INJURY DETERMINATION REPORT

HUDSON RIVER GROUNDWATER RESOURCES

ISSUED AS PART OF THE

HUDSON RIVER NATURAL RESOURCE DAMAGE ASSESSMENT

HUDSON RIVER NATURAL RESOURCE TRUSTEES

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

U.S. DEPARTMENT OF THE INTERIOR

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EXECUTIVE SUMMARY

This injury determination is issued by the Hudson River Natural Resource Trustees as a part of the Type B assessment of the Hudson River environment undertaken pursuant to 43 CFR 11. The Hudson River Natural Resource Trustees (Trustees) are New York State through the Department of Environmental Conservation (NYSDEC), the U.S. Department of the Interior (DOI) through the U.S. Fish and Wildlife Service (USFWS) and the National Park Service (NPS), and the U.S. Department of Commerce through the National Oceanic and Atmospheric Administration (NOAA). The Trustees have determined that an injury to groundwater has occurred in the municipalities of Hudson Falls, Fort Edward and Stillwater, pursuant to 43 CFR §11.62 (c), and that the injury is directly related to releases of hazardous substances, including polychlorinated biphenyls (PCBs) and volatile organic compounds (VOCs), to the soil, surface water, and groundwater by the General Electric Company (GE) at the Fort Edward and Hudson Falls manufacturing facilities (GE Facilities). Such releases resulted in hazardous substances from the GE Facilities reaching groundwater via soil, groundwater and surface water pathways, which caused repeated and prolonged exceedances of New York State groundwater standards set forth in 6 NYCRR 703.

Under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the Superfund Amendments and Reauthorization Act of 1986, 42 USC 9601 *et seq*., the Trustees have the authority to assess injury to, destruction of or loss of natural resources resulting from releases of hazardous substances to the environment and to restore, replace or acquire the equivalent of such injured resources. *See* 42 USC 9607(f). The Trustees are continuing to perform an assessment of the injury to, destruction of, and loss of natural resources in the Hudson River environment, to quantify such injury, and to determine damages, including the injury and damages to groundwater resources that have resulted from the release of hazardous substances to the environment from the GE Facilities.

The purpose of this assessment is to: (1) evaluate natural resource injuries and losses in natural resource services within the Hudson River assessment area due to releases of hazardous substances from the GE Facilities; (2) plan and implement actions to restore injured resources to their baseline condition or replace such resource; and (3) compensate the public for any associated interim service losses.

The Trustees' groundwater injury determination is part of the broader, ongoing natural resource damage assessment of the Hudson River environment pursuant to 43 CFR 11, as described in the Hudson River Assessment Plan (USFWS 2002). As a part of the assessment, the Trustees have evaluated releases of PCBs and VOCs from the GE Facilities and the resulting injuries to groundwater, whose highest and best use is as a source of drinking water (New York State Class GA). This injury determination documents the Trustees' evaluation and sets forth the data, information and analysis supporting the determination.

This injury determination evaluates groundwater data derived from samples taken in the municipalities of Hudson Falls, Fort Edward, and Stillwater and other information related to the release of PCBs and VOCs from the GE Facilities.

This injury determination details these data with respect to the requirements for evaluating injury to groundwater set forth in 43 CFR §11.62 . This report does not quantify the magnitude of the injury and associated service loss, nor does it estimate the monetary damages sustained as a result of the injury. This report also does not identify alternatives for restoration planning and compensation. Those steps will be the subject of future Trustee reports.

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Acronyms and Abbreviations

BGS	Below Ground Surface
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act of 1980 and the Superfund Reauthorization Act, 42 USC 9601 *et seq.*
CWA	Clean Water Act, 33 USC 1251 *et seq.* (2008)
DOI	U.S. Department of the Interior
EPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
GE	The General Electric Company
GWUISW	Groundwater Under the Influence of Surface Water
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NRDA	Natural Resource Damage Assessment
NYSDEC	New York State Department of Environmental Conservation
PCBs	Polychlorinated Biphenyls
TSCA	Toxic Substances Control Act, 15 USC 2601 *et seq.* (2008)
USGS	U.S. Geological Survey
VOCs	Volatile Organic Compounds

1.0 INTRODUCTION

This report evaluates injuries to groundwater resources resulting from PCB and VOC releases from the GE Facilities. The injury determination is based on an evaluation of exceedances of applicable New York State groundwater standards established for PCBs and VOCs (6 NYCRR 703) and focuses on groundwater in the vicinity of the municipalities of Hudson Falls, Fort Edward, and Stillwater. The remainder of the injury determination is organized as follows:

Section 1 sets forth background information, including a summary of the Trustees' authority, a description of the characteristics and toxicity of PCBs and VOCs, and a description of the groundwater resources addressed in this injury determination.

Section 2 describes the specific assessment areas adjacent to the Hudson River and summarizes available data on PCBs and VOCs in groundwater in the assessment areas.

Section 3 contains an analysis of the PCB and VOC data in comparison to applicable groundwater standards.

Section 4 summarizes the Trustees' findings, and other elements of the injury determination for groundwater caused by PCBs and VOCs.

Section 5 contains references to the data, information, laws, regulations, literature, and other scientific materials that the Trustees utilized in the development of the injury determination.

1.1 THE TRUSTEES' AUTHORITY

Pursuant to CERCLA Section 107, 42 USC 9607(f), the State and Federal natural resource Trustees may assess injuries to natural resources resulting from the release of hazardous substances such as PCBs and VOCs to the environment, and recover damages for such injuries. Natural resources are defined to include surface water, ground water and drinking water supplies. 42 USC 9601(16). Natural resources are held in trust for the public by the United States and the States.

The authority of the Hudson River Trustees is derived from CERCLA Section 107(f)(1), 42 USC 9607(f)(1), which authorizes the President of the United States and the authorized representative of any State to act on behalf of the public to recover the cost of replacing or restoring injured natural resources, including groundwater, pursuant to CERCLA and the National Oil and Hazardous Substances Pollution Contingency Plan (40 CFR §300). The President has designated the Secretaries of Commerce and Interior to act as Trustees for the natural resources managed or controlled by their agencies (CERCLA 107(f)(2) and 40 CFR §300.600). On November 30, 1987, the Governor of the State of New York appointed the Commissioner of the Department of Environmental Conservation (NYSDEC) as the Trustee for natural resources managed and controlled by the State. The NYSDEC Commissioner's authority over natural resources under CERCLA complements long-standing statutory and common law authority to conserve, improve, and protect New York's natural resources.

The State and Federal natural resource Trustees have formed the Hudson River Natural Resource Trustee Council for the purpose of conducting a natural resource damage assessment (NRDA) to assess the impacts associated with hazardous substance releases from the GE Facilities to the environment. Each Trustee has designated representatives to perform the natural resource damage assessment.

