influent, and RO Concentrate)
Haverstraw Water Supply Project
United Water New York

FRACTION/ GROUP	ANALYTE	ANALYTICAL METHOD NO.	REPORT LIMIT[1]	UNITS	HWSP PILOT RAW WATER DATA (Dec. 2010 - July 2011)						HWSP PILOT RO INFLUENT DATA (Dec. 2010 - July 2011)						HWSP PILOT RO CONCENTRATE DATA (Dec. 2010 - July 2011)					
					# Samp.	# Detect.	Concentration Detected				# Samp.	# Detect.	Concentration Detected				# Samp.	# Detect.	Concentration Detected			
							Min	Max	Avg	95%-ile			Min	Max	Avg	95%-ile			Min	Max	Avg	95%-ile
VOCs																						
	1,1,1-Trichloroethane	E624	1	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA
	1,1,2,2-Tetrachloroethane	E624	1	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA
	1,1,2-Trichloroethane	E624	1	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA
	1,1-Dichloroethane	E624	1	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA
	1,1-Dichloroethene	E624	1	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA
	1,2-Dichloroethane	E624	1	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA
	1,2-Dichloropropane	E624	1	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA
	2-Butanone	E624	10	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA
	2-Hexanone	E624	10	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA
	4-Methyl 2-Pentanone	E624	10	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA
	Acetone	E624	10	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA
	Benzene	E624	1	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA
	Bromodichloromethane	E624	1	ug/L	21	0	ND	ND	ND	NA	20	1	0.63	0.63	0.63	0.63	21	6	0.13	0.46	0.25	0.408
	Bromoform	E624	1	ug/L	21	0	ND	ND	ND	NA	20	1	0.26	0.26	0.26	0.26	21	5	0.11	0.53	0.25	0.474
	Bromomethane	E624	1	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA
	Carbon Disulfide	E624	1	ug/L	21	0	ND	ND	ND	NA	20	1	0.22	0.22	0.22	0.22	21	0	ND	ND	ND	NA
	Carbon Tetrachloride	E624	1	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA
	Chlorobenzene	E624	1	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA
	Chloroethane	E624	1	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA
	Chloroform	E624	1	ug/L	21	0	ND	ND	ND	NA	20	4	0.19	1.4	0.61	1.27	21	20	0.24	2.4	0.61	1.45
	Chloromethane	E624	1	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA
	cis-1,2-Dichloroethene	E624	1	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA
	cis-1,3-Dichloropropene	E624	1	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA
	Dibromochloromethane	E624	1	ug/L	21	0	ND	ND	ND	NA	20	1	0.71	0.71	0.71	0.71	21	6	0.11	0.42	0.21	0.368
	Dichlorodifluoromethane (Freon 12)	E624	1	ug/L	19	0	ND	ND	ND	NA	19	0	ND	ND	ND	NA	19	0	ND	ND	ND	NA
	Ethyl Benzene	E624	1	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA
	Methylene Chloride	E624	1	ug/L	21	2	0.36	0.88	0.62	0.854	20	1	0.78	0.78	0.78	0.78	21	2	0.37	0.9	0.64	0.874
	Styrene	E624	1	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	21	1	0.28	0.28	0.28	0.28
	Tetrachloroethene	E624	1	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA
	Toluene	E624	1	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA
	trans-1,2-Dichloroethene	E624	1	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA
	trans-1,3-Dichloropropene	E624	1	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA
	Trichloroethene	E624	1	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA
	Vinyl Chloride	E624	1	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA
	Xylenes - Total	E624	3	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	21	2	0.64	1	0.82	0.982
SVOCs																						
	1,2,4-Trichlorobenzene	E625	1	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	1,2-Dichlorobenzene	E625	10	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	1,3-Dichlorobenzene	E625	10	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	1,4-Dichlorobenzene	E625	10	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	2,4,5-Trichlorophenol	E625	10	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	2,4,6-Trichlorophenol	E625	10	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	2,4-Dichlorophenol	E625	10	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	2,4-Dimethylphenol	E625	10	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	2,4-Dinitrophenol	E625	30	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	2,4-Dinitrotoluene	E625	2	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	2,6-Dinitrotoluene	E625	2	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA

Table 1B - Summary of Pilot Water Quality Laboratory Analytical Data,
Clean Water Act Methods (40 CFR 136) (Raw Water, RO Influent, and RO Concentrate)
Haverstraw Water Supply Project
United Water New York

FRACTION/ GROUP	ANALYTE	ANALYTICAL METHOD NO.	REPORT LIMIT[1]	UNITS	HWSP PILOT RAW WATER DATA (Dec. 2010 - July 2011)						HWSP PILOT RO INFLUENT DATA (Dec. 2010 - July 2011)						HWSP PILOT RO CONCENTRATE DATA (Dec. 2010 - July 2011)					
					# Samp.	# Detect.	Concentration Detected				# Samp.	# Detect.	Concentration Detected				# Samp.	# Detect.	Concentration Detected			
							Min	Max	Avg	95%-ile			Min	Max	Avg	95%-ile			Min	Max	Avg	95%-ile
	2-Chloronaphthalene	E625	10	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	2-Chlorophenol	E625	10	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	2-Methyl-4,6-Dinitrophenol	E625	10	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	2-Methylnaphthalene	E625	10	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	2-Nitroaniline	E625	20	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	2-Nitrophenol	E625	10	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	3,3'-Dichlorobenzidine	E625	20	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	3-Nitroaniline	E625	20	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	4,6-Dinitro-2-Methylphenol	E625	30	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	4-Bromophenyl Phenyl Ether	E625	10	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	4-Chloro-3-Methylphenol	E625	10	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	4-Chloroaniline	E625	10	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	4-Chlorophenyl Phenyl Ether	E625	10	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	4-Methylphenol	E625	10	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	4-Nitroaniline	E625	20	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	4-Nitrophenol	E625	30	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	Acenaphthene	E625	10	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	Acenaphthylene	E625	10	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	Anthracene	E625	10	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	Benzo(a)Anthracene	E625	1	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	Benzo(a)Pyrene	E625	1	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	Benzo(b)Fluoranthene	E625	1	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	Benzo(ghi)Perylene	E625	10	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	Benzo(k)Fluoranthene	E625	1	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	bis(2-Chloroethoxy) Methane	E625	10	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	bis(2-Chloroethyl) Ether	E625	1	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	bis(2-Chloroisopropyl) Ether	E625	10	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	bis(2-Ethylhexyl) Phthalate	E625	10	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	Butyl Benzyl Phthalate	E625	10	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	Carbazole	E625	10	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	Chrysene	E625	10	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	Dibenzo(a,h)Anthracene	E625	1	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	Dibenzofuran	E625	10	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	Diethyl Phthalate	E625	10	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	Dimethyl Phthalate	E625	10	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	Di-N-Butyl Phthalate	E625	10	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	Di-N-Octyl Phthalate	E625	10	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	Fluoranthene	E625	10	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	Fluorene	E625	10	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	Hexachlorobenzene	E625	1	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	Hexachlorobutadiene	E625	2	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	Hexachlorocyclopentadiene	E625	10	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	Hexachloroethane	E625	1	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	Indeno(1,2,3-cd)Pyrene	E625	1	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	Isophorone	E625	10	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	Naphthalene	E625	10	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	Nitrobenzene	E625	1	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	n-Nitroso-di-n-Propylamine	E625	1	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	n-Nitrosodiphenylamine	E625	10	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA

Table 1B - Summary of Pilot Water Quality Laboratory Analytical Data,
Clean Water Act Methods (40 CFR 136) (Raw Water, RO Influent, and RO Concentrate)
Haverstraw Water Supply Project
United Water New York

FRACTION/ GROUP	ANALYTE	ANALYTICAL METHOD NO.	REPORT LIMIT[1]	UNITS	HWSP PILOT RAW WATER DATA (Dec. 2010 - July 2011)						HWSP PILOT RO INFLUENT DATA (Dec. 2010 - July 2011)						HWSP PILOT RO CONCENTRATE DATA (Dec. 2010 - July 2011)					
					# Samp.	# Detect.	Concentration Detected				# Samp.	# Detect.	Concentration Detected				# Samp.	# Detect.	Concentration Detected			
							Min	Max	Avg	95%-ile			Min	Max	Avg	95%-ile			Min	Max	Avg	95%-ile
	Pentachlorophenol	E625	30	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	Phenanthrene	E625	10	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	Phenol	E625	10	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
	Phenols, Total	E420.1	0.05	mg/L	13	0	ND	ND	ND	NA	12	0	ND	ND	ND	NA	13	0	ND	ND	ND	NA
	Pyrene	E625	10	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	15	0	ND	ND	ND	NA
Pesticides																						
	4,4'-DDD	E608	0.04	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	17	0	ND	ND	ND	NA
	4,4'-DDE	E608	0.02	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	17	0	ND	ND	ND	NA
	4,4'-DDT	E608	0.02	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	17	0	ND	ND	ND	NA
	Aldrin	E608	0.02	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	17	0	ND	ND	ND	NA
	alpha-BHC	E608	0.02	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	17	0	ND	ND	ND	NA
	beta-BHC	E608	0.02	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	17	0	ND	ND	ND	NA
	Chlordane	E608	0.5	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	17	0	ND	ND	ND	NA
	delta-BHC	E608	0.02	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	17	1	0.018	0.018	0.018	0.018
	Dieldrin	E608	0.02	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	17	0	ND	ND	ND	NA
	Endosulfan I	E608	0.02	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	17	0	ND	ND	ND	NA
	Endosulfan II	E608	0.02	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	17	0	ND	ND	ND	NA
	Endosulfan Sulfate	E608	0.02	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	17	0	ND	ND	ND	NA
	Endrin	E608	0.02	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	17	0	ND	ND	ND	NA
	Endrin aldehyde	E608	0.02	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	17	0	ND	ND	ND	NA
	Endrin Ketone	E608	0.02	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	17	0	ND	ND	ND	NA
	gamma-BHC	E608	0.02	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	17	2	0.025	0.033	0.029	0.0326
	Heptachlor	E608	0.02	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	17	0	ND	ND	ND	NA
	Heptachlor epoxide	E608	0.02	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	17	0	ND	ND	ND	NA
	Methoxychlor	E608	0.02	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	17	0	ND	ND	ND	NA
	Toxaphene	E608	1	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	17	0	ND	ND	ND	NA
PCBs																						
	Aroclor 1016	E608	1	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA
	Aroclor 1221	E608	1	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA
	Aroclor 1232	E608	1	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA
	Aroclor 1242	E608	1	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA
	Aroclor 1248	E608	1	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA
	Aroclor 1254	E608	1	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA
	Aroclor 1260	E608	1	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA
	Aroclor 1262	E608	1	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA
	Aroclor 1268	E608	1	ug/L	21	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA
Metals																						
	Aluminum, Total	E200.7	200	ug/L	27	27	201	1,530	669	1044	32	4	79	86.3	82.5	85.94	32	24	79.9	464	198	360.4
	Aluminum, Total, Low Level	E200.8	10	ug/L	5	5	561	1,070	785	1031.8	13	1	50.6	50.6	50.6	50.6	13	12	55.9	149	85.9	128.1
	Antimony	E200.7	10	ug/L	21	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA	21	4	3.6	4.7	4.2	4.685
	Arsenic	E200.7	5	ug/L	21	4	3.6	4.1	3.9	4.085	21	0	ND	ND	ND	NA	21	4	3.4	6.9	5.4	6.84
	Barium	E200.7	200	ug/L	21	21	14.6	25.1	19.4	23.5	21	21	11.4	20.8	16.2	19.9	21	21	70.8	139	109	135
	Beryllium	E200.7	2	ug/L	21	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA
	Boron	E200.7	50	ug/L	10	9	17	338	192	328.8	14	12	27.3	401	181	360.3	13	13	16.9	1,810	550	1248.4
	Boron, Low Level	E200.8	20	ug/L	6	1	61.9	61.9	61.9	61.9	17	9	88.7	244	149	240.4	19	14	59.6	747	337	713.2
	Cadmium	E200.7	5	ug/L	21	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA

\\[illegible] Tables 2011-08[illegible]
8/[illegible]/2011

Table 1B - Summary of Pilot Water Quality Laboratory Analytical Data,
Clean Water Act Methods (40 CFR 136) (Raw Water, RO Influent, and RO Concentrate)
Haverstraw Water Supply Project
United Water New York

FRACTION/ GROUP	ANALYTE	ANALYTICAL METHOD NO.	REPORT LIMIT[1]	UNITS	HWSP PILOT RAW WATER DATA (Dec. 2010 - July 2011)						HWSP PILOT RO INFLUENT DATA (Dec. 2010 - July 2011)						HWSP PILOT RO CONCENTRATE DATA (Dec. 2010 - July 2011)					
					# Samp.	# Detect.	Concentration Detected				# Samp.	# Detect.	Concentration Detected				# Samp.	# Detect.	Concentration Detected			
							Min	Max	Avg	95%-ile			Min	Max	Avg	95%-ile			Min	Max	Avg	95%-ile
	Calcium	E200.7	5000	ug/L	21	21	15,800	67,100	27,900	49,600	21	21	16,500	72,700	30,500	59,200	21	21	102,000	468,000	196,000	402,000
	Chromium	E200.7	10	ug/L	21	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA
	Cobalt	E200.7	50	ug/L	18	0	ND	ND	ND	NA	19	0	ND	ND	ND	NA	19	0	ND	ND	ND	NA
	Copper	E200.7	25	ug/L	21	8	4.3	41.7	12.2	35.26	21	1	5.8	5.8	5.8	5.8	21	8	4.8	12	6.5	10.075
	Cyanide - Total	SM 4500 CN-E	0.01	mg/L	13	0	ND	ND	ND	NA	12	0	ND	ND	ND	NA	13	0	ND	ND	ND	NA
	Cyanide, Amenable	SM 4500 CN	0.01	mg/L	12	0	ND	ND	ND	NA	11	0	ND	ND	ND	NA	12	0	ND	ND	ND	NA
	Iron, Total	E200.7	150	ug/L	27	27	396	2,280	1,160	1872	32	0	ND	ND	ND	NA	32	0	ND	ND	ND	NA
	Iron, Total, Low Level	E200.8	30	ug/L	5	5	892	1,560	1340	1546	13	0	ND	ND	ND	NA	13	0	ND	ND	ND	NA
	Lead	E200.7	5	ug/L	21	6	2.8	5.5	4.2	5.5	21	0	ND	ND	ND	NA	21	5	3	15.4	11.8	15.12
	Magnesium	E200.7	5000	ug/L	18	18	3,280	63,100	20,300	56,810	19	19	3,140	120,000	29,500	77,070	19	19	19,400	784,000	195,000	475,300
	Manganese, Total	E200.7	15	ug/L	27	27	32.5	89.6	63.5	85.58	32	32	3.2	27.3	9.85	17.745	32	32	15.8	168	59.7	115.45
	Manganese, Total, Low Level	E200.8	2	ug/L	5	5	62.2	73.3	68.3	72.86	13	5	9.1	17.5	13	17.32	13	13	25.6	112	55.5	109
	Mercury, Low Level	E1631E	0.5	ng/L	13	13	1.3	9.9	4.34	9.18	13	13	0.13	0.83	0.59	0.824	13	13	2.4	8	4.32	6.98
	Mercury	E245.1	0.2	ug/L	21	0	ND	ND	ND	NA	21	1	0.21	0.21	0.21	0.21	21	0	ND	ND	ND	NA
	Molybdenum	NA																				
	Nickel	E200.7	40	ug/L	21	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA	21	5	4.3	10.8	6.58	9.98
	Potassium	E200.7	5000	ug/L	18	18	577	19,500	6,380	17,375	19	19	543	37,100	9,330	23,600	19	19	5,220	234,000	61,600	138,600
	Selenium	E200.7	5	ug/L	21	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA
	Silver	E200.7	10	ug/L	21	1	0.85	0.85	0.85	0.85	21	7	0.64	1.5	0.82	1.284	21	5	0.66	1.3	0.9	1.238
	Sodium	E200.7	5000	ug/L	18	18	9,920	454,000	147,000	436,150	19	19	13,300	959,000	224,000	536,900	19	19	81,300	6,360,000	1,460,000	3,696,000
	Strontium	E200.7	0.54	ug/L	14	14	75.5	570	265	487.45	23	23	71.1	1,320	320	722.4	6	6	672	7,800	3,430	7,416
	Thallium	E200.7	10	ug/L	21	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA
	Vanadium	E200.7	50	ug/L	18	1	2.6	2.6	2.6	2.6	19	0	ND	ND	ND	NA	19	8	2.6	4.4	3.6	4.365
	Zinc	E200.7	30	ug/L	21	12	5.7	12.3	8.58	11.475	21	0	ND	ND	ND	NA	21	5	7	14.7	9.72	14.02
Select Inorganics/Ions																						
	Bromide	E300	0.1	mg/L	16	15	0.04	4.2	1.5	3.85	26	20	0.056	4.9	1.6	3.76	14	14	0.055	41	13	37.815
	Chloride	E300	1	mg/L	17	17	18.7	1,400	481	1,368	32	32	26.2	2,820	577	1,437	14	14	239	16,700	4,850	13,385
	Fluoride	E300	0.1	mg/L	16	14	0.034	0.4	0.12	0.355	29	20	0.039	0.33	0.091	0.188	14	10	0.037	3	0.76	2.865
	Hexane Extractable Material, Silica Gel Treated - Oil And Grease (Nonpolar)	E1664A	5	mg/L	32	14	1.8	4	2.657	3.61	58	17	1.7	4	2.844	3.94	16	8	1.5	4.4	2.913	4.05
	Selenium	E200.7	5	ug/L	21	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA	21	0	ND	ND	ND	NA
	Sulfate	E300	1	mg/L	16	16	7.2	182	72.8	179.75	32	32	7.6	357	92.1	230	14	14	257	2,440	846	2,174
Conventional Parameters																						
	Ammonia	SM4500_NH3_H	0.1	mg/L	16	13	0.052	0.26	0.15	0.254	14	9	0.034	0.24	0.12	0.228	14	14	0.097	1.7	0.51	1.635
	COD	E410.4	10	mg/L													8	8	24.7	676	226	642.4
	Nitrate	E300/SM4500B	0.1	mg/L	16	16	0.31	1.3	0.47	0.723	13	13	0.33	0.52	0.41	0.502	13	13	1.6	3.2	2.6	3.14
	Nitrite	E300/SM4500B	0.1	mg/L	16	9	0.014	0.049	0.025	0.042	13	5	0.014	0.029	0.022	0.029	13	13	0.014	0.13	0.051	0.112
	P, Total	SM4500-P-E	0.03	mg/L	14	14	0.061	0.32	0.12	0.236	9	4	0.01	0.056	0.035	0.055	9	7	0.003	0.41	0.12	0.341
	TKN	E351.2	0.5	mg/L	13	13	0.18	0.46	0.32	0.46												
	TVS	E160.4	10	mg/L	8	0	ND	ND	ND	NA												
	TVSS	E160.4	10	mg/L	5	0	ND	ND	ND	NA							1	0	ND	ND	ND	NA
Radionuclides																						
	Gross Alpha	E900	1.2 to 3	pCi/L	12	4	2.1	31.6	11.95	28.585	12	1	18.7	18.7	18.7	18.7	12	0	BRL	BRL	NA	NA
	Gross Beta	E900	0.88 to 3.2	pCi/L	12	9	1.73	425	58.57	267.4	12	7	2.82	33.7	18.203	31.39	12	11	6.2	420	91.92	281
	Radium-226	E903.0	0.14 to 0.18	pCi/L	12	4	0.088	0.119	0.102	0.118	12	2	0.058	0.19	0.129	0.1839	12	7	0.126	0.31	0.209	0.292