1.2 POLYCHLORINATED BIPHENYLS AND VOLATILE ORGANIC COMPOUNDS

PCBs are hazardous substances as defined in CERCLA § 101(14), and consist of 209 individual compounds, known as congeners. A congener may have between one and ten chlorine atoms, which may be located at various positions on the PCB molecule. Commercial production of PCBs began in the United States in 1929. PCBs were often used as dielectric fluids in the manufacture of electrical transformers and capacitors. PCBs were marketed as mixtures of congeners based upon the characteristics (density, viscosity, etc.) required by purchasers. These mixtures were marketed under the trade name "Aroclor" followed by a four digit number, the last two digits of that number typically indicating the chlorine content of the mixture by percent. For example, Aroclor 1268 is a waxy substance containing 68 percent chlorine; Aroclor 1242 is a less dense, oily substance containing 42 percent chlorine, etc. Different Aroclors were used for different purposes based on their physical and chemical characteristics.

In 1976, Congress passed the Toxic Substances Control Act (TSCA), which required EPA to establish labeling and disposal requirements for PCBs. TSCA also mandated an eventual ban on the manufacture and processing of PCBs. As a result of this legislation, virtually all uses of PCBs and their manufacture have been prohibited in the United States since May 1979.

PCBs persist in the environment for many decades and scientific research indicates they can be harmful to both humans and wildlife. The exact nature of these effects depends on many factors, including the level and duration of exposure, the specific PCBs to which the organism is exposed, and the specific organism. For example, high PCB concentrations in the brain have been associated with a high probability of death in a number of bird species (Hoffman *et al.* 1996). In addition, lower concentrations may cause a variety of adverse effects, such as partial or complete reproductive failure, birth defects, impaired growth, behavioral changes, lesions, immune system dysfunction, and hormone imbalances. These or other adverse effects have been observed in a wide variety of species, including fish, birds, and mink.[1]

PCBs bioaccumulate in animals, increasing in concentration as they move up the food chain. This bioaccumulation occurs both via bioconcentration and biomagnification. Bioaccumulation is the absorption and concentration of PCBs in the tissues of an organism from the environment in which it lives. Biomagnification is the process by which organisms of successively higher trophic levels of the food chain accumulate increasingly higher concentrations of PCBs as they consume organisms in lower portions of the food chain.

PCBs are classified as human carcinogens by the International Agency for Research on Cancer (Lauby-Secretan et al., 2013) and as a probable human carcinogen by numerous national and international health-protective organizations, such as the EPA, the Agency for Toxic Substances and Disease Registry (an arm of the U.S. Public Health Service), the National Toxicology Program of the U.S. Department of Health and Human Services, and the World Health Organization. PCBs are also related to a number of non-cancer health effects in animals, including effects on the immune system, reproductive system, nervous system, and endocrine system. Studies in humans support the evidence for PCBs' non-cancer effects, including reproductive effects and neuro-developmental effects for infants and children.

VOCs are a class of chemical compounds that evaporate at relatively low temperatures as compared to other types of compounds, such as semi-volatile organic chemicals and PCBs. There exist many dozens of VOCs that have been used in a variety of industrial applications for over 100 years. VOCs cause a variety of adverse effects in humans, wildlife, and other natural resources.

Chlorinated benzenes are a class of twelve similar VOCs: monochlorobenzene; 1,2-,1,3-,1,4-dichlorobenzene; 1,2,3-, 1,2,4-, 1,3,5-trichlorobenzene; 1,2,3,4-, 1,2,3,5-, 1,2,4,5-tetrachlorobenzene;

[1] Studies of the effects of PCBs on fish include: Stickel *et al.* 1984, Barron *et al.* 2000, Orn *et al.* 1998, Niimi 1996, Dey *et al.* 1993, Wirgin and Garte 1989, Bowser *et al.* 1990. Studies of the effects of PCBs on birds include: Hoffman *et al.* 1998, Hoffman *et al.* 1995, Van den Berg *et al.* 1992, and Tillitt *et al.* 1993. Studies of the effects of PCBs on mink include: Aulerich and Ringer 1977, Jensen *et al.* 1977, Wren *et al.* 1987, Heaton *et al.* 1995, Restum *et al.* 1998, and Bursian *et al.* 2003.

pentachlorobenzene; and hexachlorobenzene. Chlorinated benzenes have been used as solvents, electrical insulators, pesticides, herbicides, fungicides, and dye carriers. After stopping the use of PCBs in its manufacturing process, GE began using a replacement dielectric fluid composed in part of chlorinated benzenes (Geraghty and Miller, 1986; HSI/GeoTrans, 1999).

Chlorinated benzenes tend to have low water solubility and high soil adsorption, and will bioaccumulate in the fatty tissues of biological organisms. Chlorinated benzenes affect fish and invertebrate reproduction, and can be toxic to plants. Insects exposed to chlorinated benzenes suffer from developmental effects and shortened lifespans. Although the impacts of chlorinated benzenes on birds and mammals are not fully understood, researchers have documented the presence of chlorinated benzenes in the fat of wild animal populations and bird eggs (EPA 1985).

Humans can be exposed to chlorinated benzenes from the air, water, or food. Exposure to 1,2,4-trichlorobenzene at levels of 3 to 5 ppm in air can irritate the respiratory system and eyes. Trichlorobenzenes cause adverse liver, kidney, endocrine (thyroid and adrenal), reproductive and developmental effects in exposed laboratory animals (ATSDR 2010; USEPA IRIS 2012). Research of acute and sub-chronic exposure via inhalation, or ingestion of dichlorobenzene in animals resulted in adverse effects on the heart, kidney, liver, spleen, thymus, and the central nervous system. Humans exposed to 1,2-dichlorobenzene and 1,4-dichlorobenzene at high concentrations were found to experience irritation of the eyes and nose, difficulty breathing and an upset stomach (ATSDR 2006).

1.3 DESCRIPTION OF GROUNDWATER RESOURCES AND DEFINITION OF GROUNDWATER ASSESSMENT AREA

Groundwater resources are defined in the NRDA regulations at 43 CFR §11.14(t) as follows:

> … [W]ater in a saturated zone or stratum beneath the surface of land or water and the rocks or sediments through which groundwater moves. It includes groundwater resources that meet the definition of drinking water supplies.

An assessment area is defined in the NRDA regulations 43 CFR §11.14(c) as follows:

> … [T]he area or areas within which natural resources have been affected directly or indirectly by the discharge of oil or release of a hazardous substance and that serves as the geographic basis for the injury assessment.

For the purpose of this injury determination, the groundwater resources and the assessment area include the groundwater underlying and in the surrounding areas of the Hudson Falls plant site, the Fort Edward plant site, and the Stillwater well field. Identification of the foregoing areas within this injury determination does not preclude the Trustees from assessing additional groundwater resources in the future.

1.4 DEFINITION OF INJURY

The DOI NRDA regulations at 43 CFR §11.62 (c)(1) provide that an injury to groundwater has occurred if there exist:

> Concentrations of substances in excess of water quality criteria, established by section 1401(1)(d) of the SDWA, or by other Federal or State laws or regulations that establish such criteria for public water supplies, in groundwater that before the discharge or release met the criteria and is a committed use, as the phrase is used in this part, as a public water supply;

or,

> Concentrations of substances in excess of applicable water quality criteria, established by section 304(a)(1) of the CWA, or by other Federal or State laws or regulations that establish such criteria for domestic water supplies, in groundwater that before the discharge or release met the criteria and is a committed use as that phrase is used in this part, as a domestic water supply.

1.5 APPLICABLE WATER QUALITY STANDARDS

The groundwater standards for PCBs are found in the NYSDEC regulations at 6 NYCRR 703.5. These regulations have changed over the past approximately 30 years. Currently. for PCBs, the standard for fresh groundwater is .09 ug/L (parts per billion, or ppb). For VOCs, the most restrictive standard for fresh groundwater is 2 ppb for the compound vinyl chloride. For the remaining applicable VOCs, the standard for fresh groundwater is typically 5 ppb, with the exceptions of dichlorobenzenes (3 ppb each) and chloroform (7 ppb). Exceedance of these standards constitutes a natural resource injury pursuant to the DOI NRDA regulations.

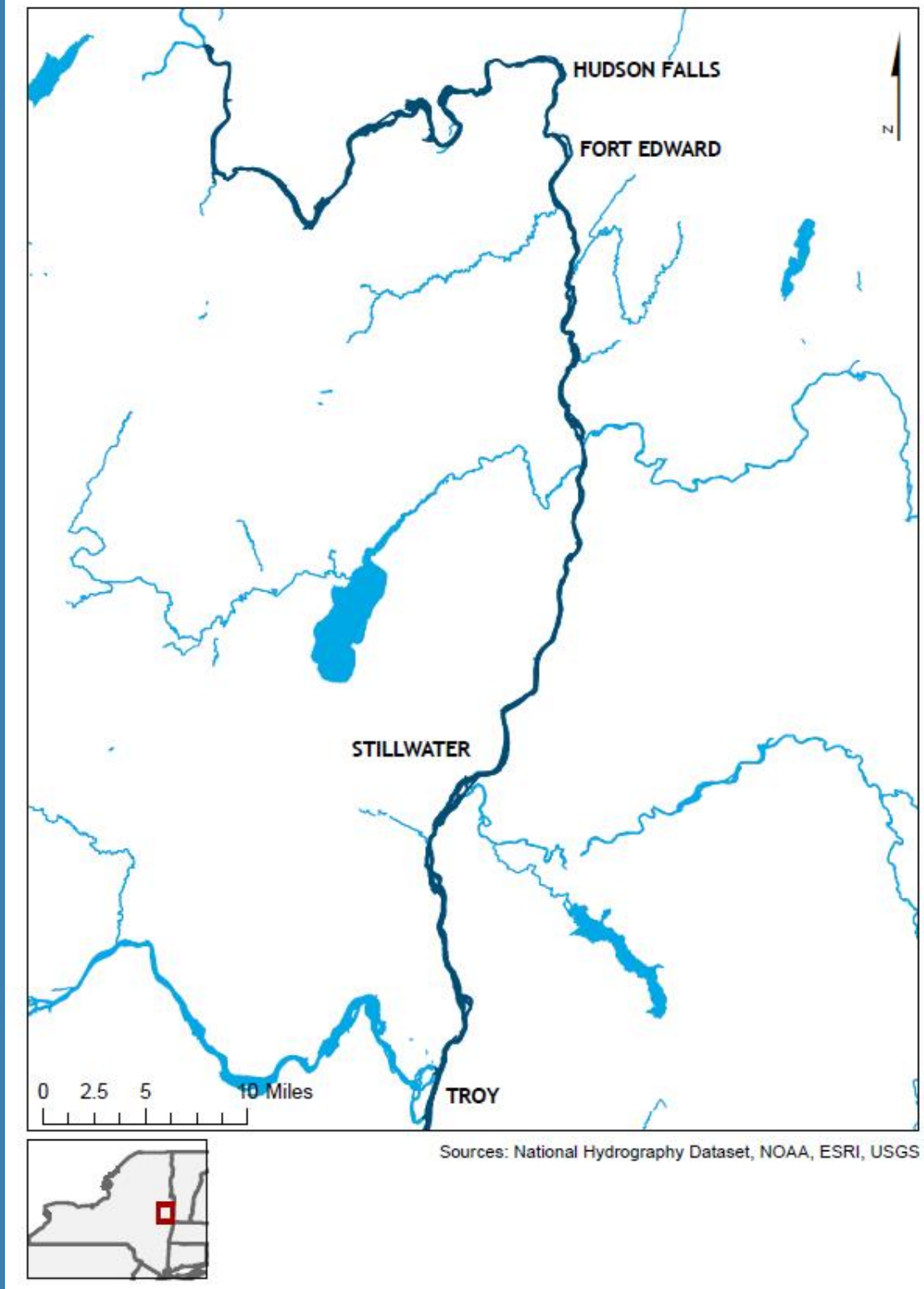
2.0 DESCRIPTION OF RELEASES IN THE ASSESSMENT AREAS AND ANALYSIS OF GROUNDWATER CONTAMINATION

GE used PCBs as a dielectric fluid inside the bodies of electrical capacitors in its manufacturing processes at the Hudson Falls and Fort Edward Facilities (Dames and Moore, 1976). Beginning in 1947 at General Electric's Fort Edward plant, and beginning in 1952 at its Hudson Falls plant, PCB-laden waste waters were discharged directly into the Hudson River (Clark, Dietz and Associates, 1975). These direct discharges continued until 1977 (Lawler, Matusky and Skelly, 1985; Geraghty and Miller, 1986). In addition, the GE Facilities contributed PCBs to the Hudson River watershed and ultimately to the river by disposing of manufacturing wastes in nearby landfills and wastewater collection systems (*e.g.,* sewers and municipal wastewater treatment plants) (Clark, Dietz and Associates, 1975). In 1975 discharges were estimated at about 30 pounds per day or about 11,000 pounds per year; estimates for earlier years are greater. Altogether, EPA has estimated that the two facilities discharged approximately 1.3 million pounds of PCBs into the river (EPA, 1991).

Additional PCBs entered the Hudson River via the migration of PCB-contaminated groundwater and oils through bedrock at the Hudson Falls facility. In 1991, these seeps were augmented by the partial failure of the Allen Mill gate structure near the Hudson Falls facility. This failure resulted in a release of PCB-contaminated oils and sediments from the plant that had accumulated within the structure (GeoTrans, Inc., 2001).

GE also used and released many different VOCs at its two plant sites, including trichloroethylene and related compounds, and trichlorobenzene. Trichloroethylene and other similar VOCs were primarily used as solvents and degreasers in the cleaning of metal capacitor parts, while trichlorobenzene was used as a component of a replacement dielectric fluid that GE used after PCB use ended in 1977 (Geraghty and Miller, 1986; HSI/GeoTrans, 1999).