Table 1B - Summary of Pilot Water Quality Laboratory Analytical Data,
Clean Water Act Methods (40 CFR 136) (Raw Water, RO Influent, and RO Concentrate)
Haverstraw Water Supply Project
United Water New York

FRACTION/ GROUP	ANALYTE	ANALYTICAL METHOD NO.	REPORT LIMIT[1]	UNITS	HWSP PILOT RAW WATER DATA (Dec. 2010 - July 2011)						HWSP PILOT RO INFLUENT DATA (Dec. 2010 - July 2011)						HWSP PILOT RO CONCENTRATE DATA (Dec. 2010 - July 2011)					
					# Samp.	# Detect.	Concentration Detected				# Samp.	# Detect.	Concentration Detected				# Samp.	# Detect.	Concentration Detected			
							Min	Max	Avg	95%-ile			Min	Max	Avg	95%-ile			Min	Max	Avg	95%-ile
Pathogens/Microbiologicals																						
	Cryptosporidium	E1623	0.1	Oocysts/L	14	1	0.05	0.05	0.05	0.05												
	Fecal Coliform	SM9221E	1	colf/100mL	22	22	1	3,500	270	1,526	26	2	122	122	122	122	19	1	1	1	1	1
	Giardia	E1623	0.1	Cysts/L	14	6	0.05	0.55	0.18	0.46												
	Total Coliform	SM9222B	1	colf/100mL	22	22	140	11,000	1,700	7,720	26	3	110.5	455	285	437.775	12	8	2	550	120	434.5
	Escherichia Coli	NA																				

Notes:
General - Blanks in the table indicate no analysis performed/no data available.
- All results are based on laboratory analyses performed by Test America, Inc.
[1] The Laboratory Reporting Limit is the lowest concentration that can be reliably measured within specified limits of precision and accuracy.
[2] Historical Hudson River water quality data was collected by United Water between 2007 and 2008.
[3] Water Quality models used for comparison are referenced in appended memo, SW-1.
(1) ND denotes not detected.
(2) NA denotes not applicable.
(3) BRL denotes below reporting limit.
[4] previously analyzed using EPA method 625 for Semi-Volatile Organic Compounds
[5] Please note that the Human Consumption of Fish classification H(FC) has more stringent guidelines than the Water Supply classification H(WS).
[6] Based on 5/26/11 meeting with NYSDEC, Acute ratio - 46:1, Chronic ratio - 131:1
[7] Based on assumption of 4 log removal of pathogens/microbiologicals during pretreatment

Table 2A - Summary of Historical Hudson River Water Quality
Laboratory Analytical Data, Non-Clean Water Act Methods
Haverstraw Water Supply Project
United Water New York

FRACTION/ GROUP	ANALYTE	ANALYTICAL METHOD NO.	REPORT LIMIT[1]	UNITS	HISTORICAL HUDSON RIVER WATER QUALIT (2007-08, all sites)[2]					
					# Samp.	# Detect.	Concentration Detected			
							Min	Max	Avg	95%-ile
VOCs										
	1,1,1-Trichloroethane	SW8260B	5	ug/L	35	0	ND	ND	ND	NA
	1,1,2,2-Tetrachloroethane	NA								
	1,1,2-Trichloroethane	SW8260B	5	ug/L	35	0	ND	ND	ND	NA
	1,1-Dichloroethane	NA								
	1,1-Dichloroethene	SW8260B	5	ug/L	35	0	ND	ND	ND	NA
	1,2-Dibromo-3-Chloropropane	SW8260B	5	ug/L	49	0	ND	ND	ND	NA
	1,2-Dibromoethane	SW8260B	5	ug/L	36	0	ND	ND	ND	NA
	1,2-Dichloroethane	SW8260B	5	ug/L	35	0	ND	ND	ND	NA
	1,2-Dichloropropane	SW8260B	5	ug/L	35	0	ND	ND	ND	NA
	2-Butanone	NA								
	2-Hexanone	NA								
	4-Methyl 2-Pentanone	NA								
	Acetone	NA								
	Benzene	SW8260B	5	ug/L	35	1	0.23	0.23	0.23	0.23
	Bromodichloromethane	NA								
	Bromoform	NA								
	Bromomethane	NA								
	Carbon Disulfide	NA								
	Carbon Tetrachloride	SW8260B	5	ug/L	35	0	ND	ND	ND	NA
	Chlorobenzene	SW8260B	5	ug/L	35	0	ND	ND	ND	NA
	Chloroethane	NA								
	Chloroform	NA								
	Chloromethane	NA								
	cis-1,2-Dichloroethene	SW8260B	5	ug/L	35	0	ND	ND	ND	NA
	cis-1,3-Dichloropropene	NA								
	Dibromochloromethane	NA								
	Dichlorodifluoromethane (Freon 12)	NA								
	Ethyl Benzene	SW8260B	5	ug/L	35	0	ND	ND	ND	NA
	Methylene Chloride	SW8260B	5	ug/L	35	8	0.28	1.1	0.41	0.845
	Styrene	SW8260B	5	ug/L	35	0	ND	ND	ND	NA
	Tetrabromobisphenol A	L200	0.1	ug/L	11	0	ND	ND	ND	NA
	Tetrachloroethene	SW8260B	5	ug/L	35	0	ND	ND	ND	NA
	Toluene	SW8260B	5	ug/L	35	11	0.11	0.43	0.23	0.385
	trans-1,2-Dichloroethene	SW8260B	5	ug/L	35	0	ND	ND	ND	NA
	trans-1,3-Dichloropropene	SW8260B	1	ug/L						
	Trichloroethene	SW8260B	5	ug/L	35	0	ND	ND	ND	NA
	Vinyl Chloride	SW8260B	5	ug/L	35	0	ND	ND	ND	NA
	Xylenes - Total	SW8260B	5	ug/L	35	0	ND	ND	ND	NA
SVOCs										
	1,2,4-Trichlorobenzene	SW8270C	5	ug/L	35	0	ND	ND	ND	NA
	1,2-Dichlorobenzene	SW8270C	5	ug/L	35	0	ND	ND	ND	NA
	1,3-Dichlorobenzene	NA								
	1,4-Dichlorobenzene	NA								
	2,4,5-Trichlorophenol	NA								
	2,4,6-Trichlorophenol	SW8270C	10	ug/L	11	0	ND	ND	ND	NA
	2,4-Dichlorophenol	NA								
	2,4-Dimethylphenol	NA								
	2,4-Dinitrophenol	NA								
	2,4-Dinitrotoluene	NA								
	2,6-Dinitrotoluene	NA								
	2-Chloronaphthalene	NA								
	2-Chlorophenol	NA								
	2-Methyl-4,6-Dinitrophenol	NA								
	2-Methylnaphthalene	NA								
	2-Nitroaniline	NA								
	2-Nitrophenol	NA								
	3,3'-Dichlorobenzidine	NA								
	3-Nitroaniline	NA								
	4,6-Dinitro-2-Methylphenol	NA								
	4-Bromophenyl Phenyl Ether	NA								
	4-Chloro-3-Methylphenol	NA								
	4-Chloroaniline	NA								
	4-Chlorophenyl Phenyl Ether	NA								
	4-Methylphenol	NA								

Table 2A - Summary of Historical Hudson River Water Quality
Laboratory Analytical Data, Non-Clean Water Act Methods
Haverstraw Water Supply Project
United Water New York

FRACTION/ GROUP	ANALYTE	ANALYTICAL METHOD NO.	REPORT LIMIT[1]	UNITS	HISTORICAL HUDSON RIVER WATER QUALIT (2007-08, all sites)[2]					
					# Samp.	# Detect.	Concentration Detected			
							Min	Max	Avg	95%-ile
	4-Nitroaniline	NA								
	4-Nitrophenol	NA								
	Acenaphthene	NA								
	Acenaphthylene	NA								
	Anthracene	SW8270C	10	ug/L	16	0	ND	ND	ND	NA
	Atrazine	SW8270C	10	ug/L	22	0	ND	ND	ND	NA
	Benzo(a)Anthracene	NA								
	Benzo(a)Pyrene	NA								
	Benzo(b)Fluoranthene	NA								
	Benzo(ghi)Perylene	NA								
	Benzo(k)Fluoranthene	NA								
	bis(2-Chloroethoxy) Methane	NA								
	bis(2-Chloroethyl) Ether	NA								
	bis(2-Chloroisopropyl) Ether	NA								
	bis(2-Ethylhexyl) Phthalate	SW8270C	10	ug/L	16	0	ND	ND	ND	NA
	bis(20Ehtylhexyl) Adipate	E525	1	ug/L	11	0	ND	ND	ND	NA
	Dioxin (2,3,7,8-TCDD)	SW8270C	10	pg/L	14	1	14	14	14	14
	Butyl Benzyl Phthalate	NA								
	Carbazole	NA								
	Chrysene	NA								
	Dibenzo(a,h)Anthracene	NA								
	Dibenzofuran	NA								
	Diethyl Phthalate	NA								
	Dimethyl Phthalate	NA								
	Di-N-Butyl Phthalate	NA								
	Di-N-Octyl Phthalate	NA								
	Fluoranthene	NA								
	Fluorene	NA								
	Hexachlorobenzene	SW8270C	10/1	ug/L	16	0	ND	ND	ND	NA
	Hexachlorobutadiene	NA								
	Hexachlorocyclopentadiene	SW8270C	10	ug/L	16	0	ND	ND	ND	NA
	Hexachloroethane	NA								
	Indeno(1,2,3-cd)Pyrene	NA								
	Isophorone	NA								
	Naphthalene	NA								
	Nitrobenzene	NA								
	n-Nitroso-di-n-Propylamine	NA								
	n-Nitrosodiphenylamine	NA								
	Pentachlorophenol	SW8270C	30	ug/L	27	0	ND	ND	ND	NA
	Phenanthrene	NA								
	Phenol	SW8270C	10	ug/L	16	0	ND	ND	ND	NA
	Phenols, Total	NA								
	Pyrene	NA								
Pesticides										
	2,4,5-T	SW8151	0.5	ug/L	9	0	ND	ND	ND	NA
	4,4'-DDD	SW8081	0.05	ug/L	16	0	ND	ND	ND	NA
	4,4'-DDE	SW8081	0.05	ug/L	16	0	ND	ND	ND	NA
	4,4'-DDT	SW8081	0.05	ug/L	16	0	ND	ND	ND	NA
	Alachlor	E525	1	ug/L	11	0	ND	ND	ND	NA
	Aldicarb	E531.1	1	ug/L	1	0	ND	ND	ND	NA
	Aldicarb Sulfone	E531.1	1	ug/L	1	0	ND	ND	ND	NA
	Aldicarb Sulfoxide	E531.1	1	ug/L	1	0	ND	ND	ND	NA
	Aldrin	SW8081	0.05	ug/L	16	0	ND	ND	ND	NA
	alpha-BHC	SW8081	0.05	ug/L	16	0	ND	ND	ND	NA
	alpha-Chlordane	SW8081	0.05	ug/L	22	0	ND	ND	ND	NA
	beta-BHC	SW8081	0.05	ug/L	16	0	ND	ND	ND	NA
	Carbaryl	E531.1	1	ug/L	1	0	ND	ND	ND	NA
	Carbofuran	E531.1	1	ug/L	10	0	ND	ND	ND	NA
	Chlordane	NA								
	delta-BHC	SW8081	0.05	ug/L	16	0	ND	ND	ND	NA
	Dieldrin	SW8081	0.05	ug/L	16	0	ND	ND	ND	NA
	Dinoseb	SW8151	0.5	ug/L	10	0	ND	ND	ND	NA
	Diquat	E549.1	1	ug/L	11	0	ND	ND	ND	NA
	Endothall	E548.1	50	ug/L	11	0	ND	ND	ND	NA
	Endosulfan I	SW8081	0.05	ug/L	16	0	ND	ND	ND	NA

Table 2A - Summary of Historical Hudson River Water Quality
Laboratory Analytical Data, Non-Clean Water Act Methods
Haverstraw Water Supply Project
United Water New York

FRACTION/ GROUP	ANALYTE	ANALYTICAL METHOD NO.	REPORT LIMIT[1]	UNITS	HISTORICAL HUDSON RIVER WATER QUALIT (2007-08, all sites)[2]					
					# Samp.	# Detect.	Concentration Detected			
							Min	Max	Avg	95%-ile
	Endosulfan II	SW8081	0.05	ug/L	16	0	ND	ND	ND	NA
	Endosulfan Sulfate	SW8081	0.05	ug/L	16	0	ND	ND	ND	NA
	Endrin	SW8081	0.05	ug/L	16	0	ND	ND	ND	NA
	Endrin aldehyde	SW8081	0.05	ug/L	16	0	ND	ND	ND	NA
	Endrin Ketone	SW8081	0.05	ug/L	16	0	ND	ND	ND	NA
	gamma-BHC	SW8081	0.05	ug/L	16	0	ND	ND	ND	NA
	gamma-Chlordane	SW8081	0.05	ug/L	22	3	0.007	0.014	0.01	0.014
	Glyphosate	E547	10	ug/L	11	0	ND	ND	ND	NA
	Heptachlor	SW8081	0.05	ug/L	16	0	ND	ND	ND	NA
	Heptachlor epoxide	SW8081	0.05	ug/L	7	0	ND	ND	ND	NA
	Methomyl	E531.1	1	ug/L	1	0	ND	ND	ND	NA
	Methoxychlor	SW8081	0.05	ug/L	16	0	ND	ND	ND	NA
	Oxamyl	E531.1	1	ug/L	11	0	ND	ND	ND	NA
	Simazine	E525	0.5	ug/L	11	0	ND	ND	ND	NA
	Toxaphene	SW8081	1	ug/L	16	0	ND	ND	ND	NA
	Azinphosmethyl	NA								
	Basudin, Neocidol	NA								
	Chlorpyrifos	NA								
	Coumaphos	NA								
	Cygon	NA								
	Dasanit	NA								
	DDVP (Dichlorvos)	NA								
	Demeton	NA								
	Demeton-O	NA								
	Demeton-S	NA								
	Disulfoton	NA								
	EPN	NA								
	Ethoprophos	NA								
	Ethyl Parathion	NA								
	Famphur	NA								
	Fenthion	NA								
	Malathion	NA								
	Methyl Parathion	NA								
	Mevinphos	NA								
	o,o,o-Triethyl Phosphorothioate	NA								
	o,o-Diethyl o-Pyrazinyl Phosphorothioate	NA								
	Phorate	NA								
	Ronnel	NA								
	Stirophos	NA								
	Sulfotep	NA								
	Sulprofos	NA								
	Tokuthion (Prothiofos)	NA								
	Trichloronate	NA								
PCBs										
	Aroclor 1016	SW8082	0.5	ug/L	18	0	ND	ND	ND	NA
	Aroclor 1221	SW8082	1	ug/L	18	0	ND	ND	ND	NA
	Aroclor 1232	SW8082	0.5	ug/L	18	0	ND	ND	ND	NA
	Aroclor 1242	SW8082	0.5	ug/L	18	0	ND	ND	ND	NA
	Aroclor 1248	SW8082	0.5	ug/L	18	0	ND	ND	ND	NA
	Aroclor 1254	SW8082	0.5	ug/L	18	0	ND	ND	ND	NA
	Aroclor 1260	SW8082	0.5	ug/L	18	0	ND	ND	ND	NA
PCB Congeners										
	Decachlorobiphenyl-209 (Sur)	NA								
	PCB 101 (BZ)	NA								
	PCB 105 (BZ)	NA								
	PCB 118 (BZ)	NA								
	PCB 126 (BZ)	NA								
	PCB 128 (BZ)	NA								
	PCB 138 (BZ)	NA								
	PCB 153 (BZ)	NA								
	PCB 156 (BZ)	NA								
	PCB 169 (BZ)	NA								
	PCB 170 (BZ)	NA								