FIGURE 1 THE UPPER HUDSON RIVER FROM HUDSON FALLS TO THE FEDERAL DAM AT TROY



2.1 HUDSON FALLS PLANT SITE AND SURROUNDING AREA

The Hudson Falls plant site is listed on the New York State Registry of Inactive Hazardous Waste Sites as a Class 2 site, defined as one posing a significant threat to human health and the environment and requiring remediation (Site #5-58-013). The Hudson Falls plant site is located on the eastern bank of the Hudson River adjacent to the Bakers Falls dam, at River Mile 196,[2] in the Village of Hudson Falls, Town of Kingsbury, Washington County. Approximately 14 acres in size, the site is located along Sumpter Street and Allen Street, between Bridge St. to the north and the GL&V foundry property to the south. To the north and south of the site are industrial properties; to the east are residential properties. Features at the site include several large former manufacturing buildings, one of which currently houses the site's wastewater treatment plant. A rail line and Sumpter Street run through the property. (NYSDEC, 2004)

2.1.1 Description of Releases, Pathway, and Groundwater Contamination at Hudson Falls Plant Site

GE began using PCBs as a dielectric fluid in manufacturing electrical capacitors at the Hudson Falls facility in 1952. PCBs (as Aroclors) were delivered to the plant in rail cars. GE off-loaded, stored, blended and refined PCBs at the Hudson Falls plant site until 1977, when GE switched to an alternative dielectric fluid. PCBs were released to the environment, including groundwater, in a variety of ways and at a variety of places at the Hudson Falls plant site over a period of 25 years. PCBs were spilled during off-loading from rail cars. PCBs were also spilled during transfer from the tank farm to the "treat" area located in one of the manufacturing buildings. Generally, PCBs were lost due to spills and leaks in the delivery, transfer, storage, blending and refining processes. (Dunn Geoscience Corporation, 1989).[3]

General Electric used VOCs as solvents and degreasers at the Hudson Falls Plant Site beginning in 1952. The most commonly used VOCs were trichloroethylene, 1,1,1-trichloroethane, and tetrachloroethylene (Geraghty and Miller, 1986). In addition, trichlorobenzene was used as a replacement dielectric fluid until 1983. (HIS GeoTrans, 1999). Trichlorobenzene was delivered to the plant site in rail cars, while solvent VOCs were delivered in tank trucks and drums (Geraghty and Miller, 1986). VOCs were released to the environment, including groundwater, in a variety of ways, including spills and leaks (Dames and Moore, 1997).

The main capacitor manufacturing building, Building 1, contained a series of underground air shafts (or air plenums) that were carved into the bedrock under the building when it was constructed. These plenums, which were originally intended to allow air circulation within the building, collected spilled fluids, including PCBs and VOCs, from within the building. The plenums led to an unlined return air duct which was carved directly into the underlying bedrock, which provided a direct pathway for PCBs to reach groundwater (Geraghty and Miller, 1987).

Prior to installation and pumping from site extraction wells in the remedial program for this site, groundwater flow beneath the Hudson Falls plant site was generally southwesterly toward the Hudson River. Thus, groundwater contaminated with PCBs and other contaminants historically entered the river. A Record of Decision for the site selected a remedy for contaminated groundwater that includes a groundwater recovery system, with the installation of a tunnel and drain system (NYSDEC, 2004). The tunnel and drain system is

[2] The Hudson River flows from River Mile 315 at Lake Tear of the Clouds, in the Adirondack Mountains, south to the Battery in Manhattan. "River Miles" are miles up-stream from the Battery, which is designated "River Mile 0."

[3] On October 13, 1994, the New York State Department of Environmental Conservation and Office of the Attorney General issued a "Notice of Violation" to General Electric notifying the company of unpermitted "discharges and releases of PCBs from the Hudson Falls Plant site into the Ground Water of the State which then flows directly into the Hudson River, a Class C fresh surface water of the State of New York."

constructed to minimize the migration of contaminated groundwater to the Hudson River. The selected groundwater remedy also includes long term maintenance components, including a prohibition on the extraction of groundwater for any purpose other than remediation-related activities (NYSDEC, 2004).

2.1.2 Analysis of Groundwater Contamination at Hudson Falls Plant Site

Polychlorinated Biphenyls

Groundwater at and near the Hudson Falls plant site is contaminated with PCBs. PCBs have been detected in samples from all groundwater zones (regimes) at the site. Of these samples, Aroclor 1242[4] is the most commonly detected PCB (NYSDEC, 2004).

Approximately 177 groundwater monitoring wells were installed at the Hudson Falls site between 1987 and 2000, from which approximately 400 groundwater samples were collected and analyzed for PCBs. PCBs in 335 samples (84%) exceeded the current New York State groundwater standard of 0.09 ppb (6 NYCRR 703.5). PCBs in 166 wells (94%) exceeded the standard of 0.09 ppb (See, for example, GeoTrans, 2001).

The site is located on the eastern bank of the Hudson River adjacent to the Bakers Falls dam. The stratigraphic units that have been identified beneath the Site are the overburden, the Snake Hill Shale, the Glens Falls Limestone, and the Isle La Motte Limestone. Beneath the Site, the overburden, which consists of fill, sand, clay and till, ranges in thickness from two to 21 feet. The bedrock formations generally strike north-northeast, have an undulatory surface, and dip approximately three to five degrees to the southeast. The Snake Hill Shale, which is the uppermost bedrock formation, ranges in thickness from 150 to 250 feet beneath the Site. The Glens Falls Limestone and Isle La Motte Limestone, which are beneath the Snake Hill Shale, are approximately 100 and 60 feet thick, respectively. (NYSDEC, 2004)

PCB concentrations in the overburden groundwater greater than 10,000 ppb have been recorded beneath and just outside of the former manufacturing buildings, where Dense Non-Aqueous Phase Liquid (DNAPL) has been observed.[5,6] PCB concentrations in overburden groundwater generally decline with distance from the former manufacturing buildings, although they exceed the New York groundwater standard.

The highest PCB concentrations in groundwater found in the upper Snake Hill Shale are greater than 1,000 ppb, and are generally found near the manufacturing buildings; in the middle Snake Hill Shale to the northeast, west and southwest of the former manufacturing buildings; and in the lower Snake Hill Shale beneath the historic Allen Mill structure, directly west of the Hudson Falls site on the edge of the Hudson River. PCB concentrations in the Snake Hill Shale groundwater are generally lower north of the former manufacturing buildings, although they exceed the New York groundwater standard.

Glens Falls Limestone and Isle la Motte Limestone groundwater containing PCB concentrations greater than 100 ppb is found in a northeast-southwest trending area extending from the central portion of the site under the manufacturing buildings to the north portion of the adjacent GL&V foundry property. PCB concentrations in the Glens Falls Limestone and Isle la Motte Limestone groundwater are generally lower, although they exceed the New York groundwater standard to the north, south, and west of the site (NYSDEC, 2004).

In 2009 and 2010, groundwater was collected from 97 existing wells and analyzed for PCBs. Twelve additional wells were also installed and sampled. No substantive differences in the general distribution of

4 As discussed in Section 1.2, PCBs were marketed under the trade name "Aroclor" followed by a four digit number, the last two digits indicating the chlorine percentage of the mixture. Aroclor 1242 is 42% chlorine.

5 DNAPL at the Hudson Falls site contains PCBs and other organic chemical contaminants; PCB content ranges from 4% to 100%.

6 The water solubility of Aroclor 1242 is approximately 200 ppb, so groundwater samples containing greater than 200 ppb PCB indicate the presence of emulsions or DNAPL.

PCB-contaminated groundwater were noted between the 2010 sampling results and the samples collected between 1987 and 2000. Of the 104 samples collected from 100 wells, PCBs in 74 samples (71%) exceeded the current standard of 0.09 ppb (Tetra Tech Geo, 2011).

Volatile Organic Chemicals

Groundwater at the Hudson Falls site is also heavily contaminated with a wide array of volatile organic chemicals (VOCs), including chlorinated benzenes, trichloroethylene (TCE), and breakdown-products of TCE. As discussed in a 2001 Remedial Investigation report prepared for General Electric:

> The nature of contamination at the [Hudson Falls] Site has been well defined. Historic releases of fuel, chlorinated solvents and dielectric fluids contaminated the overburden and bedrock groundwater beneath the Site and surrounding areas with polychlorinated biphenyls (PCBs), volatile organic compounds (VOCs), and base/neutral semi-volatile organic compounds (B/N SVOCs). These contaminants are found as non-aqueous phase liquid (NAPL), as a NAPL-water emulsion, and dissolved in groundwater. (GeoTrans, 2001)

As illustrated in Table 1, several VOCs are consistently detected in Hudson Falls groundwater in excess of New York State Class GA groundwater standards. Trichloroethylene and its breakdown product dichloroethylene and vinyl chloride, among other contaminants, have been found to exceed standards for all years for which standards have existed, frequently by a factor of greater than 10,000 (See, for example, Geo Trans, 2001).

2.1.3 Methodology

The methodology utilized in groundwater sampling at the Hudson Falls plant site was subjected to quality assurance/quality control protocols generally accepted at the time the sampling was performed and/or was scientifically verified and documented. Groundwater samples were collected from wells constructed according to generally accepted methods at the time of construction (See, for example, HIS/Geotrans 1998). The Trustees' use of these data in making this injury determination is therefore in compliance with the NRDA regulatory requirements set forth at 43 CFR §11.64.

FIGURE 2 LOCATION OF THE GE HUDSON FALLS PLANT SITE

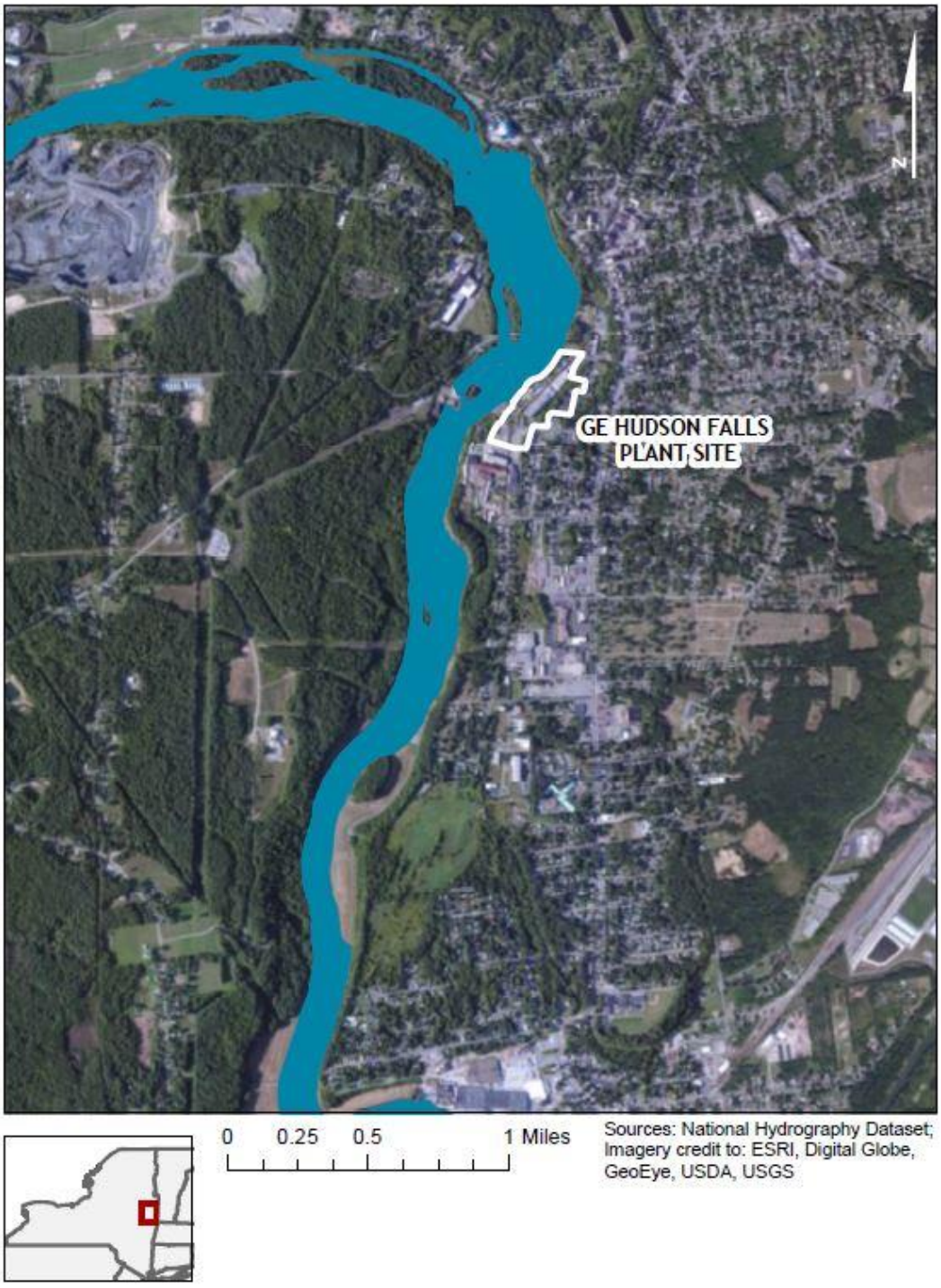
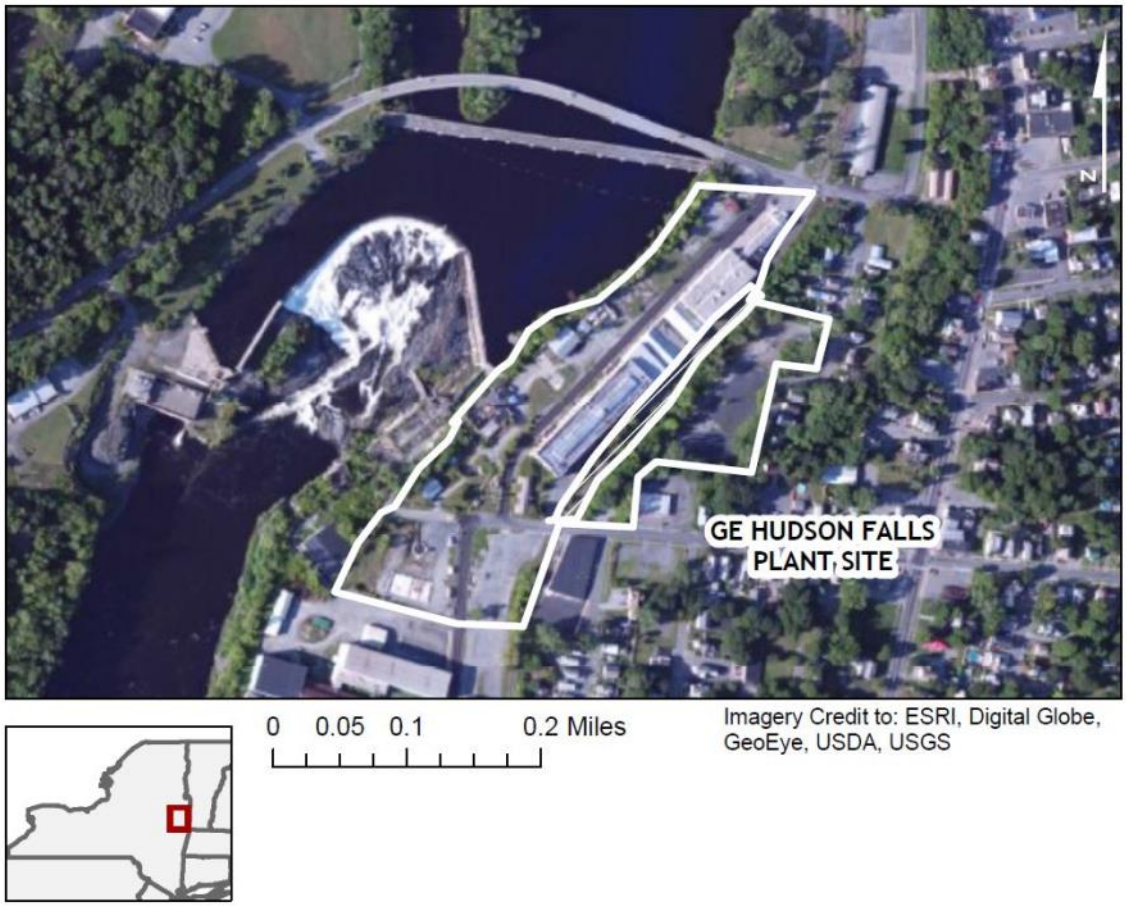