Table 2A - Summary of Historical Hudson River Water Quality
Laboratory Analytical Data, Non-Clean Water Act Methods
Haverstraw Water Supply Project
United Water New York

FRACTION/ GROUP	ANALYTE	ANALYTICAL METHOD NO.	REPORT LIMIT[1]	UNITS	HISTORICAL HUDSON RIVER WATER QUALIT					
							Concentration Detected			
							Min	Max	Avg	95%-ile
	PCB 18 (BZ)	NA								
	PCB 180 (BZ)	NA								
	PCB 183 (BZ)	NA								
	PCB 184 (BZ)	NA								
	PCB 187 (BZ)	NA								
	PCB 195 (BZ)	NA								
	PCB 206 (BZ)	NA								
	PCB 28 (BZ)	NA								
	PCB 44 (BZ)	NA								
	PCB 49 (BZ)	NA								
	PCB 52 (BZ)	NA								
	PCB 66 (BZ)	NA								
	PCB 77 (BZ)	NA								
	PCB 8 (BZ)	NA								
	PCB 87 (BZ)	NA								
	PCB 90 (BZ)	NA								
EDCs/PPCPs										
	1,4-Dichlorobenzene	NA								
	1-Methylnapthalene	NA								
	2-Methylnaphthalene	NA								
	17alpha-Estradiol	L211	0.5	ng/L	11	0	ND	ND	ND	NA
	17alpha-Ethynyl estradiol	L211	0.5	ng/L	11	0	ND	ND	ND	NA
	17beta-Estradiol	L211	0.5	ng/L	11	0	ND	ND	ND	NA
	3-Hydroxylcarbofuran	E531.1	1	ug/L	1	0	ND	ND	ND	NA
	4-n-Octylphenol	L200	0.5	ug/L	11	0	ND	ND	ND	NA
	Acetaminophen	E1694	50	ng/L	11	4	1	9	6	NA
	Acetophenone	NA								
	Amoxicilion	L221	0.05	ug/L	9	0	ND	ND	ND	NA
	Anthracene	NA								
	Antipyrine	L220	0.001	ug/L	11	0	ND	ND	ND	NA
	Aspirin	L221	0.05	ug/L	11	5	0.06	0.34	0.22	NA
	Azithromycin	E1694	10	ng/L	11	0	ND	ND	ND	NA
	Bacitracin	L220	0.5	ug/L	9	0	ND	ND	ND	NA
	Benzo(a)pyrene	BNASIM/SW8270C SIM	52/50	ng/L	16	0	ND	ND	ND	NA
	Bezafibrate	L221	0.5	ng/L	11	0	ND	ND	ND	NA
	Bisphenol A	L200/MS-SIM	0.1/1	ug/L	11	0	ND	ND	ND	NA
	Bromoform	NA								
	Caffeine	L220/E1694	5/50	ng/L	11	11	60	298	131	NA
	Carbadox	L220	50	ng/L	11	0	ND	ND	ND	NA
	Carbamazepine	L220/E1694	0.1/10	ng/L	11	11	2	12	5	NA
	Carbazole	NA								
	Chloramphenicol	L221	5	ng/L	11	0	ND	ND	ND	NA
	Chlorotetracycline	L221	50	ng/L	11	0	ND	ND	ND	NA
	Ciprofloxacine	L220	50	ng/L	11	0	ND	ND	ND	NA
	cis-Testosterone	L211	0.1	ng/L	11	0	ND	ND	ND	NA
	Clofibric Acid	L221	0.5	ng/L	11	0	ND	ND	ND	NA
	Cotinine	L220/E1694	1/10	ng/L	11	11	2	12	9	12
	DEET	L220	1/8	ng/L	11	11	8	179	51	116
	Dichlofenec	L221	0.5	ng/L	11	0	ND	ND	ND	NA
	Diethylstilbestrol (DES)	L211	0.5	ng/L	11	0	ND	ND	ND	NA
	Diltiazem	L220/E1694	1/5	ng/L	11	3	1	1	1	1
	Doxycycline	L221	0.05	ug/L	11	0	ND	ND	ND	NA
	Enrofloxacin	L220	0.05	ug/L	11	0	ND	ND	ND	NA
	Erythromycin	L220	0.001	ug/L	11	0	ND	ND	ND	NA
	Estriol	L211	0.5	ng/L	11	0	ND	ND	ND	NA
	Estrone	L211	0.5	ng/L	11	0	ND	ND	ND	NA
	Fluoranthene	BNASIM/SW8270C SIM	52/50	ng/L	16	0	ND	ND	ND	NA
	Fluoxetine (Prozac)	L220/E1694	1/25	ng/L	11	1	3	3	3	3
	Galaxolide	S170	10	ng/L	11	10	12	65	28	NA
	Gemfibrozil	L221/E1694	0.5/25	ng/L	11	11	2.8	13	6	11
	Ibuprofen	L221/E1694	50/25	ng/L	11	0	ND	ND	ND	NA
	Isophorone	NA								
	Isopropyl Benzene	NA								
	Lasalocid	L220	1	ng/L	11	0	ND	ND	ND	NA
	Levothyroxine (Synthroid)	L220	50	ng/L	22	0	ND	ND	ND	NA

Table 2A - Summary of Historical Hudson River Water Quality
Laboratory Analytical Data, Non-Clean Water Act Methods
Haverstraw Water Supply Project
United Water New York

FRACTION/ GROUP	ANALYTE	ANALYTICAL METHOD NO.	REPORT LIMIT[1]	UNITS	HISTORICAL HUDSON RIVER WATER QUALIT					
					.	# Detect.	Concentration Detected Min	Max	Avg	95%-ile
	Lincomycin	L220/E1694	0.1/10	ng/L	11	4	0.1	0.1	0.1	0.1
	Monensin	L220	0.1	ng/L	11	0	ND	ND	ND	NA
	Naphthalene	8270C/BNASIM/SW8270C SIM	0.01/52/50	ng/L	16	0	ND	ND	ND	NA
	Naproxen	L220/E1694	2/50	ng/L	11	11	0.002	0.007	0.003	0.006
	Narasin	L220	0.1	ng/L	11	0	ND	ND	ND	NA
	Nicotine	L220	0.005	ug/L	11	10	0.01	0.199	0.0881	0.1954
	Nonylphenol Diethoxylate (Tech.)	NA								
	Norfloxacin	L220	500	ng/L	4	0	ND	ND	ND	NA
	Oleandomycin	L220	1	ng/L	11	0	ND	ND	ND	NA
	Oxytetracycline	L221	500	ng/L	11	0	ND	ND	ND	NA
	p-Nonylphenol (Tech.)	NA								
	p-tert-Octylphenol	L200/MS-SIM	0.0005/1	ug/L	11	0	ND	ND	ND	NA
	Pentachlorophenol	NA								
	Paraxanthine	L220	5	ng/L	11	11	9	75	41	74.5
	Penicillin G	L221	2	ng/L	11	0	ND	ND	ND	NA
	Penicillin V	L221	2	ng/L	11	0	ND	ND	ND	NA
	Phenanthrene	NA								
	Phenol	E625/SW8270C	10	ug/L	16	0	ND	ND	ND	NA
	Phenylphenol	L200	100	ng/L	11	0	ND	ND	ND	NA
	Prednisone	L220/L221	2	ng/L	22	0	ND	ND	ND	NA
	Progesterone	L211	100	ng/L	11	0	ND	ND	ND	NA
	Pyrene	8720C/BNASIM/SW8270C SIM	10000/52/50	ng/L	16	0	ND	ND	ND	NA
	Roxithromycin	L220	1	ng/L	11	0	ND	ND	ND	NA
	Salinomycin	L220/L221	0.1	ng/L	22	0	ND	ND	ND	NA
	Simvastatin	L220	1	ng/L	11	0	ND	ND	ND	NA
	Sulfachloropyridazine	L220/L221	5	ng/L	22	0	ND	ND	ND	NA
	Sulfadiazine	L220/L221	5	ng/L	22	0	ND	ND	ND	ND
	Sulfadimethoxine	L220/L221	0.1	ng/L	22	1	0.1	0.1	0.1	0.1
	Sulfamerazine	L220/L221	5	ng/L	22	0	ND	ND	ND	ND
	Sulfamethazine	L220/L221	1	ng/L	22	0	ND	ND	ND	NA
	Sulfanethizole	L220/L221	5	ng/L	22	0	ND	ND	ND	NA
	Sulfamethoxazole	L220/L221/E1694	5/25	ng/L	22	11	6	13	8	NA
	Sulfathiazole	L220/L221	5	ng/L	22	0	ND	ND	ND	NA
	Theobromine	L220	50	ng/L	11	0	ND	ND	ND	NA
	Theophylline	L221	5	ng/L	11	1	6	6	6	6
	Tonalid	S170	10	ng/L	11	0	ND	ND	ND	NA
	trans-Testosterone	L211	0.1	ng/L	11	0	ND	ND	ND	NA
	Triclosan	NA								
	Trimethoprim	L220/E1694	1/10	ng/L	11	4	1	2	1	1.5
	Tylosin	L220/L221/E1694	1/10	ng/L	22	0	ND	ND	ND	NA
	Virginiamycin M1	L220/L221	0.5	ng/L	11	0	ND	ND	ND	NA
Metals										
	Chromium (Hexavalent Compounds)	SW7196A	10	ug/L						
	Asbestos	ELAP 198.2 - 10 M	0.02	mfl						
Select Inorganics/Ions										
	Chloride	NA								
	Petroleum Hydrocarbons C10-C28	NA								
	Perchlorate	NA								
	Silica	200.7/A4500C/SM4500-SI-C	1/0.1/1	mg/L	73	73	1.3	15	4.6	5.4
Conventional Parameters										
	Algae	NA								
	Total Algae (including Diatom)	NA								
	Alkalinity, Total As CaCO3	A2320B	5	mg/L	194	192	8.7	110	59	80.9
	Alkalinity, Bicarbonate	NA								
	Alkalinity, Hydroxide (CaCO)	NA								
	Alkalinity, Total As CaCO3	NA								
	BOD20	NA								
	BOD5	NA								
	Chlorophyll A	NA								
	Conductivity	NA								
	DOC	SM5310B	1	mg/L	324	279	1	4.4	2.485	3.91
	N,Total	CALC		mg/L	67	9	1.2	4.9	2.844	4.54
	Ortho P, Total	SM4500P-E-ORTHO	0.03	mg/L	74	0	ND	ND	ND	NA

Table 2A - Summary of Historical Hudson River Water Quality
Laboratory Analytical Data, Non-Clean Water Act Methods
Haverstraw Water Supply Project
United Water New York

FRACTION/ GROUP	ANALYTE	ANALYTICAL METHOD NO.	REPORT LIMIT[1]	UNITS	HISTORICAL HUDSON RIVER WATER QUALIT					
							Min	Max	Avg	95%-ile
	TDS	SM2540C	100/10	mg/L	324	300	6	11,000	2,987	8,200
	TOC	SM5310C/SM5310B	1	mg/L	325	278	1	4.7	2.536	4.1
	TSS	SM2540D	10	mg/L	324	288	1	100	25.475	67.95
	UV 254	SM5910B	0.009	1/cm	112	112	0.08	0.26	0.12	0.19
	Color, Apparent	Field	15	mg/L						
Radionuclides										
	Cesium-137	NA								
	Radium-228	E904.0	0.33 to 0.39	pci/L	19	0	ND	ND	ND	NA
	Strontium-89	700-SR/SR-03-RC-MOD	0.57 to 0.84	pci/L	10	10	BRL	0.75	NA	NA
	Strontium-90	700-SR/E905.0/SR-03-RC MOD	0.15 to 0.51	pci/L	11	11	BRL	0.98	NA	NA
	Tritium	E906.0	120	pci/L	11	11	BRL	BRL	NA	NA
	Uranium	SW6020	0.14 to 0.7	ug/L	21	10	BRL	0.98	NA	NA
Pathogens/Microbiologicals										
	Diatom	NA								
	HPC	SM9215B	2/1	cfu/mL	216	210	2	738	179	321

Notes:
General - Blanks in the table indicate no analysis performed/no data available.
- All results are based on laboratory analyses performed by Test America, Inc.
[1] The Laboratory Reporting Limit is the lowest concentration that can be reliably measured within specified limits of precision and accuracy.
[2] Historical Hudson River water quality data was collected by United Water between 2007 and 2008.
[3] Water Quality models used for comparison are referenced in appended memo, SW-1.
(1) ND denotes not detected.
(2) NA denotes not applicable.
(3) BRL denotes below reporting limit.
[4] previously analyzed using EPA method 625 for Semi-Volatile Organic Compounds
[5] Please note that the Human Consumption of Fish classification H(FC) has more stringent guidelines than the Water Supply classification H(WS).
[6] Based on 5/26/11 meeting with NYSDEC, Acute ratio - 46:1, Chronic ratio - 131:1
[7] Based on assumption of 4 log removal of pathogens/microbiologicals during pretreatment

Table 2B - Summary of Pilot Water Quality Laboratory Analytical Data,
Non-Clean Water Act Methods (Raw Water, RO Influent, and RO Concentrate)
Haverstraw Water Supply Project
United Water New York

FRACTION/ GROUP	ANALYTE	ANALYTICAL METHOD NO.	REPORT LIMIT[1]	UNITS	HWSP PILOT RAW WATER DATA (Dec. 2010 - July 2011)						HWSP PILOT RO INFLUENT DATA (Dec. 2010 - July 2011)						HWSP PILOT RO CONCENTRATE DATA (Dec. 2010 - July 2011)					
					# Samp.	# Detect.	Concentration Detected				# Samp.	# Detect.	Concentration Detected				# Samp.	# Detect.	Concentration Detected			
							Min	Max	Avg	95%-ile			Min	Max	Avg	95%-ile			Min	Max	Avg	95%-ile
Pesticides																						
	2,4,5-T	NA																				
	4,4'-DDD	NA																				
	4,4'-DDE	NA																				
	4,4'-DDT	NA																				
	Alachlor	NA																				
	Aldicarb	NA																				
	Aldicarb Sulfone	NA																				
	Aldicarb Sulfoxide	NA																				
	Aldrin	NA																				
	alpha-BHC	NA																				
	alpha-Chlordane	NA																				
	beta-BHC	NA																				
	Carbaryl	NA																				
	Carbofuran	NA																				
	Chlordane	NA																				
	delta-BHC	NA																				
	Dieldrin	NA																				
	Dinoseb	NA																				
	Diquat	NA																				
	Endothall	NA																				
	Endosulfan I	NA																				
	Endosulfan II	NA																				
	Endosulfan Sulfate	NA																				
	Endrin	NA																				
	Endrin aldehyde	NA																				
	Endrin Ketone	NA																				
	gamma-BHC	NA																				
	gamma-Chlordane	NA																				
	Glyphosate	NA																				
	Heptachlor	NA																				
	Heptachlor epoxide	NA																				
	Methomyl	NA																				
	Methoxychlor	NA																				
	Oxamyl	NA																				
	Simazine	NA																				
	Toxaphene	NA																				
	Azinphosmethyl	SW8141	1	ug/L	7	0	ND	ND	ND	NA	6	0	ND	ND	ND	NA	1	0	ND	ND	ND	NA
	Basudin, Neocidol	SW8142	1	ug/L	7	0	ND	ND	ND	NA	6	0	ND	ND	ND	NA	1	0	ND	ND	ND	NA
	Chlorpyrifos	SW8143	1	ug/L	7	0	ND	ND	ND	NA	6	0	ND	ND	ND	NA	1	0	ND	ND	ND	NA
	Coumaphos	SW8144	1	ug/L	7	0	ND	ND	ND	NA	6	0	ND	ND	ND	NA	1	0	ND	ND	ND	NA
	Cygon	SW8145	1	ug/L	7	0	ND	ND	ND	NA	6	0	ND	ND	ND	NA	1	0	ND	ND	ND	NA
	Dasanit	SW8146	1	ug/L	7	0	ND	ND	ND	NA	6	0	ND	ND	ND	NA	1	0	ND	ND	ND	NA
	DDVP (Dichlorvos)	SW8147	1	ug/L	7	0	ND	ND	ND	NA	6	0	ND	ND	ND	NA	1	0	ND	ND	ND	NA
	Demeton	SW8148	1	ug/L	7	0	ND	ND	ND	NA	6	0	ND	ND	ND	NA	1	0	ND	ND	ND	NA
	Demeton-O	SW8149	1	ug/L	3	0	ND	ND	ND	NA	2	0	ND	ND	ND	NA	1	0	ND	ND	ND	NA
	Demeton-S	SW8150	1	ug/L	3	0	ND	ND	ND	NA	2	0	ND	ND	ND	NA	1	0	ND	ND	ND	NA
	Disulfoton	SW8151	1	ug/L	7	0	ND	ND	ND	NA	6	0	ND	ND	ND	NA	1	0	ND	ND	ND	NA
	EPN	SW8152	1	ug/L	7	0	ND	ND	ND	NA	6	0	ND	ND	ND	NA	1	0	ND	ND	ND	NA