FIGURE 3 GE HUDSON FALLS SITE



7 On October 13, 1994, the New York State Department of Environmental Conservation and Office of the Attorney General issued a "Notice of Violation" to General Electric notifying the company of unpermitted "discharges and releases of PCBs from the Fort Edward Plant site into the groundwater of the State of New York."

TABLE 1. MAXIMUM CONCENTRATIONS DETECTED IN GROUNDWATER HUDSON FALLS (SEE NOTES)

	Prior to 1989		1989 - 1997		1998 - 2011	
Contaminant	**Class GA Standard (6 NYCRR 703) (ug/L) 1978 to 1989**	**Maximum Conc. Detected**	**Class GA Standard (6 NY-CRR 703) (ug/L) 1989 to 1997**	**Maximum Conc. Detected**	**Class GA Standard (6 NYCRR 703) (ug/L) 1998 to present**	**Maximum Conc. Detected**
1,2,4 - trichlorobenzene (Note 2)			5	7,700	5	399
1,2 -dichlorobenzene			4.7	31	3	4
1,3-dichlorobenzene			4.7	36	3	4
1,4-dichlorobenzene			4.7	110	3	5
Chlorobenzene			5	340	5	56
cis-1,2-Dichloroethene (Note 3)			5	120,000	5	121,000
trans-1,2-Dichloroethene (Note 3)		53	5	11,000	5	993
Toluene		10	5	13	5	241
Trichloroethylene		38	5	130,000	5	25,200
vinyl chloride	5	75	2	27,000	2	2,590
1, 1-dichloroethane		15	5	8,200	5	3,280
1,1,1-trichloroethane		2	5	15,000	5	1,520
tetrachloroethylene			5	97	5	649
chloroform	100	23	7	45	7	13
PCBs		1,630	0.10	2,100,000	0.09	72,000

Notes: **Data for contaminants detected at both the Fort Edward and Hudson Falls sites in each of the past two decades (1990 through 2012).**

1. This table presents data for contaminants detected at the Hudson Falls site in each of the past two decades (1990 through 2012). Other contaminants which were detected at various times in concentrations exceeding WQS are: 1,2,3-trichlorobenzene, chloroethane, napthalene, methylene chloride, ethyl benzene, benzene, 1,1-dichloroethene, and BEHP.

2. Groundwater was only sporadically analyzed for chlorinated benzenes until the 1990s.

3. Cis- and trans-1,2-dichloroethyne were reported as either "sum of cis and trans" or just as "trans" until the 1990s.

2.2 GE FORT EDWARD PLANT SITE AND SURROUNDING AREA

The GE Fort Edward Facility plant is a Class 2 site on the New York State Registry of Inactive Hazardous Waste Sites (Site #5-58-004). A Class 2 site is defined as one posing a significant threat to human health and the environment and requiring remediation (NYS ECL 27-1305(2)(b)). The Fort Edward site is situated approximately 800 feet east of the Hudson River (River Mile 195) between the Villages of Hudson Falls to the north and Fort Edward to the south. The facility occupies approximately 32 acres of land and is bounded by Broadway on the east, the Delaware & Hudson Railroad on the west, and Park Avenue on the south (NYSDEC, 2000).

2.2.1 Description of Releases, Pathway, and Groundwater Contamination at Fort Edward Plant Site

GE began using PCBs as a dielectric fluid in manufacturing electrical capacitors at the Fort Edward facility in 1947. GE used PCBs at the Fort Edward plant site until 1977, when GE switched to alternative dielectric fluids. PCBs were delivered to GE in rail cars, then off-loaded, refined and mixed at the Fort Edward plant. PCBs were released to the environment, including groundwater, in a variety of ways and at a variety of places at the Fort Edward Site during the 30 years they were used (Lawler, Matusky and Skelly, 1985).

GE used volatile organic chemicals (VOCs) as solvents and degreasers at the Fort Edward Plant Site beginning in 1947. The most commonly used VOC was trichloroethylene; however, GE also used toluene and xylene. In addition, trichlorobenzene was used as a replacement dielectric until 1983 (Lawler, Matusky and Skelly, 1985; Industrial Chemical Survey, 1981). VOCs were released to the environment, including groundwater, in a variety of ways, including spills and leaks (Lawler, Matusky and Skelly, 1985).

PCBs and VOCs were spilled during off-loading and transferring between and among outdoor storage tanks. PCBs and VOCs collected in sewers that served operational areas and sanitary waste. These hazardous substances were then released to groundwater from leaks in those sewer lines. PCBs and VOCs were also discharged to a leach field, from which they moved directly into groundwater (Vullo, 1989; Clark and Dietz, 1975).[7]

The Fort Edward plant site is controlled by a groundwater table divide which trends northeast to southwest. Groundwater flow in the northwestern, western and southwestern portion of the facility is generally to the west towards the Hudson River. Flow in the central and southeastern portion of the facility is generally to the southeast toward Park Avenue (Geraghty and Miller, 1983).

2.2.2Analysis of Groundwater Contamination at Fort Edward Plant Site

Polychlorinated Biphenyls

Groundwater at and near the Fort Edward plant site is contaminated with PCBs. PCBs have been detected in samples from all groundwater zones (regimes) at the site. Aroclor 1242 is the most commonly identified PCB in groundwater at the Fort Edward site.

In 1982, PCBs were detected in private homeowner wells in the vicinity of the Fort Edward plant (Lawler, Matusky and Skelly, 1985). Between 1987 and 1998, over 135 groundwater monitoring wells were installed at and near the Fort Edward site. Between 1995 and 1998, approximately 420 groundwater samples were collected from those wells and analyzed for PCBs. PCBs in 240 samples (57%) exceeded the current New

[7] On October 13, 1994, the New York State Department of Environmental Conservation and Office of the Attorney General issued a "Notice of Violation" to General Electric notifying the company of unpermitted "discharges and releases of PCBs from the Fort Edward Plant site into the groundwater of the State of New York."

York State groundwater standard of 0.09 ppb (6 NYCRR 703.5). PCBs in 65 wells (48%) exceeded the standard of 0.09 ppb (See, for example, O'Brien and Gere Engineers, 1998).

The groundwater sampling program at the Fort Edward plant was designed to characterize the geographical and geological extent of *known* contamination in groundwater. The sampling program was not a randomized study designed to determine the relative amount of PCB contamination in groundwater. The wells were installed, and the samples collected, for specific purposes, including identifying and determining the extent of contamination. Well installation and sampling were targeted towards defining the boundaries of the contamination, so many wells were installed outside of the known contamination plume with the goal of confirming the relatively clean nature of the groundwater in those areas and to monitor for PCB migration. Others were installed within the plume to characterize the nature and extent of the contamination. Thus, many of the wells sampled at the Fort Edward plant site were expected to meet groundwater standards (See, for example, O'Brien and Gere, 2012).

The targeted nature of the well installation is apparent from the dataset. 42 (68%) of the 62 wells that produced samples that exceeded the current groundwater standard of 0.09 ppb PCBs consistently displayed PCB concentrations that exceed the standard throughout the sampling period. These wells are within the contamination plume. On the periphery of and outside of the contamination plume, 71 (84%) of the 85 wells that have produced samples in which PCBs were not detected (non-detects, or NDs) consistently displayed NDs throughout the sampling period. These wells were installed outside of the PCB contamination plume. Only 14 of the 135 wells (10%) displayed concentrations of PCBs both above and below the groundwater standard through the sampling period.

More recent sampling has confirmed the general location and concentrations of contaminated groundwater at the Fort Edward plant site. However, some wells that displayed non-detect values in the late 1990s, now display PCB contamination in excess of the current New York State groundwater standard. 48 wells were sampled in June of 2011, and of those wells, 36 displayed contamination characteristics consistent with data from the late 1990s (24 wells remained contaminated in excess of the standard, 12 wells remained non-detect) (O'Brien and Gere, 2012). However, 12 wells that were consistently non-detect in the late 1990s, exceeded the New York State groundwater standard in 2011.

Volatile Organic Chemicals

Groundwater at the Fort Edward site is also heavily contaminated with a wide array of volatile organic chemicals (VOCs), including chlorinated benzenes, trichloroethylene (TCE), and breakdown-products of TCE. Hydrogeological studies of the Fort Edward site conducted in the early 1980s revealed that groundwater in the shallow over-burden and in the shallow bedrock beneath the site were contaminated by VOCs (Geraghty & Miller, 1983; Lawler, Matusky, and Skelly, 1985).

As illustrated in Table 2, several VOCs are consistently detected in Fort Edward groundwater in excess of current New York State Class GA groundwater standards. Chlorinated benzenes, trichloroethylene and trichloroethylene's breakdown products dichloroethylene and vinyl chloride, among other contaminants, exceed standards for all years for which standards have existed, frequently by factors of 100 to 1,000 (See, for example, O'Brien & Gere Engineers, Inc., 1997).

2.2.3 Methodology

The methodology utilized in groundwater sampling at the Fort Edward plant site was subjected to quality assurance/quality control protocols generally accepted at the time the sampling was performed and/or was scientifically verified and documented. Groundwater samples were collected from wells constructed

according to generally accepted methods at the time of construction (See, for example, O'Brien and Gere, 1997). The Trustees' use of these data in making this injury determination is therefore in compliance with the NRDA regulatory requirements set forth at 43 CFR §11.64.