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Haverstraw Water Supply Project
United Water New York

FRACTION/ GROUP	ANALYTE	ANALYTICAL METHOD NO.	REPORT LIMIT[1]	UNITS	HWSP PILOT RAW WATER DATA (Dec. 2010 - July 2011)						HWSP PILOT RO INFLUENT DATA (Dec. 2010 - July 2011)						HWSP PILOT RO CONCENTRATE DATA (Dec. 2010 - July 2011)					
					# Samp.	# Detect.	Concentration Detected				# Samp.	# Detect.	Concentration Detected				# Samp.	# Detect.	Concentration Detected			
							Min	Max	Avg	95%-ile			Min	Max	Avg	95%-ile			Min	Max	Avg	95%-ile
	Ethoprophos	SW8153	1	ug/L	7	0	ND	ND	ND	NA	6	0	ND	ND	ND	NA	1	0	ND	ND	ND	NA
	Ethyl Parathion	SW8154	1	ug/L	7	0	ND	ND	ND	NA	6	0	ND	ND	ND	NA	1	0	ND	ND	ND	NA
	Famphur	SW8155	1	ug/L	7	0	ND	ND	ND	NA	6	0	ND	ND	ND	NA	1	0	ND	ND	ND	NA
	Fenthion	SW8156	1	ug/L	7	0	ND	ND	ND	NA	6	0	ND	ND	ND	NA	1	0	ND	ND	ND	NA
	Malathion	SW8157	1	ug/L	7	0	ND	ND	ND	NA	6	0	ND	ND	ND	NA	1	0	ND	ND	ND	NA
	Methyl Parathion	SW8158	1	ug/L	7	0	ND	ND	ND	NA	6	0	ND	ND	ND	NA	1	0	ND	ND	ND	NA
	Mevinphos	SW8159	1	ug/L	7	0	ND	ND	ND	NA	6	0	ND	ND	ND	NA	1	0	ND	ND	ND	NA
	o,o,o-Triethyl Phosphorothioate	SW8160	1	ug/L	7	0	ND	ND	ND	NA	6	0	ND	ND	ND	NA	1	0	ND	ND	ND	NA
	o,o-Diethyl o-Pyrazinyl Phosphorothioate	SW8161	1	ug/L	7	0	ND	ND	ND	NA	6	0	ND	ND	ND	NA	1	0	ND	ND	ND	NA
	Phorate	SW8162	1	ug/L	7	0	ND	ND	ND	NA	6	0	ND	ND	ND	NA	1	0	ND	ND	ND	NA
	Ronnel	SW8163	1	ug/L	7	0	ND	ND	ND	NA	6	0	ND	ND	ND	NA	1	0	ND	ND	ND	NA
	Stirophos	SW8164	1	ug/L	7	0	ND	ND	ND	NA	6	0	ND	ND	ND	NA	1	0	ND	ND	ND	NA
	Sulfotep	SW8165	1	ug/L	7	0	ND	ND	ND	NA	6	0	ND	ND	ND	NA	1	0	ND	ND	ND	NA
	Sulprofos	SW8166	1	ug/L	7	0	ND	ND	ND	NA	6	0	ND	ND	ND	NA	1	0	ND	ND	ND	NA
	Tokuthion (Prothiofos)	SW8167	1	ug/L	7	0	ND	ND	ND	NA	6	0	ND	ND	ND	NA	1	0	ND	ND	ND	NA
	Trichloronate	SW8168	1	ug/L	7	0	ND	ND	ND	NA	6	0	ND	ND	ND	NA	1	0	ND	ND	ND	NA
PCBs																						
	Aroclor 1016	NA																				
	Aroclor 1221	NA																				
	Aroclor 1232	NA																				
	Aroclor 1242	NA																				
	Aroclor 1248	NA																				
	Aroclor 1254	NA																				
	Aroclor 1260	NA																				
PCB Congeners																						
	Decachlorobiphenyl-209 (Sur)	SW8082	1	ng/L	8	0	ND	ND	ND	NA	7	0	ND	ND	ND	NA	8	0	ND	ND	ND	NA
	PCB 101 (BZ)	SW8082	1	ng/L	8	2	0.36	1.5	0.93	1.443	7	1	1.2	1.2	1.2	1.2	8	1	1.9	1.9	1.9	1.9
	PCB 105 (BZ)	SW8082	1	ng/L	8	0	ND	ND	ND	NA	7	0	ND	ND	ND	NA	8	1	0.59	0.59	0.59	0.59
	PCB 118 (BZ)	SW8082	1	ng/L	8	0	ND	ND	ND	NA	7	0	ND	ND	ND	NA	8	1	0.31	0.31	0.31	0.31
	PCB 126 (BZ)	SW8082	1	ng/L	8	0	ND	ND	ND	NA	7	0	ND	ND	ND	NA	8	0	ND	ND	ND	NA
	PCB 128 (BZ)	SW8082	1	ng/L	8	0	ND	ND	ND	NA	7	0	ND	ND	ND	NA	8	0	ND	ND	ND	NA
	PCB 138 (BZ)	SW8082	1	ng/L	8	0	ND	ND	ND	NA	7	0	ND	ND	ND	NA	8	0	ND	ND	ND	NA
	PCB 153 (BZ)	SW8082	1	ng/L	8	0	ND	ND	ND	NA	7	0	ND	ND	ND	NA	8	0	ND	ND	ND	NA
	PCB 156 (BZ)	SW8082	1	ng/L	8	0	ND	ND	ND	NA	7	0	ND	ND	ND	NA	8	0	ND	ND	ND	NA
	PCB 169 (BZ)	SW8082	1	ng/L	8	0	ND	ND	ND	NA	7	0	ND	ND	ND	NA	8	0	ND	ND	ND	NA
	PCB 170 (BZ)	SW8082	1	ng/L	8	0	ND	ND	ND	NA	7	0	ND	ND	ND	NA	8	0	ND	ND	ND	NA
	PCB 18 (BZ)	SW8082	1	ng/L	8	5	0.75	1.6	1.2	1.6	7	3	0.58	2.6	1.5	2.46	8	4	2.6	6.1	4.1	5.83
	PCB 180 (BZ)	SW8082	1	ng/L	8	0	ND	ND	ND	NA	7	0	ND	ND	ND	NA	8	0	ND	ND	ND	NA
	PCB 183 (BZ)	SW8082	1	ng/L	5	1	0.55	0.55	0.55	0.55	4	0	ND	ND	ND	NA	5	1	0.9	0.9	0.9	0.9
	PCB 184 (BZ)	SW8082	1	ng/L	5	0	ND	ND	ND	NA	4	0	ND	ND	ND	NA	5	0	ND	ND	ND	NA
	PCB 187 (BZ)	SW8082	1	ng/L	5	0	ND	ND	ND	NA	4	0	ND	ND	ND	NA	5	0	ND	ND	ND	NA
	PCB 195 (BZ)	SW8082	1	ng/L	5	0	ND	ND	ND	NA	4	0	ND	ND	ND	NA	5	0	ND	ND	ND	NA
	PCB 206 (BZ)	SW8082	1	ng/L	5	0	ND	ND	ND	NA	4	0	ND	ND	ND	NA	5	0	ND	ND	ND	NA
	PCB 28 (BZ)	SW8082	1	ng/L	8	5	0.52	1.1	0.72	1.04	7	2	0.3	0.31	0.31	0.3095	8	5	0.48	19	4.3	15.358
	PCB 44 (BZ)	SW8082	1	ng/L	8	3	0.3	2	0.96	1.859	7	0	ND	ND	ND	NA	8	4	0.61	1.6	0.89	1.465
	PCB 49 (BZ)	SW8082	1	ng/L	8	2	0.71	0.76	0.74	0.758	7	1	0.44	0.44	0.44	0.44	8	2	0.4	3	1.7	2.87
	PCB 52 (BZ)	SW8082	1	ng/L	8	3	0.4	0.59	0.51	0.584	7	0	ND	ND	ND	NA	8	4	0.48	0.98	0.74	0.9515

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United Water New York

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					# Samp.	# Detect.	Concentration Detected Min	Max	Avg	95%-ile	# Samp.	# Detect.	Concentration Detected Min	Max	Avg	95%-ile	# Samp.	# Detect.	Concentration Detected Min	Max	Avg	95%-ile
	PCB 66 (BZ)	SW8082	1	ng/L	8	1	0.3	0.3	0.3	0.3	7	0	ND	ND	ND	NA	8	1	0.55	0.55	0.55	0.55
	PCB 77 (BZ)	SW8082	1	ng/L	8	0	ND	ND	ND	NA	7	0	ND	ND	ND	NA	8	0	ND	ND	ND	NA
	PCB 8 (BZ)	SW8082	1	ng/L	8	5	0.52	6.4	1.9	5.36	7	4	0.46	3.8	1.4	3.359	8	5	0.75	3.9	1.7	3.4
	PCB 87 (BZ)	SW8082	1	ng/L	8	0	ND	ND	ND	NA	7	0	ND	ND	ND	NA	8	0	ND	ND	ND	NA
	PCB 90 (BZ)	SW8082	1	ng/L	8	0	ND	ND	ND	NA	7	0	ND	ND	ND	NA	8	1	0.39	0.39	0.39	0.39
EDCs/PPCPs																						
	1,4-Dichlorobenzene	SW8260B	0.5	ug/L	7	0	ND	ND	ND	NA	6	0	ND	ND	ND	NA						
	1-Methylnapthalene	BNASIM/SW8270C SIM	52/50	ng/L	7	0	ND	ND	ND	NA	6	0	ND	ND	ND	NA						
	2-Methylnaphthalene	BNASIM/SW8270C SIM	52/50	ng/L	7	0	ND	ND	ND	NA	6	0	ND	ND	ND	NA						
	17alpha-Estradiol	NA																				
	17alpha-Ethynyl estradiol	NA																				
	17beta-Estradiol	NA																				
	3-Hydroxylcarbofuran	NA																				
	4-n-Octylphenol	NA																				
	Acetaminophen	E1694	50	ng/L	7	4	15	37	27.0	35.65	6	4	20	55	35	51.7						
	Acetophenone	SW8270C	1	ug/L	7	0	ND	ND	ND	NA	6	0	ND	ND	ND	NA						
	Amoxicillon	NA																				
	Anthracene	BNASIM/SW8270C SIM	52/50	ng/L	7	0	ND	ND	ND	NA	6	0	ND	ND	ND	NA						
	Antipyrene	NA																				
	Aspirin	NA																				
	Azithromycin	E1694	10	ng/L	5	3	4.2	23	12.0	21.65	4	0	ND	ND	ND	NA						
	Bacitracin	NA																				
	Benzo(a)pyrene	BNASIM	52/50	ng/L	7	2	5.9	7	6.5	6.945	6	0	ND	ND	ND	NA						
	Bezafibrate	NA																				
	Bisphenol A	MS-SIM	1	ug/L	7	0	ND	ND	ND	NA	6	0	ND	ND	ND	NA						
	Bromoform	E524.2/SW8260B	0.5	ug/L	7	0	ND	ND	ND	NA	6	4	17	530	300.0	518						
	Caffeine	E1694	50	ng/L	7	6	37	260	160.0	260	6	6	38	290	180	287.5						
	Carbadox	NA																				
	Carbamazepine	E1694	10	ng/L	7	5	2.9	5.2	4.1	5.12	6	5	2.7	5.5	3.7	5.18						
	Carbazole	SW8270C	1	ug/L	7	0	ND	ND	ND	NA	6	0	ND	ND	ND	NA						
	Chloramphenicol	NA																				
	Chlorotetracycline	NA																				
	Ciprofloxacine	NA																				
	cis-Testosterone	NA																				
	Clofibric Acid	NA																				
	Cotinine	E1694	10	ng/L	7	5	4.2	17	11.0	16.8	6	5	3.5	40	18	37.4						
	DEET	NA																				
	Dichlofenec	NA																				
	Diethylstilbestrol (DES)	NA																				
	Diltiazem	E1694	5	ng/L	5	4	2.8	4.8	3.6	4.59	4	3	1.5	5	3	4.75						
	Doxycycline	NA																				
	Enrofloxacin	NA																				
	Erythromycin	NA																				
	Estriol	NA																				
	Estrone	NA																				
	Fluoranthene	BNASIM/SW8770C SIM	52/50	ng/L	7	7	7.6	15	10.6	15	6	0	ND	ND	ND	NA						
	Fluoxetine (Prozac)	E1694	25	ng/L	6	2	22	25	24.0	24.85	5	0	ND	ND	ND	NA						
	Galaxolide	NA																				
	Gemfibrozil	E1694	25	ng/L	7	3	16	26	20.0	25.1	6	2	14	23	19	22.55						

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					# Samp.	# Detect.	Concentration Detected				# Samp.	# Detect.	Concentration Detected				# Samp.	# Detect.	Concentration Detected			
							Min	Max	Avg	95%-ile			Min	Max	Avg	95%-ile			Min	Max	Avg	95%-ile
	Ibuprofen	E1694	25	ng/L	7	4	20	41	27.0	38.45	6	4	18	46	30	44.05						
	Isophorone	SW8270C	10	ng/L	7	0	ND	ND	ND	NA	6	0	ND	ND	ND	NA						
	Isopropyl Benzene	SW8260B	0.5	ng/L	7	0	ND	ND	ND	NA	6	0	ND	ND	ND	NA						
	Lasaloid	NA																				
	Levothyroxine (Synthroid)	NA																				
	Lincomycin	E1694	10	ng/L	7	4	0.29	1.1	0.7	1.075	6	3	0.56	1.2	0.99	1.2						
	Monensin	NA																				
	Naphthalene	BNASIM/SW8770C SIM	52/50	ng/L	7	3	7.1	9.3	8.6	9.3	6	3	7.3	8.9	8.3	8.87						
	Naproxen	E1694	50	ng/L	7	5	28	55	39.0	52.8	6	5	17	44	35	43.8						
	Narasin																					
	Nicotine	NA																				
	Nonylphenol Diethoxylate (Tech.)	MS-SIM	20/21	ug/L	7	0	ND	ND	ND	NA	6	0	ND	ND	ND	NA						
	Norfloxacin	NA																				
	Oleandomycin	NA																				
	Oxytetracycline	NA																				
	p-Nonylphenol (Tech.)	NA																				
	p-tert-Octylphenol	NA																				
	Pentachlorophenol	SW8270C	10	ug/L	7	0	ND	ND	ND	NA	6	0	ND	ND	ND	NA						
	Paraxanthine	NA																				
	Penicillin G	NA																				
	Penicillin V	NA																				
	Phenanthrene	BNASIM/SW8770C SIM	52/50	ng/L	7	3	6.6	9.4	8.3	9.34	6	0	ND	ND	ND	NA						
	Phenol	SW8270C	10	ug/L	7	0	ND	ND	ND	NA	6	0	ND	ND	ND	NA						
	Phenylphenol	NA																				
	Prednisone	NA																				
	Progesterone	NA																				
	Pyrene	BNASIM/SW8770C SIM	52/50	ng/L	7	7	6.6	14	9.1	14	6	0	ND	ND	ND	NA						
	Roxithromycin	NA																				
	Salinomycin	NA																				
	Simvastatin	NA																				
	Sulfachloropyridazine	NA																				
	Sulfadiazine	NA																				
	Sulfadimethoxine	NA																				
	Sulfamerazine	NA																				
	Sulfamethazine	NA																				
	Sulfanethizole	NA																				
	Sulfamethoxazole	E1694	25	ng/L	7	6	6	18	13.0	17.75	6	6	5.9	17	11	16.75						
	Sulfathiazole	NA																				
	Theobromine	NA																				
	Theophylline	NA																				
	Tonalid	NA																				
	trans-Testosterone	NA																				
	Triclosan	E1694	50	ng/L	7	5	6.4	16	10.0	14.8	6	2	7.1	17	12	16.5						
	Trimethoprim	E1694	10	ng/L	7	3	4.7	5.9	5.5	5.89	6	4	4.3	7.8	5.4	7.34						
	Tylosin	E1694	10	ng/L	7	4	1.2	11	4.8	9.995	6	1	2.9	2.9	2.9	2.9						
	Virginiamycin M1	NA																				
Metals																						
	Chromium (Hexavalent Compounds)	SW7196A	10	ug/L	15	1	3	3	3	3	14	3	2.5	5.4	3.9	5.24	14	3	1.5	4.2	2.5	3.96
	Asbestos	ELAP 198.2 - 10 M	0.02	mfl	11	0	ND	ND	ND	NA	11	0	ND	ND	ND	NA	11	ND	ND	ND	ND	NA

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					# Samp.	# Detect.	Concentration Detected				# Samp.	# Detect.	Concentration Detected				# Samp.	# Detect.	Concentration Detected			
							Min	Max	Avg	95%-ile			Min	Max	Avg	95%-ile			Min	Max	Avg	95%-ile
Select Inorganics/Ions																						
	Chloride	SW9251	5	mg/L	24	24	19	3,570	429	1,061	24	24	23.7	3,540	461	1,009	23	23	164	23,300	3,290	7,131
	Petroleum Hydrocarbons C10-C28	SW8015B	0.1	mg/L	13	1	0.1	0.1	0.1	0.1												
	Perchlorate[3]	E332.0	0.1	mg/L	14	8	0.056	0.43	0.204	0.419	23	19	0.086	0.42	0.163	0.319						
	Silica	A4500C/SM4500_SI_F/ SM4500-SI-C	0.1/1	mg/L	8	8	3.02	5.98	4.21	5.599	23	22	0.734	8.53	3.681	5.681	5	5	0.288	80.5	45.858	77.68
Conventional Parameters																						
	Algae	ALGAE		Cells/mL	12	12	20	1,000	405	1,000												
	Algae, Total (incuding diatom)	ALGAE		Cells/mL	11	11	120	3,900	1,272	3,450												
	Alkalinity	A2320B	5	mg/L							21	21	30.4	74.1	46.9	70	21	21	48.6	250	125	242
	Alkalinity, Bicarbonate	A2320B	5	mg/L							20	20	30.4	74.1	47.8	70.2	20	20	48.6	250	129	242.4
	Alkalinity, Hydroxide (CaCO)	A2320B	5	mg/L							20	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA
	Alkalinity, Total As CaCO3	A2320B	5	mg/L							20	0	ND	ND	ND	NA	20	0	ND	ND	ND	NA
	BOD20	SM5210B	6	mg/L	15	0	ND	ND	ND	NA							8	0	ND	ND	ND	NA
	BOD5	SM5210B	6	mg/L	1	0	ND	ND	ND	NA												
	Chlorophyll A	SM10200H	1	mg/m3	13	6	2.3	5.3	3.5	5.1												
	Conductivity	2510B/A2150B	1	umhos/cm	23	23	181	11,000	1,494	3,748	23	23	198	10,500	1,566	3,451	22	22	0.953	55,200	8,751	21,100
	DOC	SM5310B	1	mg/L	13	13	2.6	4.2	3.3	4.08	8	8	1.5	2.8	2	2.66	8	8	8.1	14.3	11.3	14.195
	N,Total	CALC		mg/L	8	8	0.538	1.49	0.87	1.295												
	Ortho P	SM4500P-E-ORTHO	0.03	mg/L	9	9	0.02	0.065	0.044	0.063	6	0	ND	ND	ND	NA	6	0	ND	ND	ND	NA
	Ortho P, Total	SM4500P-E-ORTHO	0.03	mg/L	4	4	0.031	0.13	0.061	0.118	2	0	ND	ND	ND	NA	2	1	0.008	0.008	0.008	0.008
	TDS	SM2540C	10	mg/L	47	47	74	5,500	1,130	3,859	44	44	80	6,850	1,110	2,981	43	43	728	43,500	7,110	22,660
	TOC	SM5310B	1	mg/L	33	33	2.6	3.7	3.1	3.44	29	29	1.4	2.2	1.8	2.1	29	29	3.6	34.5	11	14
	TSS	SM2540D	10	mg/L	33	33	10	86	29.9	56.2	14	0	ND	ND	ND	NA	14	6	10	35	19.5	34.25
	UV 254	SM5910B	0.009	1/cm	9	9	0.077	0.152	0.11	0.138												
	Color, Apparent	Field	15	mg/L	134	134	46	662	226	457.4	41	41	ND	22	5.317	15	18	18	13	32	23.5	31.15
Radionuclides																						
	Cesium-137	E901.1	9.6 to 12	pci/L	5	0	BRL	BRL	NA	NA	5	0	BRL	BRL	NA	NA	5	0	BRL	BRL	NA	NA
	Radium-228	E904.0	0.33 to 0.39	pci/L	9	1	0.48	0.48	0.48	0.48	9	0	BRL	BRL	NA	NA	9	5	0.46	0.92	0.684	0.902
	Stronitium-89	NA																				
	Strontium-90	E905.0/SR-03-RC-MOD	0.15 to 0.51	pci/L	4	0	BRL	BRL	NA	NA	4	0	BRL	BRL	NA	NA	4	2	0.36	0.5	0.43	0.493
	Tritium	E906.0	120	pci/L	5	1	240	240	240	240	5	1	192	192	192	192	5	1	169	169	169	169
	Uranium	SW6020	0.14 to 0.7	ug/L	7	4	0.16	0.78	0.41	0.729	7	1	0.36	0.36	0.36	0.36	7	4	0.3	1.2	0.73	1.151
Pathogens/Microbiologicals																						
	Diatom	ALGAE		Cells/mL	12	12	70	3,000	781	2,450												
	HPC	SM9215B	1	cfu/mL							29	28	1	4,900	360	2,132	30	30	27	20,000	3,000	8,805

Table 2B - Summary of Pilot Water Quality Laboratory Analytical Data,
Non-Clean Water Act Methods (Raw Water, RO Influent, and RO Concentrate)
Haverstraw Water Supply Project
United Water New York

FRACTION/ GROUP	ANALYTE	ANALYTICAL METHOD NO.	REPORT LIMIT[1]	UNITS	HWSP PILOT RAW WATER DATA (Dec. 2010 - July 2011)						HWSP PILOT RO INFLUENT DATA (Dec. 2010 - July 2011)						HWSP PILOT RO CONCENTRATE DATA (Dec. 2010 - July 2011)					
					# Samp.	# Detect.	Concentration Detected				# Samp.	# Detect.	Concentration Detected				# Samp.	# Detect.	Concentration Detected			
							Min	Max	Avg	95%-ile			Min	Max	Avg	95%-ile			Min	Max	Avg	95%-ile

Notes:
General - Blanks in the table indicate no analysis performed/no data available.
- All results are based on laboratory analyses performed by Test America, Inc.
[1] The Laboratory Reporting Limit is the lowest concentration that can be reliably measured within specified limits of precision and accuracy.
[2] Historical Hudson River water quality data was collected by United Water between 2007 and 2008.
[3] Water Quality models used for comparison are referenced in appended memo, SW-1.
(1) ND denotes not detected.
(2) NA denotes not applicable.
(3) BRL denotes below reporting limit.
[4] previously analyzed using EPA method 625 for Semi-Volatile Organic Compounds
[5] Please note that the Human Consumption of Fish classification H(FC) has more stringent guidelines than the Water Supply classification H(WS).
[6] Based on 5/26/11 meeting with NYSDEC, Acute ratio - 46:1, Chronic ratio - 131:1
[7] Based on assumption of 4 log removal of pathogens/microbiologicals during pretreatment
[8] RO influent measured from the filtrate of each MF/UF unit.

Table 3 - Summary of Sonde and Pilot Process Water Quality Analyzer Data,
Sonde, Raw Water, RO Influent, and RO Concentrate
Haverstraw Water Supply Project
United Water New York

Parameter	Units	Historical Hudson River Water Quality Data (April 2007 - April 2008)[2]					Sonde Water Quality Buoy Data (March 2008 - July 2011)					HWSP Pilot Plant Data (December 2010 - July 2011)														
												Raw Water (Pilot Influent)					Reverse Osmosis Influent					Reverse Osmosis Concentrate				
		No. of samples	Min	Max	Avg	95th Percentile	No. of samples	Min	Max	Avg	95th Percentile	No. of samples[4]	Min	Max	Avg	95th Percentile	No. of samples[4]	Min	Max	Avg	95th Percentile	No. of samples[4]	Min	Max	Avg	95th Percentile
pH	-	1,435	6.7	8.4	7.6	8	NA	6.72	8.52	7.72	8.35	NA	6.83	8.12	7.35	7.56	NA	2.60	7.60	5.79	7.50	110	5.4	8.1	6.4	7.3
Salinity	ppt	1,585	0.1	14.5	2.8	7.9	NA	0.07	8.27	2.23	5.7	126	0.1	4.5	1.1	3.1	123	0.1	4.6	1.1	3.3	110	0.5	29.5	6.5	20.0
Conductance at 25C	uS/cm	1,585	169	24,000	5,028	13,540	NA	160	14,320	4,090	101,200	NA	65	9,988	2,151	6,422	NA	190	8,939	2,072	6,125	NA	198	43,997	9,456	30,645
Temperature	deg C	1,585	0.4	30.0	15.6	27.4	NA	1.06	30.0	18.07	28.2	NA	0.9	26.3	8.5	22.8	123	3.6	25.4	12.3	24.4	110	5.9	26.0	14.2	25.1
TDS	mg/L	324	6	11,000	2,987	8,200	-	-	-	-	-	37	74	4340	1080	3124	34	80	4,800	952	2,717	33	728	28800	5940	18960
TOC	mg/L	325	1.0	4.7	2.5	4.1	-	-	-	-	-	26	2.6	3.7	3.1	3.375	24	1.4	2.2	1.8	2.1	25	3.6	34.5	11	14.18
Turbidity	NTU	211	0.8	69.0	18.7	56.0	NA	0.1	155.8	20.42	49.9	NA	2.3	99.8	21.9	48.9	NA	0.02	0.26	0.03	0.04	-	-	-	-	-

1. Average, minimum and maximum values include all detected samples, during indicated time frame. Percentile values include all available data results.
2. Historical data was collected weekly were sampled from April '07 through May '08.
3. Sonde water quality data was collected hourly for approximately 300 days each year since March '08.
4. HWSP Pilot data for pH, Conductance, Temperature and Turbidity in the raw water and RO influent was continuously collected every minute from December '10 until June '11.
   HWSP Pilot data for pH and Temperature was collected in the field for RO concentrate. RO concentrate conductance was collected continuously every minute from December '10 until June '11.
5. Data was compiled from the following data sources:
   - Weekly and monthly WQ laboratory sampling results
   - Weekly WQ field monitoring results
   - Continuous water quality buoy monitoring data
   - HWSP Pilot Laboratory Data through February '11 and Field Data through April '11

Appendix C

CDM

Memorandum

DEIS Support Technical Memorandum (TM # SW-1) *July 2, 2010*
Source Water and Receiving Water Analysis

Introduction

The purpose of this technical memorandum is to provide additional information requested by New York State Department of Environmental Conservation *(NYSDEC) as part of the Final Scoping Document for a DEIS for the United Water New York's (United Water) proposed Haverstraw Water Supply Project. This memo addresses NYSDEC's request for the following additional information:

The discussion of existing water quality of the Hudson River, and the effects on that water quality from relevant industrial or municipal wastewater discharges and other relevant activities, will be expanded. Specific information to be provided will include:

- *Assess potential contaminants reaching the intake site as a result of upstream dredging of PCBs, including data from the proposed pilot operation as well as any water quality sampling data available from the PCB dredging operations;*

- *Evaluate possible contamination at the proposed intake site by groundwater flow from the former Haverstraw landfill, based on sampling data from landfill monitoring wells as well as sampling data from proposed intake or pilot operation; modeling may be used to augment or support conclusions, but may not be substituted for sampling;*

- *Identify and assess potential contaminant loads at the proposed intake site from discharges to the river by other industrial operations, including waste water treatment plants and power generation facilities; location maps and discharge profiles will be provided for all such discharges within 25 miles of the proposed water intake site, and pilot plant sampling will specifically test for constituents of these identified discharges;*

- *Identify and assess impacts on water quality at the proposed intake site of existing significant non-point water pollution sources within 25 miles of the proposed intake site, including but not limited to agricultural or landscaping operations adjoining the shoreline, and storm drain discharges; and*

- *Based on available water quality data and information gathered during operation of the pilot plant, provide a full chemical and contaminate profile of Hudson River*

> *water at the intake; analysis of data should reflect changes over time, including but not limited to tidal and seasonal variations as well as any effects of large precipitation or storm water flow event (such as spring runoff).*

United Water requested an assessment of potential contaminants reaching the Haverstraw Water Supply Project intake and a profile of water quality constituents at the intake location. In response, this technical memorandum has been developed and addresses several key potential sources of contamination identified by NYSDEC. These are:

- Upstream dredging of PCBs
- Haverstraw Landfill groundwater
- Indian Point Nuclear Power Plant
- Other loadings within a 25-mile radius

Each of these potential sources is discussed below in the context of a water quality profile at the intake location.

1.0 Assessment of Potential Impacts at the Intake from Upstream Dredging of PCBs

The assessment of potential impacts at the intake from upstream dredging of PCBs includes a consideration of both measured data and model results for pre-dredging, during-dredging, and post-dredging conditions.

Pre-Dredging Conditions - The New York State Department of Health (DOH) began monitoring nine public drinking water supplies on the Hudson River for PCBs in May 2008 to establish a baseline before now on-going General Electric dredging of contaminated sediments in the Upper Hudson River commenced in 2009 from. The dredging will occur along a 40 mile stretch of the Hudson River from river mile 153.9 to river mile 193.7. The southern-most of the drinking water supplies monitored is at Poughkeepsie. Poughkeepsie (about river mile 80) is significantly upstream and closer to the General Electric dredging than the proposed Haverstraw intake (about river mile 38). The measured baseline PCB concentration for Poughkeepsie raw water was less than 68.7 ng/L. The measured baseline PCB concentration for Poughkeepsie treated water was less than 31.1 ng/L. These data were web available from DOH in February 2010 at http://www.nyhealth.gov/press/releases/2008/2008-07-21_pcb_testing_pre_dredging.htm and http://www.nyhealth.gov/environmental/water/drinking/hudson_river_baseline_monitoring_program_summary_2008.htm. In New York State, the drinking water maximum concentration for PCBs is 500 ng/L. Thus, prior to General Electric dredging, raw water PCB levels at Poughkeepsie were at least seven times smaller than the final maximum drinking water standard. These DOH measurements at Poughkeepsie set a reasonable expectation for even lower pre-dredging PCB levels at the proposed Haverstraw intake.

A lower pre-dredging baseline PCB concentration for the proposed Haverstraw intake would be approximately 12 – 34 ng/L (average 25 ng/L), based on data collected by NYSDEC in 1998-2000 in the Hudson River between the Bear Mountain Bridge and the Tappan Zee Bridge on four occasions. These data have been included in an August 2003 report web available on February 1, 2010 at http://www.dec.ny.gov/docs/water_pdf/carp.pdf. Thus, prior to General Electric dredging, raw water PCB levels near the proposed Haverstraw intake were at least fourteen times smaller than the final maximum drinking water standard over a range of tidal and seasonal conditions.

In addition, 2007 and 2008 Hudson River water quality monitoring conducted by United Water, reported non-detects for a number of PCB Aroclors near the proposed intake over a range of tidal and seasonal conditions.

During-Dredging Conditions - Dredging of the Upper Hudson River began in 2009 and was suspended after a few months. Phase 1 dredging occurred between May 15 and October 26, 2009 and 10% of a six year project was completed. Phase 2 dredging is anticipated to start in May 2011. Phase 1 dredging is described at www.hudsondredgingdata.com. During Phase 1 dredging activities, in-river PCB samples were collected and analyzed. Samples were collected far upstream of the proposed Haverstraw intake site, in the vicinity of the dredging with the southernmost samples collected at Poughkeepsie, NY.

During Phase 1 dredging, the 500 ng/L drinking water standard was exceeded near the dredging site; however that was not the case near Poughkeepsie and, by inference, further downstream in the vicinity of United Water's proposed intake. Per Figures I-3-4 and I-3-5 of the March 2010 *Hudson River PCBs Site EPA Phase I Evaluation Report* available at www.hudsondredgingdata.com, "tri+PCB" homolog concentrations in the Hudson River near Poughkeepsie ranged from 10 to 21 ng/L and total PCBs measured via the "Green Bay" analytical laboratory method ranged from 17 to 26 ng/L. Both of these ranges are based on seven samples collected between May and November 2009 during and immediately following Phase I Upper Hudson River dredging for a variety of seasonal and tidal conditions. Thus, PCB levels in the Hudson River during Phase 1 Upper Hudson River dredging operations were not problematic from a drinking water perspective near Poughkeepsie, the southernmost extent of regulatory monitoring for the Upper Hudson River dredging project.

The "Green Bay" and "tri+PCB" methods have been accepted by EPA, NYSDEC, and NYSDOH for measuring PCB concentrations. The "tri+PCB" method captures the mass of all of the PCB congeners with three to ten chlorine substitutions, but misses those congeners with one and two chlorine substitutions. The "Green Bay" method records peaks from an analytical instrument which can then be converted to congeners and homologs.

Expected PCB concentrations near the proposed United Water Intake when dredging operations resume are below 26 ng/L. Below 26 ng/L is not dissimilar to and is statistically the same as what might be expected absent dredging activities (e.g., measurements made by NYSDEC from 1998 to 2000 in Haverstraw Bay, less than 34 ng/L). One plausible explanation for why dredging activities on the Upper Hudson River do not elevate downstream water concentrations of PCBs (as demonstrated by measured data) is that sediments contaminated with PCBs that are suspended during dredging operations on the Upper Hudson River settle back to the sediment bed in upstream reaches of the River.

Further, as explained by Mr. Walter Mugdan, Director of the Emergency and Remedial Response Division at the Region 2 office of the EPA, during a March 15, 2010 seminar at the Smithsonian's National Museum of the American Indian in New York City, a resuspension standard used for the Upper Hudson River PCB remedial dredging was specifically designed to protect drinking water intakes downriver of the dredging operations. Mr. Mugdan also indicated that it is likely that the resuspension standard would be modified for Phase 2 dredging expected to commence in 2011. The 500 ng/L drinking water standard for PCBs was achieved during the dredging operations even 20 to 30 miles upstream of the nearest Hudson River drinking water intake. Mr. Mugdan indicated that there were no measurable impacts to the Lower Hudson River as a result of the Phase 1 dredging. Visual aids from Mr. Mugdan's presentation, titled *Hudson River Dredging – Overview and Update*, are web-available at http://www.hudsonriver.org. Final decisions regarding the next phase of Upper Hudson River PCB dredging will be made by EPA sometime after June 2010.

It is anticipated that when Upper Hudson River remedial dredging resumes in 2011, United Water will be collecting Hudson River water quality data at its proposed intake location for the Haverstraw Water Supply Project and the EPA will again be monitoring Hudson River water quality at Poughkeepsie, NY.

Post-Dredging Conditions – At some point in the future, the dredging of the Upper Hudson River will be completed and a large source of PCBs to the lower Hudson River will be removed. Based on previous HydroQual modeling work for the Contaminant Assessment and Reduction Project (CARP), the Upper Hudson River is responsible for up to 93% of the PCB concentration resulting near the proposed United Water intake in Haverstraw Bay (see CARP matrix downloadable from http://www.carpweb.org).

The EPA has projected changes to the PCB loading to the lower Hudson River at Albany in the future as a result of the completion of the Upper Hudson River dredging. These projected changes include a 98% drop over sixty-nine years in annual PCBs delivered from the Upper Hudson River at Albany according to the column labeled "R20RS (REM 3/10/Select - w/0.13%resuspension) - 6 yr dredge" in Table 363150-7, Tri+ PCB Load Over Federal Dam, on page 70 of *Responsiveness Summary Hudson River PCBs Site Record* *of Decision,* web available at http://www.epa.gov/hudson/Resp_Summ_Files/rsbk3-02.pdf.

Concentrations in the lower Hudson River resulting from the expected post-dredging PCB loading change have been modeled by HydroQual for the Contaminant Assessment and Reduction Project (CARP). The CARP model results, accessed by HydroQual specifically for United Water Haverstraw Water Supply Project New York State Environmental Quality Review Act (SEQR) purposes, suggest that near the proposed United Water Intake, future (i.e., 37 years from now) PCB water column concentrations from the Upper Hudson River and all other expected sources (e.g., in-place legacy sediments, STPs, CSO, runoff, atmospheric deposition, etc.) will be 2 – 10 ng/L, at least a 10 ng/L decrease from NYSDEC 1998-2000 CARP measurements in Haverstraw Bay.

During a March 15, 2010 seminar at the Smithsonian's National Museum of the American Indian in New York City, Mr. Walter Mugdan, Director of the Emergency and Remedial Response Division at the Region 2 office of the EPA, indicated that the EPA's Record of Decision (ROD) projection for the drop in PCB loadings to the Hudson River resulting from future completion of Upper Hudson River dredging was likely an overestimate by a factor of two or three times. The projection included assumptions about natural attenuation and burial of PCBs which the agency now considers to be overestimated.

The CARP modeled estimate of less than 10 ng/L of PCBs in Haverstraw Bay after completion of the Upper Hudson River dredging is probably a factor of three higher, less than 30 ng/L rather than 10 ng/L, based on EPA's recently reported concern that loadings reductions it reported in the ROD are overestimated. Even 30 ng/L near the proposed Haverstraw Water Supply Project Intake would not pose a drinking water threat to human health as described below. Given the uncertainty regarding the PCB loading to the lower Hudson River at Albany in the future after the completion of the Upper Hudson River dredging, a modeling analysis which considers a worst-case future with current PCB loadings is relevant.

Concentrations in the lower Hudson River resulting from a "no action" case on the Upper Hudson River have been modeled by HydroQual for the Contaminant Assessment and Reduction Project (CARP). The CARP model results, accessed by HydroQual specifically for United Water Haverstraw Water Supply Project SEQR purposes, suggest that near the proposed United Water Intake, future (i.e., 37 years from now) PCB water column concentrations from the Upper Hudson River and all other expected sources (e.g., in-place legacy sediments, Sewage Treatment Plants, Combined Sewage Overflows, runoff, atmospheric deposition, etc.) will be 13.6 – 55.2 ng/L (average 31.6 ng/L) in Haverstraw Bay without any Upper Hudson River remedial action. This result suggests that even without Upper Hudson River remediation, there will be almost a factor of ten between the safe drinking waters standard and PCB levels near the proposed water intake.

On the basis of measurements and numerical modeling, future PCB concentrations in the Hudson River near the proposed United Water intake will be far below the safe drinking water standard of 500ng/L both during continued Upper Hudson River dredging activities and after Upper Hudson River dredging is completed. The raw water at the proposed intake will be compliant with the PCB drinking water standard, even without the further PCB removal that United Water's proposed treatment system will achieve.

2.0 Assessment of Potential Impacts at the Intake from Groundwater Flow from Former Haverstraw Landfill

To date, a release from the Haverstraw Landfill via groundwater to the Hudson River has not been identified by the CDM team.

3.0 Identification and Assessment of Contaminant Loadings within a 25-Mile Radius

A wide range of contaminants and contaminant sources have been considered and are described below. At the request of NYSDEC, sources and contaminants were identified within a 25-mile radius. As part of this process, although not requested directly by NYSDEC, added attention has been given to the topic of discharge of radionuclides from the Indian Point Nuclear Power Plant due to the location of the Indian Point Nuclear Power Plant relative to the proposed United Water Haverstraw Water Supply Intake.

3.1 Identification of Contaminant Loadings within a 25-Mile Radius

Contaminant sources were identified by considering the Toxics Release Inventory (TRI), the National Priorities List (NPL), and the State Pollutant Discharge Elimination System (SPDES) facilities/sites databases. Data were obtained within a 26-mile radius of the proposed United Water Haverstraw Water Supply Intake to be fully inclusive of a 25-mile radius.

Two criteria were used to determine which facilities/sites to include. The first criterion was distance from the facility/site to the proposed intake location. The second criterion was whether or not the facility/site location would ultimately drain to the Hudson River within the search radius. The watersheds draining to the Hudson River within the 26 mile radius were identified. Figure 1 displays both the search radius and those watersheds that drain to the Hudson River within the search radius. As shown on Figure 1, there are 18 relevant watersheds in total. The 18 watersheds are named on Figure 1. Twelve of the watersheds each include drainage areas not immediately adjacent to the Hudson River and each ultimately discharges to discrete locations along the Hudson River. Six of the watersheds are immediately adjacent to the Hudson River and drain directly to the Hudson River, dispersed along a length of the shoreline.

When identifying facilities/sites to be included in the analysis, all facilities/sites falling outside of the search radius, facilities/sites that discharge to watersheds that do not drain to the Hudson River and those draining to the Hudson River outside of the search radius were eliminated. Those facilities discharging within one of the 12 non-adjacent watersheds were assigned a discharge location to the Hudson River corresponding to the watershed drainage point. The remaining facilities falling within the six watersheds adjacent to the Hudson River were assigned individual discharge locations along the River. All facilities within the search area were included regardless of whether they have discharge data. For instances where no discharge data are available, either estimates can later be made for the loads of individual chemicals or the loads can be left as zero where an estimate is not possible or appropriate. Figure 2 displays the locations of the contaminant sources identified from NPL, SPDES, and TRI. Figure 3 displays these locations along with the Hudson River discharge locations used in numerical modeling simulations.

3.1.1 Identification of SPDES Facilities

The SPDES permitted facilities to be considered were determined using data supplied by AKRF as well as data available through the EPA Permit Compliance System (PCS) (http://www.epa.gov/enviro/html/pcs/pcs_query_java.html) and the Enforcement & Compliance History Online (ECHO) (http://www.epa-echo.gov/echo/compliance_report_water_icp.html) websites. All facilities were queried for the region. The list resulting from the regional query was shortened to only those falling within watersheds draining to the Hudson River within 26 miles of the intake location. The query list included both major and minor discharges. The majority of the minor discharges did not have any monitoring data available. All discharges to tributaries of the Hudson River were assigned the tributary's discharge location on the Hudson River for numerical modeling purposes. All of the major discharges that discharge directly to the Hudson River were assigned individual discharge locations. The minor dischargers discharging directly to the Hudson River were assigned either the nearest tributary or major discharge point for numerical modeling purposes. In total, there were 19 major discharges and 366 minor discharges included. The major facilities are listed in Table 1. A complete list of major and minor facilities is included in Appendix A.

Table 1. Major SPDES Discharges Included in the Model

Permit	*Name*	*Discharge Watershed*
NY0006262	DANSKAMMER GENERATING STATION	Breakneck Brook-Hudson River
NY0008231	ROSETON GENERATING STATION	Breakneck Brook-Hudson River
NY0025976	BEACON (C) WPCP	Breakneck Brook-Hudson River

NY0026310	NEWBURGH (C) WWTP	Breakneck Brook-Hudson River
NY0005096	IBM - EAST FISHKILL FACILITY	Wiccopee Creek-Fishkill Creek
NY0022144	CORNWALL (T) WWTP	Silver Stream-Moodna Creek
NY0022446	NEW WINDSOR (T) STP	Silver Stream-Moodna Creek
NY0023761	WEST POINT-TARGET HILL STP	Foundry Brook-Hudson River
NY0100803	PEEKSKILL SANITARY SD WWTP	Annsville Creek
NY0004472	INDIAN POINT NUCLEAR POWER PLANT	Furnace Brook-Hudson River
NY0005711	LOVETT GENERATING STATION	Furnace Brook-Hudson River
NY0028851	STONY POINT (T) STP	Furnace Brook-Hudson River
NY0028533	HAVERSTRAW JOINT REGIONAL STP	Furnace Brook-Hudson River
NY0008010	BOWLINE POINT GENERATING STATION	Furnace Brook-Hudson River
NY0026743	YORKTOWN HEIGHTS SD WWTP	Bailey Brook-Croton River
NY0108324	OSSINING SANITARY SD WWTP	Sparta Brook-Hudson River
NY0026051	ORANGETOWN (T) SD#2 STP	Sparkill Creek-Hudson River
NY0031895	ROCKLAND CO SD#1 STP	Sparkill Creek-Hudson River
NY0026689	YONKERS JOINT WWTP	Sparkill Creek-Hudson River

3.1.2 Identification of TRI Facilities

The TRI facilities were identified using data supplied by AKRF as well as data available through the National Institute of Health (NIH) and National Library of Medicine (NLM) TRI/NPL website (http://toxmap.nlm.nih.gov/toxmap/main/index.jsp) and the EPA TRI website (http://www.epa.gov/enviro/html/tris/index.html). Similar to the approach used for the SPDES data, all facilities/sites for the region were queried and then narrowed down to those discharging to watersheds draining to the Hudson River within the search radius. In addition, all sites with no releases to the water were identified and eliminated from the list of sites. All sites with reported releases to water between the years 1988 and 2008 were included. Sites were assigned discharge points if discharging directly to the Hudson River or the appropriate tributary discharge point if discharging to a tributary. A total of eighteen TRI facilities discharging to water within the search radius were identified. Of the 18 sites, 4 have major SPDES permits associated with them and 6 have minor SPDES permits associated with them. In this sense, only eight new sources were identified. The TRI facilities are listed in Table 2, with a complete list of all facilities/sites included in Appendix A.

Table 2. Toxic Release Inventory Discharges to Water Included in the Model

TRI ID	*Name*	*Discharge Watershed*
10702GRPHT1050N	GRAPHITE METALLIZING CORP	Saw Mill River
10598NTLBSRTE13	IBM T. J. WATSON RESEARCH CENTER	Bailey Brook-Croton River

10548VHDSN138AL	U.S. VA HUDSON VALLEY HEALTHCARE SYSTEM	Furnace Brook-Hudson River
10566THMRL1057L	BASF PEEKSKILL PIGMENT FACILITY	Furnace Brook-Hudson River
10980KYFRSKAYFR	KAY-FRIES INC.	Furnace Brook-Hudson River
10993LVTTGSAMSO	MIRANT LOVETT GENERATING STATION	Furnace Brook-Hudson River
10562MTLLZ19SOU	METALLIZED CARBON CORP	Sparta Brook-Hudson River
10701CBLCRFOOTO	BICC UTILITY CABLE CO.	Sparkill Creek-Hudson River
10962MNGRPROUTE	MINIGRIP INC.	Sparkill Creek-Hudson River
12553MBLLN1281R	GLOBAL COS LLC NEWBURGH TERMINAL	Quassaic Creek
10918CHSTR15OAK	NEXANS ENERGY USA INC	Silver Stream-Moodna Creek
12543STRNLHENRY	EASTERN ALLOYS INC	Silver Stream-Moodna Creek
12508THRSTONEEA	THREE STAR ANODIZING CORP.	Wiccopee Creek-Fishkill Creek
12533BM EASTF	IBM CORP	Wiccopee Creek-Fishkill Creek
12533MCRS HUDSO	NXP SEMICONDUCTORS	Wiccopee Creek-Fishkill Creek
12550DNSKM594RI	DANSKAMMER GENERATING FACILITY	Breakneck Brook-Hudson River
12550RSTNG992RA	ROSETON GENERATING FACILITY	Breakneck Brook-Hudson River
12553WRXTRRIVER	WAREX TERMINALS CORP NORTH TERMINAL	Breakneck Brook-Hudson River

3.1.3 Identification of NPL Sites

NPL sites were identified in the same manner as the TRI sites using information obtained by AKRF along with information HydroQual obtained from the NIH/NLM website to get all sites for the region. Those sites that fall within the Hudson River watershed and the 26 mile search radius were selected. NPL sites were included regardless of status. Discharge points were assigned for each of the sites within the immediate Hudson River watershed and those in tributaries were assigned the tributary discharge location. The six NPL facilities are listed in Table 3, with a complete list included in Appendix A.

Table 3. National Priorities List Sites Included in the Model

NPL ID	*Name*	*Discharge Watershed*
NYD980780795	KATONAH MUNICIPAL WELL	Bailey Brook-Croton River
NYD980652275	BREWSTER WELL FIELD	Bailey Brook-Croton River
NYD010959757	MARATHON BATTERY CORP.	Foundry Brook-Hudson River
NYD000511451	NEPERA CHEMICAL CO., INC.	Silver Stream-Moodna Creek
NYSFN0204269	SHENANDOAH ROAD GROUNDWATER CONTAMINATION	Wiccopee Creek-Fishkill Creek
NY0002455756	CONSOLIDATED IRON AND METAL	Breakneck Brook-Hudson River

3.1.4 Identification of Non-Point Source Inputs

Non-point sources were identified in two ways. First, HydroQual's previous modeling of the NY/NJ Harbor Estuary includes models which estimate CSO and storm water (SW) discharge volumes from precipitation records, drainage areas, land-use types, and sewer system characteristics. Second, 67 of the minor SPDES permits identified in the 25-mile radius analysis for United Water are storm water permits.

3.1.5 Identification of Contaminants

133 different contaminants were identified from the SPDES, TRI, and NPL 25-mile radius searches. Based on the SPDES permitted facilities with available Discharge Monitoring Report (DMR) data, there were 82 different contaminants discharged by at least one discharger within the search area. There were TRI releases of 44 different contaminants reported within the search area by at least one facility. There were 55 contaminants of concern listed across all of the NPL sites. There was some overlap in the contaminants identified across the different source types, and some that were unique to each source type.

In addition to the SPDES, TRI, and NPL data, data collected by NYSDEC CARP were considered. The Yonkers and Rockland County wastewater treatment facility effluents were sampled and analyzed by NYSDEC CARP for 288 different contaminants. These contaminants include: dioxin/furan congeners, PCB congeners, PAHs, organochlorine pesticides, and metals. Of the 288 contaminants measured by NYSDEC CARP in the STP effluents, 270 were detected at least once. Of these 270 contaminants detected in the STP effluents at least once, 263 did not appear in any of the SPDES, TRI or NPL databases. Including the contaminants measured by NYSDEC CARP, there are 396 unique contaminants within a 25-mile radius of the proposed intake. 193 of the contaminants are PCB congeners. The contaminants are listed in Appendix B.

In addition, CARP also monitored contaminant concentrations throughout the region at CSO and stormwater discharge points and in small runoff-dominated tributaries. Together with volumetric discharge estimates from HydroQual watershed/sewershed models, CSO and stormwater loading estimates could be made for 270 contaminants measured by CARP.

3.2 Estimation of Contaminant Loadings

The contaminant specific loadings developed for each discharge identified from SPDES and TRI are included in Appendix C. The development of these loading estimates was a large effort and involved decision making on a case by case basis based on varied types of information available. Information may have been aggregated for multiple outfalls associated with a given source, flow and concentration information may have been combined to develop a loading, or seasonal information may have been annualized, etc. The loading estimates were a critical input requirement for completing the numerical modeling evaluation within the 25-mile radius. Specifically, the steps in the modeling evaluation were to: identify discharge locations, identify contaminants released, calculate loadings for each contaminant/discharge location, perform generic loading model simulations for each discharge location, and to scale generic model simulation results for specific contaminant loadings estimates. The loading estimates developed represent a great deal of information and are probably useful for purposes beyond Haverstraw Water Supply Project SEQR requirements.

Appendix C is a table ordered alphabetically by contaminant name. For each contaminant, the multiple sources of that contaminant are identified in adjacent rows. The last row per contaminant looks at the multiple sources as a sum. The columns in Appendix C include: the facilities/sites and the model calculated mean and maximum response factors as presented in Appendix A, the contaminant name, the available loading data from SPDES and TRI, and finally the expected mean and maximum contaminant concentrations near the proposed intake location. The concentrations near the proposed intake location were calculated based on multiplying the model calculated response factors by the contaminant loadings.

3.2.1 Assessment of Contaminant Loadings within a 25-Mile Radius

Specifically for the 25-mile radius evaluation, numerical model calculations were performed using the high resolution computational grid, hydrodynamic model, and contaminant transport model developed for the United Water project. The computational grid underlying the project modeling is shown on Figure 4.

A generic continuous discharge release was simulated for each discharge location using the high resolution computational grid, hydrodynamic model, and contaminant transport models. The simulations produced the contaminant concentration resulting near the United Water intake location per unit loading from each identified facility/site contaminant source. The last two columns in the Appendix A table present the high resolution numerical model calculations of mean and maximum concentration resulting near the Haverstraw Water Supply Project proposed intake per unit loading release from the various facilities and sites identified.

The simulations were conservative in nature in that no decay or transformation processes were considered. In total, 72 model simulations were performed representing direct releases to the Hudson River from individual sources within immediately adjacent watersheds and aggregated source releases from non-adjacent watersheds. The conservative assumption of no attenuation of loadings from non-adjacent watersheds was used for these calculations in an attempt to maximize the loadings potentially reaching the proposed United Water intake. Each simulation included the fifteen water years from October 1994 to September 2009. The fifteen water years included in the simulations capture a wide range of seasonal variations and weather conditions.

The 72 model simulations were used to predict resulting concentrations in the Hudson River at the proposed United Water intake location due to specific contaminant releases. Specifically, the generic model results for unit loadings were scaled based on the actual reported magnitudes of individual contaminant loadings. The individual discharge results for a given contaminant were then summed to determine the total estimated contaminant concentration at the proposed United Water intake site. This approach allows additional contaminants to be considered in the future without much additional effort other than developing loading estimates. If necessary, results for any additional sources could be estimated based on the results of nearby facilities/sites.

A limitation of the 72 simulation modeling approach is that it ignores partitioning of the contaminants onto particles. While it is true that the settling of particles out of the water column to the sediment bed is a loss term not considered in the 72 model simulations, which would tend to result in model over-prediction of contaminant concentrations, there is also a particle effect not considered in the model that could cause model under-prediction of contaminant concentrations. Since estuaries are known to be efficient trappers of particles, specific contaminants which exhibit strong particulate phase partitioning would be transported toward the ocean over longer time scales (i.e., more slowly) than contaminants which do not associate with particles. Further, the location of the boundary of the high resolution model developed for the project within the estuary rather than at the ocean is less than ideal because of the bi-directional estuarine transport dynamics and the proximity of some of the contaminant sources evaluated to the model boundary.

In addition to the 72 generic continuous release model simulations performed on the high resolution computational grid, additional simulations were completed using the CARP modeling framework to quantify the effect phase partitioning of contaminants to particulate organic carbon and other suspended particles could have on the predicted concentrations at the intake site. The CARP modeling framework includes linked sediment transport, organic carbon production, and contaminant fate and transport models. Sediment transport model outputs and associated organic carbon transport model outputs required to simulate partitioning of contaminants to solids or organic carbon were readily available from CARP and were used for the 25-mile radius analysis. The computational grid associated with the CARP modeling framework includes less spatial resolution than the computational grid developed specifically for Haverstraw Water Supply Project purposes. Although providing less spatial resolution, the CARP modeling framework advantageously provided the ability for the Haverstraw Water Supply Project to readily consider sediment transport and contaminant phase partitioning effects on contaminant concentrations near the proposed intake.

To quantify the impacts of sediment/organic carbon transport and contaminant phase partitioning processes, CARP model simulations for a number of 25-mile radius discharges were specifically completed on the CARP model grid. Both entirely dissolved phase and highly sorbed (i.e., bound to particulate organic carbon) substances were simulated to demonstrate the maximum potential impacts of sediment transport on the estimated concentrations at the intake site. In total, 12 CARP model simulations were performed by HydroQual for the Haverstraw Water Supply Project 25-mile radius analysis of facilities/sites. An additional CARP model simulation was necessary for non-point source evaluation purposes.

The CARP model testing results indicate that the significance of not including sediment transport effects in the high resolution modeling analysis varies by distance from the intake location and reach of the River. Of the locations tested with the CARP model, calculations of factors for concentration at the intake per mass release were most similar for a dissolved vs. a fully particle bound contaminant for the Haverstraw Joint Regional Sewage Treatment Plant (JRSTP), Newburgh/Beacon, and north boundary discharge locations. It is noted that the test simulations using a fully particle bound contaminant are somewhat unrealistic in that all contaminants to some degree have a dissolved phase. The intention was to make the test as drastic as possible to maximize the impact of potential sediment transport effects. Average factors for concentration near the Haverstraw Water Supply Project Intake per mass release were within less than 25% difference whether calculated as dissolved tracers or fully particle bound substances for each of the JRSTP, Newburgh/Beacon, and upstream model boundary discharge locations. Maximum factors for intake concentration per mass release were within less than 7% difference whether calculated as dissolved tracers or fully particle bound substances for each of these three release locations. These results indicate that for contaminant releases from these locations, sediment transport would not be expected to have an appreciable impact on the factors, even for 100% particulate phase contaminants. Actual contaminants would have much smaller differences.

Somewhat greater differences in calculated factors for concentration at the intake per mass release would be expected for fully particulate vs. fully dissolved contaminant releases from Indian Point, less than 25% difference either on an average factor or maximum factor basis. It is noted that actual radionuclides or contaminants would have much smaller differences than the fully particulate substance simulated for testing purposes. Radionuclides such as tritium are fully in the dissolved phase and the potential differences due to particle phenomena are completely irrelevant.

The worst comparability between factors for concentration at the intake per mass release calculated for fully dissolved and fully particulate contaminant releases obtained with CARP model testing were for the Saw Mill River and South boundary discharge release locations. These differences were up to 47% for average factors and up to 69% for maximum factors. These results are attributable to greatest spatial distance/time of travel to the intake from the discharge locations over which increased particle-related phenomena (i.e., settling, resuspension, etc.) potentially occur and greater energy in near bottom waters of downstream vs. upstream reaches. Stated more simply, differences in transport of fully dissolved phase and fully particulate phase contaminants become most apparent with increasing distance away from the intake location and in the downstream vs. the upstream direction. It is noted that actual contaminants would have much smaller differences than the fully particulate substance simulated for testing purposes.

Model simulations with the high resolution model were completed for each of the discharge locations determined above in Section 3.1 using a continuous load from each of the discharge points in the dissolved phase. Both the average and maximum concentrations at the proposed intake site resulting from each of the loads are tabulated in Appendix C for use in the analysis of individual chemical responses at the intake location. Appendix D expands upon Appendix C information, with the addition of CARP loading measurements for CSO, stormwater, and two major STPs to the analysis.

Results tabulated in Appendices C and D have the intended use of providing a quantitative screening tool for contaminant releases that could potentially pose a threat to the Haverstraw Water Supply Project intake location. In particular, the results in Appendices C and D are useful for contaminants for which concentrations have not been measured near the intake location. Any threats identified on the basis of Appendices C and D modeling results should be further evaluated with a more targeted analysis which considers:

- Uncertainty of the contaminant loading information. Are loadings inferred from SPDES, TRI, NPL, and CARP information representative for the specific contaminant on an ongoing basis?

- Attenuation in the watershed before reaching the Hudson River. Was zero attenuation in the watershed before reaching the Hudson River too conservative an assumption for the specific contaminant?
- Contaminant specific decay and transformation processes. Was zero decay or transformation too conservative of an assumption for the specific contaminant?
- Contaminant specific phase partitioning. Is the specific contaminant strongly particle associated and is 100% dissolved an inappropriate screening calculation assumption for the specific contaminant?
- Contaminant specific sediment transport and estuarine particle trapping effects. Is the specific contaminant entering the Hudson River far away from the intake location and is it strongly particle associated?
- Location/proximity of contaminant source location relative to model boundary location. Are the major discharge points for the specific contaminant very distant from the intake location and in the downstream direction?
- Measurements being made at the raw water intake location during pilot testing. Are new measurements consistent with model screening results?
- Removal performance of the drinking water treatment system for the specific contaminant. Does the raw water need to fully meet the drinking water standard for the specific contaminant?

An example of the application of this approach, using Appendix C or D results for tetrachloroethylene, is described here. Tetrachloroethylene discharge information is available from all three sources: SPDES, TRI and NPL. DMR data are available from four SPDES permitted facilities: Yonkers, Newburgh, and Orangetown WWTPs and IBM East Fishkill facility. TRI data are available for the IBM East Fishkill facility. 2 NPL sites list tetrachloroethylene as a contaminant of concern: the Brewster well field site and the Shenandoah Road groundwater contamination site. The concentration impact of each of these facilities/sites at the intake location is estimated by multiplying the load or release from each site by the concentration dilution factor per unit load estimated by the Haverstraw Water Supply Project numerical model for each facility/site. The concentration dilution factor per unit load estimated by the Haverstraw Water Supply Project numerical model results are found in Appendix A and C. The estimated loading estimates are found in Appendix C. The total concentration near the intake location can be estimated by summing the individual facility/site concentration impact estimates. The concentration totals are presented in Appendix D. Appendix C includes results for SPDES and TRI identified facilities only. Appendix D adds in additional results for CSO and stormwater and major STP releases for those contaminants for which loading estimates could be made. It is worth noting that the NPL site information does not include sufficient data to estimate loads but can be used to indicate the potential for a given chemical to occur within the 26 mile search area.

The maximum tetrachloroethylene concentration estimated through modeling based on the known loads is a maximum of 2.25×10^{-2} ug/L. The drinking water standard for tetrachloroethylene, 5 ug/L, is more than 200 times higher than the estimated concentrations. On this basis, tetrachloroethylene from these sources does not appear to be a problem at the intake location. Tetrachlorethylene is further discussed below in Section 3.3.5.1.

3.3 Profile of Hudson River Water Near the Proposed Intake

The profile of contaminants in Hudson River water near the proposed intake will continue to be assessed on an on-going basis as the pilot plant is operated and intake water quality is monitored. In advance of considering raw water measurements expected to be collected during pilot plant operations, previous United Water monitoring during the conceptual design phase of the proposed Haverstraw Water Supply Project and recent modeling of contaminant loadings within a 26-mile radius do much to complete a profile of contaminants in Hudson River water near the proposed intake.

Data collected by United Water between May 2007 and April 2008 include numerous samples taken at five Hudson River locations within the vicinity of the proposed location for the Haverstraw Water Supply project intake. The samples were analyzed for basic water quality parameters, trace elements, microbiological parameters, radionuclides, polychlorinated biphenyls, endocrine disrupting compounds, pharmaceuticals, and personal care products. It was demonstrated that Hudson River water near the proposed intake is largely of similar quality as other local and national water supplies.

3.3.1 Basic Water Quality Parameters, Trace Elements, and Microbiological Parameters

As mentioned previously, UWNY conducted water quality sampling of the Hudson River in 2007 and 2008. Measurements were taken at five locations in the Hudson River surrounding the proposed intake location during the sampling period from May 2007 through April 2008 under a variety of tidal and seasonal conditions. For several of the parameters, more than 200 independent measurements were made. These data demonstrate that Hudson River water near the proposed intake is largely of superior or similar quality as other local and national water supplies. It is anticipated that United Water will continue monitoring these parameters in the raw water intake during pilot operations of the proposed facility through a wide range of tidal and seasonal conditions.

In addition, the Riverkeeper has been collecting basic water quality data in Haverstraw Bay midchannel. Sampling results from September 2006 to October 2009 are available at http://www.riverkeeper.org/special/swimmableriver/data.php?id=35.5. These measurements include *Enterococci* count, temperature, salinity, chlorophyll, turbidity, and dissolved oxygen as a percentage of saturation. These data are generally confirmatory of the data collected by United Water. For example, the Riverkeeper's turbidity data range from 4 to 52 NTU and United Water's measurements range from 0.75 to 69 NTU.

Of particular interest are the Riverkeeper's measurements of *Enterococci* bacteria. *Enterococci* are considered to be sewage indicating bacteria. The Riverkeeper's presentation of *Enterococci* measurements are presented in concert with antecedent precipitation events at http://www.riverkeeper.org/special/swimmableriver/site.php?id=35.3. The majority of the *Enterococci* data (i.e., < 35 per 100 ml) suggest that the Hudson River water in Haverstraw Bay is fully safe for swimming per federal guidelines outlined in the 2000 Beaches Environmental Assessment and Coastal Health Act (BEACH Act). Elevated *Enterococci* counts, greater than 35 per 100 ml, were observed on only four occasions with no correlation to antecedent precipitation. Only one of the elevated counts, 164 *Enterococci* per 100 ml on April 25, 2007, indicates that the water in Haverstaw Bay is unsafe for swimming. In New York State, total coliform, fecal coliform, and *E. coli*, not *Enterococci*, are measured/regulated in drinking water.

Although *Enterococci* are not measured or regulated for drinking water in New York, the fact that the *Enterococci* levels measured by the Riverkeeper in Haverstraw Bay meet federal guidelines for swimming is indicative of good water quality near the proposed intake for the Haverstraw Water Supply Project.

Basic water quality parameters identified in the 25-mile radius search listed in Appendix B include: ammonia, five day biological oxygen demand (BOD5), total organic carbon (TOC), nitrate, nitrite, oil and grease, orthophosphate, chemical oxygen demand (COD), ultimate oxygen demand (ODU), dissolved oxygen (DO), pH, phosphate, phosphorus, solids, total Kjeldahl nitrogen (TKN), and turbidity.

Trace elements identified in the 25-mile radius search listed in Appendix B include: aluminum, antimony, arsenic, barium, boron, cadmium, cobalt, copper, cyanide, germanium, hafnium, hexavalent chromium, iron, lead, lithium, manganese, mercury, molybdenum, nickel, palladium, potassium, rhenium, ruthenium, selenium, silver, tantalum, tin, titanium, tungsten, vanadium, and zinc.

Microbiological parameters identified in the 25-mile radius search listed in Appendix B include: coliform and *Salmonella*.

Example 25-mile radius search results and numerical modeling results for selected basic water quality parameters, trace elements, and microbiological parameters are described, including cadmium, lead, and mercury.

3.3.1.1 Cadmium Profile Results

The federal enforceable standard for safe drinking water is 5 ug/L (5000 ng/L). Cadmium releases within a 25-mile radius of the proposed drinking water intake were identified in the four data sources examined: SPDES, TRI, NPL, and CARP. CARP measured cadmium concentrations in Haverstraw Bay a few miles downstream of the proposed intake on two occasions between 1998 and 2002. These measurements had a mean cadmium concentration of 46 ng/L (http://www.dec.ny.gov/docs/water_pdf/carp.pdf , see page 142 Table 105). On the basis of these measurements, even raw Hudson River water near the intake location would be expected to meet the safe drinking water standard for cadmium. High resolution numerical modeling results further indicate that cadmium should not be a problem. As indicated in Appendix D, numerical model results suggest that cadmium concentrations at the proposed intake location will average 15.2 ng/L and could be as high as 706 ng/L.

3.3.1.2 Lead Profile Results

The federal drinking water action level for lead is 0.015 mg/L (15,000 ng/L). Lead releases within a 25-mile radius of the proposed drinking water intake were identified in the four data sources examined: SPDES, TRI, NPL, and CARP. CARP measured dissolved phase lead concentrations in Haverstraw Bay a few miles downstream of the proposed intake on two occasions between 1998 and 2002. These measurements had a mean dissolved phase lead concentration of 99 ng/L (http://www.dec.ny.gov/docs/water_pdf/carp.pdf , see page 142 Table 105). United Water measurements of lead in the Hudson River in 2007 ranged from 5100 to 6000 ng/L. On the basis of these measurements, all below the drinking water action level of 15,000 ng/L, even raw Hudson River water near the intake location would be expected to meet the safe drinking water standard for lead. High resolution numerical modeling results further indicate that lead should not be a problem. As indicated in Appendix D, numerical model results suggest that lead concentrations at the proposed intake location will average 40 ng/L and could be as high as 2,890 ng/L.

3.3.1.3 Mercury Profile Results

The federal enforceable drinking water standard for mercury is 0.002 mg/L (2,000 ng/L). Mercury releases within a 25-mile radius of the proposed drinking water intake were identified in two of the four data sources examined: SPDES and CARP. CARP measured mercury concentrations in Haverstraw Bay a few miles downstream of the proposed intake on two occasions between 1998 and 2002. These measurements had a mean mercury concentration of 6.7 ng/L (http://www.dec.ny.gov/docs/water_pdf/carp.pdf , see page 142 Table 105). On the basis of these measurements, far below the drinking water standard of 2,000 ng/L, even raw Hudson River water near the intake location would be expected to meet the safe drinking water standard for mercury. High resolution numerical modeling results further indicate that lead should not be a problem. As indicated in Appendix D, numerical model results suggest that mercury concentrations at the proposed intake location will average 1.67 ng/L and could be as high as 109 ng/L.

3.3.2 Radionuclides

The May 2007 to April 2008 United Water sampling for radionuclides demonstrated that Maximum Contaminant Levels (MCLs) set by the EPA for drinking water were comfortably met by raw Hudson River water for radium 226/228, total uranium, strontium 90 (^{90}Sr), and tritium (^{3}H). While there were a few outlier measurements for gross alpha and gross beta, average results were below drinking water MCLs. This is an important finding because of the proximity of the Indian Point Nuclear Power Plant to the proposed intake, on the eastern shore of the Hudson River in Buchanan, NY. Cesium (^{137}Cs) is another radionuclide which may be released from Indian Point and has an MCL of less than 200 pCi/L (note that 200 pCi/L of ^{137}Cs corresponds to the entire 4 millirem per year allowance for all gross beta radionuclides in safe drinking water).

^{137}Cs was widespread in the United States in the 1950's and 1960's from fallout after atmospheric nuclear weapons testing. Maximum accidental releases of ^{137}Cs from the Indian Point Nuclear Power Plant occurred in 1971 (> 20 Ci) with more than 40 Ci of ^{137}Cs (uncorrected for decay) being released between 1960 and 1993. The fate of the Indian Point Nuclear Power Plant ^{137}Cs release has been well studied and documented by numerous researchers such as Chillrud, Jinks and Wrenn, Hairr, and Olsen. The numerical modeling report produced for the CARP, available at www.carpweb.org, summarizes much of the study and measurement of ^{137}Cs in the lower Hudson River as part of the CARP model hindcast verification exercise. The report also provides complete citations for the underlying research source documents.

The maximum accidental 1971 release as well as remaining weapons testing fallout at that time and contributions from any other historical sources produced a measured ^{137}Cs maximum dissolved phase concentration in the Hudson River near mile 30 of 1500 fCi/L (i.e., 1.5 pCi/L). Note that 1.5 pCi/L is well below the allowed 200 pCi/L drinking water standard. There was also a coincident maximum of 7,000 pCi/kg of ^{137}Cs in the particulate phase occurring slightly upstream, near River mile 40. Particulate phase ^{137}Cs would be completely filtered out for drinking water purposes and is not likely a threat. Nonetheless, the observed particulate phase ^{137}Cs can be expressed on a mass per volume basis, added to the observed dissolved phase, and compared to the drinking water standard.

The conversion of the measured particulate phase ^{137}Cs to mass per volume units involves a consideration of the total suspended solids concentrations in the Hudson River. Based on United Water's sampling of the Hudson River in Haverstraw Bay from May 2007 to April 2008, 215 total suspended solids measurements ranged from 4.4 to 100 mg/L with an average of 26.1. Assuming the highest measured total suspended solids concentration of 100 mg/L, the historical observation of 7,000 pCi/kg of ^{137}Cs in the particulate phase would be equivalent to 0.7 pCi/L. Summing the observations of dissolved and particulate phase maximum concentrations after the accidental release, 1.5 pCi/L dissolved and 0.7 pCi/L particulate, yields 2.2 pCi/L of total ^{137}Cs, well below the drinking water standard of 200 pCi/L. Present day measurements of ^{137}Cs made in the Hudson River in 2008 by IPNPP at its inlet location were even lower than the historical measured maximum of 2.2 pCi/L. In 2008, twelve monthly samples analyzed by IPNPP were all below method detections ranging from 1 to 1.5 pCi/L.

Based on the historical ^{137}Cs worst-case release of large magnitude and Hudson River measurements made at that time, it does not appear that potential future large-scale accidental releases of ^{137}Cs from Indian Point would pose a threat to the proposed Haverstraw Water Supply Project. Based on 2008 records from the IPNPP, the current release of ^{137}Cs from IPNPP is 0.014 Ci, four orders of magnitude smaller than the >20 Ci 1971 release considered in the historical worst-case analysis.

Specific questions addressed through the use of numerical water quality modeling of current loadings within a 25-mile radius of the proposed Haverstraw Water Supply Project, related to current Indian Point releases of radionuclides, include:

- Where do the compounds released from Indian Point go?
- What is the concentration of these compounds at the HWSP intake?

Numerical model results show that compounds released from Indian Point are rapidly mixed by the estuary, spreading upstream and downstream and uniformly across the Hudson. Compounds released from Indian Point would reach the proposed Haverstraw Water Supply Project intake; however, the concentrations of the compounds at the proposed Haverstraw Water Supply Project intake will be expected to be greatly reduced or diluted. Numerical modeling suggests a range of dilution factors depending upon hydrodynamic conditions in the Hudson River and the duration of the Indian Point release. Model outputs have been summarized in terms of the maximum concentration that would result at the proposed Haverstraw Water Supply Project intake per Ci/day of dissolved-phase compound (i.e., compounds such as tritium which exhibit no or little phase partitioning to solids) released by Indian Point Nuclear Power Plant. Examples of the numerical model outputs showing the dilution of Indian Point Nuclear Power Plant loads by the Hudson River are included in Table 4.

Table 4. Compounds Released from Indian Point Nuclear Power plantand Resulting Concentrations near Proposed Haverstraw Water Supply Project Intake[1]

Release Duration	Maximum Concentrations near the Proposed Haverstraw Water Supply Project Intake per Ci/day discharge from Indian Point pCi/L
Hour	1.78
Day	7.73
Week	30.13
Month	41.24
Continuous	114.6

[1]Calculated using water year 1994-95 Hudson River flows. 1994-95 is a relatively dry period and represents a condition under which the dilution effect of the Hudson River would be minimized. Portions of 1994-95 qualify as Hudson River drought conditions

based on two methods of defining droughts considered by researchers at Columbia University: departure from average precipitation method (March 1995 to March 1996) and the Palmer Drought Severity Index (August/September 1995 was a severe drought). See http://superfund.ciesin.columbia.edu/Rocklandwater/supply_droughts.html.

To put a perspective on the potential Hudson River concentrations reported in Table 4, the EPA drinking water standard for tritium is 20,000 pCi/L. Measured tritium in drinking water ranges from not detectable to 392 pCi/L per the 2005 EPA Environmental Radiation Data Report No. 122. A Ci/day release from Indian Point would produce tritium concentrations in the Hudson River well below the drinking water standard and within the range of drinking water measurements.

Per the Indian Point Annual Radiological Environmental Operating Reports for quarterly composites from the cooling water intake and in the discharge canal of the Indian Point Nuclear Power Plant, measured tritium concentrations, inferred to represent Hudson River water, have ranged between not detectable (i.e., less than 450 pCi/L) to 618 pCi/L over the time period 1997 to 2008. This is suggestive that if Indian Point Nuclear Power Plant were the singular source of tritium to the Hudson River, Indian Point Nuclear Power Plant releases could have likely ranged, at most, from 5.4 Ci/day (continuous release) to 347 Ci/day (one hour release).

Tritium releases from the Indian Point Nuclear Power Plant cooling water discharge were available for 2006 and 2007 from mass and dilution flow measurements reported as quarterly composites. There is somewhat of a pattern common to the two years in that releases are slightly elevated in the first quarter of each year as compared to the remaining quarters of the year. 2006 had a slightly higher release of tritium than 2007 overall. The information suggests that in 2006, 1557 Ci of tritium in total were discharged. This corresponds to a 4.3 Ci/day average discharge of tritium for 2006 released continuously and would be expected to produce a Hudson River tritium concentration near the intake location of 493 pCi/L based on HydroQual's modeling results presented in Table 1.

To summarize, several independent data and numerical modeling lines of evidence, spanning multiple seasons and years suggest that tritium concentrations in the Hudson River near the proposed intake are consistently below 700 pCi/L (IPNPP annual reporting 1997 to 2008, <450 to 618 pCi/L; HydroQual modeling of 2006 IPNPP loadings, 493 pCi/L; and United Water 2007 and 2008 monitoring, 39 to 391 pCi/L, all below typical detection levels). These multiple sources of information evidence that existing tritium releases will not be a problem for safe drinking water.

In addition to tritium and ^{137}Cs described already, other radionuclides discharged from Indian Point in 2008 per IPNPP records include: Ag-110m, Co-58, Co-60, Cr-51, Cs-134, Fe-55, Mn-54, Ni-63, Sb-124, Sb-125, Sr-90, Te-123m, and Te-125m. In total, these releases for 2008 were less than 0.07 Ci for the entire year. These radionuclides can be compared and contrasted to both tritium and ^{137}Cs in terms of phase partitioning behavior and half-life.

A majority of the radionuclides discharged (Ag-110m, Co-58, Co-60, Cr-51, Mn-54, Sb-124, Sb-125, Sr-90) are strongly dissolved phase, like tritium and unlike ^{137}Cs, based on known phase partitioning behavior. Further, although Fe-55, Ni-63, Te-123m, and Te-125m partition to particles more than the other radionuclides discharged by IPNPP in 2008, they are still more similar to tritium than to ^{137}Cs in terms or partitioning behavior. It is noted that ^{134}Cs would behave similarly to ^{137}Cs, but comprises only 1% of the IPNPP discharge. To the extent that these radionuclides are largely dissolved phase, the 2008 release of less than 0.07 Ci per year can be translated to a Hudson River concentration near the proposed Haverstraw Water Supply intake location of 0.022 pCi/L using modeling results presented in Table 1 for a continuous release. The lowest drinking water standard identified for any of these contaminants individually is 8 pCi/L for Sr-90, well above the 0.022 pCi/L Hudson River water concentration near the proposed intake expected for the summation of all these discharged radionuclides.

Tritium (^{3}H) and ^{137}Cs each have a relatively long half-life, 12.3 and 30.2 years, respectively, making management of their releases important over a long-term horizon. Similarly, Co-60, Sb-125, Sr-90, Fe-55, Ni-63, and Cs-134 each have a multi-year half-life. Other radionuclides discharged by IPNPP each have a half-life less than a year (e.g., Ag-110m, Co-58, Cr-51, Mn-54, Sb-124, Te-125m).

In addition to the example modeling results presented in Table 1 based on a single year of modeling and multiple release conditions for Indian Point, modeling was performed over a period of fourteen water years for a continuous release from Indian Point. Factors for converting lb/yr releases from Indian Point to ug/L concentrations resulting near the proposed Haverstraw Water Supply Project Hudson River intake were developed and are summarized in Appendix A. These factors are 2.844×10^{-05} mean and 1.36×10^{-04} maximum ug/L at the proposed Haverstraw Water Supply Project intake location per lb/yr discharge from Indian Point. These factors correspond to 0.063 pCi/L mean and 0.30 pCi/L maximum near the proposed intake per Ci/yr discharge from Indian Point.

Per the April 3, 2010 Wall Street Journal, operating licenses for Indian Point units 2 and 3, which came on line in the 1970s, are due to expire in September 2013 and December 2015, respectively. Certification is required under Section 401 of the Clean Water Act before the United States Nuclear Regulatory Commission can approve an extension of the Indian Point operating licenses. It is unclear if or how Indian Point's current operation would be changed in the future to obtain Clean Water Act Section 401 certification. An Environmental Impact Statement from Indian Point is expected after May 2010, too late to be considered in this technical memorandum for Haverstraw Water Supply Project purposes. It is a reasonable expectation that any future changes to

Indian Point's operation would only improve, not worsen, the already good water quality in Haverstraw Bay.

3.3.3 Polychlorinated Biphenyls (PCBs)

A discussion of PCB concentrations near the proposed Haverstraw Water Supply Project intake location was provided above in this technical memorandum under the evaluation of upstream dredging impacts in a description of the "pre-dredging" condition of the Hudson River. Based on measurements, a "pre-dredging" condition of the Hudson River is 25 ng/L PCBs near the proposed intake. The "pre-dredging" condition meets the drinking water standard of 500 ng/L. This data result is further confirmed by numerical modeling results presented in Appendix D which indicate mean and maximum PCB concentrations of 0.4 ng/L to 27.5 ng/L due to local sources (i.e., within a 25 mile radius) only (i.e., ignoring the Upper Hudson River Superfund Site impact).

3.3.4 Endocrine Disrupting Compounds, Pharmaceuticals, and Personal Care Products (often called emerging contaminants)

In 2007 and 2008, measurements made in the Hudson River in the Haverstraw-Stony Point area, near the proposed intake location occured over a 40-week period during high and low tides. 89 different contaminants, including phenolic endocrine disrupting chemicals, pharmaceutically active compounds, fragrances, estrogens, and other hormones, were each sampled/analyzed for 11 times. Only 19 of the 89 contaminants analyzed for were actually detected. The key findings are:

- In general, the number of compounds detected in the Hudson River was found to be slightly less than reported by the American Water Works Association (AWWA) Research Foundation's survey of concentrations for microconstituents in 17 drinking water systems around the country.
- In general, the magnitude of the concentrations of the microconstituents found in the Hudson River were comparable to those AWWA reported for its national survey of both raw and finished drinking water.
- In general, the magnitudes of the concentrations of the microconstituents found in the Hudson River were comparable to concentrations reported in the peer-reviewed literature for local and international waterways.

The nine contaminants consistently (frequency of 10 or 11 out of 11 samples) detected in the Hudson River include: caffeine, DEET, nicotine, paraxanthene, galaxolide, carbamazepine, cotinine, sulfamethoxazole, and gemifibrozil. The five contaminants occasionally (frequency of 3, 4 or 5 out of 11 samples) detected in the Hudson River include: acetaminophen, diltiazem, lincomycin, trimethoprim, and aspirin. The five contaminants infrequently (frequency of 1 or 2 out of 11 samples) detected in the Hudson River include: fluoxetine, sulfadimethoxine, naproxyn, theophylline, and nonylphenol and its isomers.

The mere presence of these contaminants does not necessarily pose a threat to drinking water safety. Attempting to rank these contaminants by magnitude of concentration may be of little or no relevance. It has yet to be determined what the environmentally relevant concentrations for the majority of these contaminants are in terms of either ecological or human health risk. Further, the potency/toxicity of each of the contaminants may very widely so that equal amounts of any of the individual contaminants may not pose equal risks.

State and/or federal water quality standards and/or criteria were not found for caffeine, DEET, nicotine, paraxanthine, galaxolide, carbamazepine, cotinine, sulfamethoxazole, gemifibrozil, acetaminophen, diltiazem, lincomycin, trimethoprim, aspirin, fluoxetine, sulfadimethoxine, naproxyn.

For theophylline, NYSDEC promulgates a surface water quality standard of 40 ug/L for the protection of non-oncogenic human health in fresh surface waters used for source water (see http://www.dec.ny.gov/regs/4590.html). The single theophylline concentration detected (detection frequency of 1 in 11) in the Hudson River near the proposed Haverstraw Water Supply Project intake location, 0.006 ug/L, is well below the NYSDEC standard. It is recognized that the Hudson River near the proposed Haverstraw Water Supply Project is salt water and the NYSDEC standard for fresh surface waters, while a basis of comparison, is not necessarily directly applicable.

For nonylphenol, the EPA has established numeric criteria to guide the states in the protection of aquatic life (see http://www.epa.gov/waterscience/criteria/nonylphenol/index). There are both acute (1 hr average, allowed to exceed once in three years) and chronic (4 day average, allowed to exceed once in three years) criteria for each of freshwater and saltwater. The saltwater criteria are 7.0 ug/L acute and 1.7 ug/L chronic. The single nonylphenol concentration detected (detection frequency of 1 in 11 or 2391 hours in 3 years) in the Hudson River near the proposed Haverstraw Water Supply Project intake location was 0.5 ug/L, well below the federal acute and chronic criteria.

It is noted that the 25-mile radius source search did not identify any inputs for the 19 contaminants detected in the Hudson River by previous United Water monitoring.

The Hudson River Environmental Society (HRES) sponsored a conference on April 23, 2010 at Vassar College which explored pharmaceuticals, personal care products, and sewage from storm overflows entering the Hudson River (see www.hres.org). A goal of the conference was to identify future actions needed to deal with the anticipated continued presence of these substances in the Hudson River. Findings of the conference include that although it is known that hormones, drugs, and personal care products enter the Hudson River and other surface waters through sewage treatment plants or CSOs, the ecological impacts and human health consequences are just beginning to be understood. Accordingly, federal and local regulatory authorities are not yet in a position to fully manage the problem, but are taking steps to do so. Emerging contaminants findings reported at the conference, relevant for the Haverstraw Water Supply Project, include:

- A possible regulatory approach that might be taken locally or nationally in the future to deal with emerging contaminants is to regulate whole effluents with numeric toxicity limits rather than numeric discharge limits for specific substances.
- NYSDEC continues to move forward with regulation of CSOs, requiring best management practices (BMPs) and long term control plans (LTCPs). Once completed, these strategies should reduce any releases of emerging contaminants via CSOs to the Hudson River and other New York waterways.
- The medical therapeutic dose of pharmaceuticals humans consume is multiple orders of magnitude greater that what is being measured nationally in receiving water or in drinking water. In this senses, pharmaceuticals are of potentially the least concern for human health as compared to other emerging contaminants.
- Since 2009, the New York State Legislature has introduced legislation to provide for the disposal of pharmaceutical drugs. The most recent bill (S. 513) was introduced on January 5, 2011, but it, as its predecessor bills, has not been enacted into law. (www.dontflushyourdrugs.net)

3.3.5 Other Contaminants

In addition to basic water quality parameters, trace elements, microbiological parameters, radionuclides, PCBs, and emerging contaminants, a number of other contaminants entering the Hudson River within a 26-mile radius of the proposed Haverstraw Water Supply Project intake were evaluated and are listed in Appendix B. An example, tetrachloroethylene, is considered here.

3.3.6. Tetrachloroethylene

An example of another contaminant is tetrachloroethylene (PERC). Through the 26-mile radius search, loadings of PERC were identified. Through numerical modeling, the loadings were translated into PERC concentrations near the proposed Haverstraw water Supply Project intake. The PERC concentration calculations and underlying numerical modeling results and loading estimates are presented in Appendices C and D. The maximum PERC concentration estimated based on the known loads is a maximum of 2.25×10^{-2} ug/L. The drinking water standard for PERC, 5 ug/L, is more than 200 times higher than the estimated concentrations.To some degree, the concentration calculated may under-predict PERC levels. It is noted that it was not possible to estimate PERC loads from two NPL sites listing PERC as a contaminant of concern. These NPL sites are the Brewster Well Field Site and the Shenandoah Road Groundwater Contamination site. In addition, given the widespread use of PERC, it is likely that stormwater runoff and/or CSOs would carry some level of PERC to the Hudson River. Modeling results available suggest that raw Hudson River water would likely meet the drinking water standard of 5 ug/L even with large loadings of PERC from the two NPL sites and