FIGURE 4 LOCATION OF THE FORT EDWARD PLANT SITE

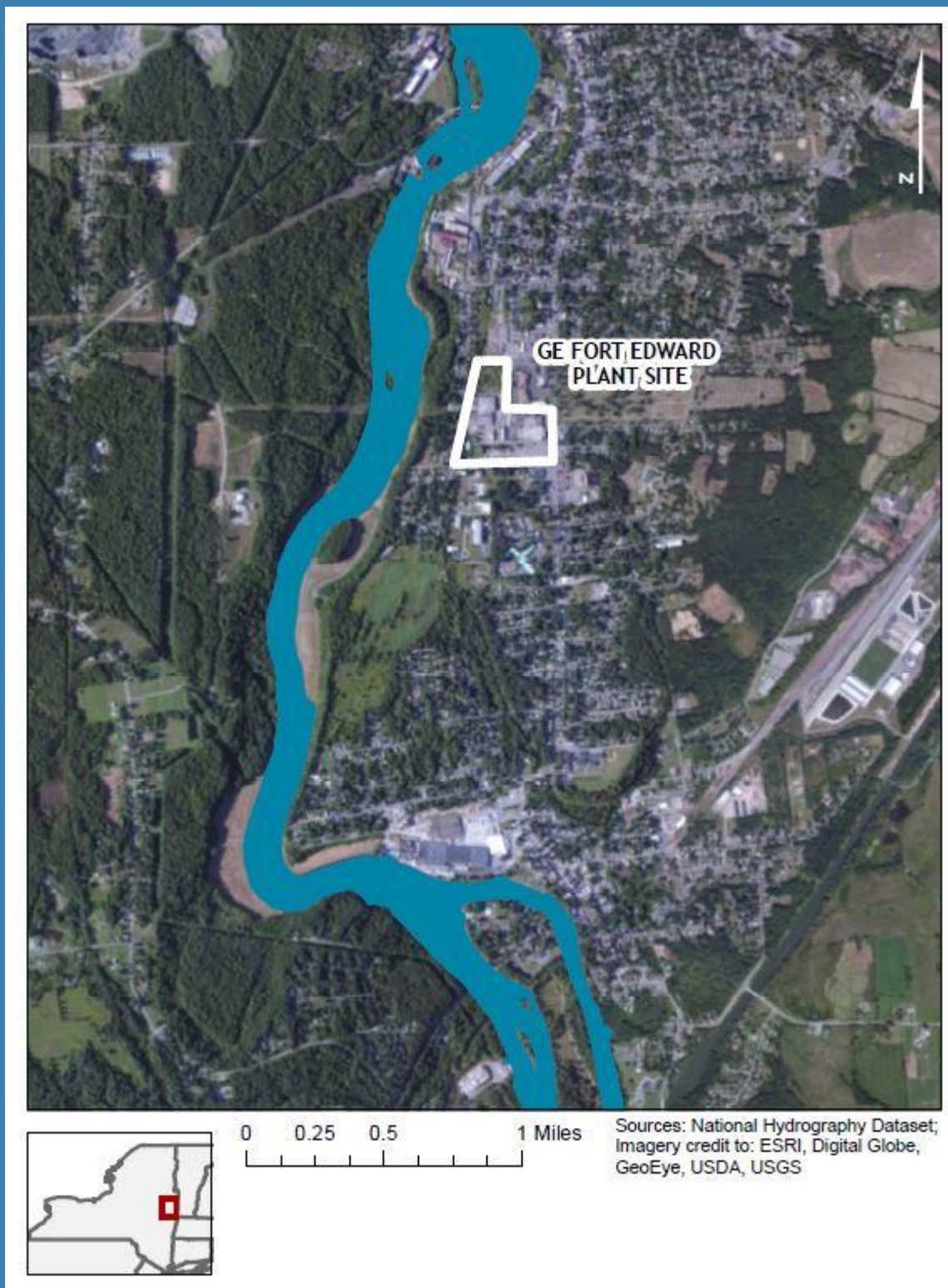


FIGURE 5 GE FORT EDWARD SITE

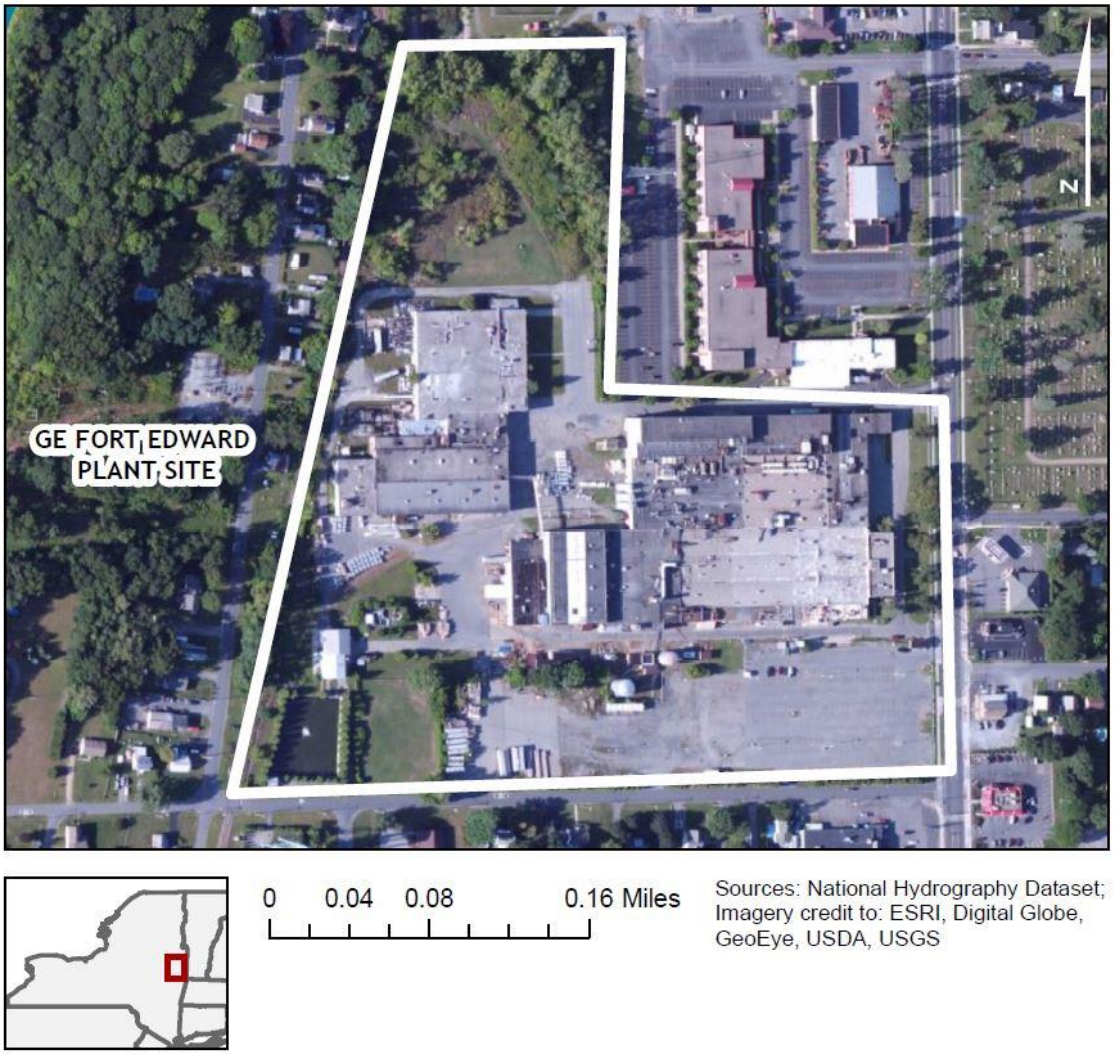


TABLE 2. MAXIMUM CONCENTRATIONS DETECTED IN GROUNDWATER FORT EDWARD (SEE NOTES)

	Prior to 1989		1989 - 1997		1998 - 2011	
Contaminant	**Class GA Standard (6 NYCRR 703) (ug/L) 1978 to 1989**	**Maximum Conc. Detected**	**Class GA Standard (6 NY-CRR 703) (ug/L) 1989 to 1997**	**Maximum Conc. Detected**	**Class GA Standard (6 NYCRR 703) (ug/L) 1998 to present**	**Maximum Conc. Detected**
1,2,4 - trichlorobenzene (Note 2)		1,100	5	240	5	80
1,2 -dichlorobenzene		8	4.7	8,900	3	63
1,3-dichlorobenzene			4.7	12,000	3	120
1,4-dichlorobenzene		1,071	4.7	6,900	3	190
Chlorobenzene		68	5	3,800	5	240
cis-1,2-Dichloroethene (Note 3)			5	760	5	3,000
trans-1,2-Dichloroethene (Note 3)		3,400	5	1,300	5	7
Toluene		70	5	39	5	117
Trichloroethylene		50,154	5	18,000	5	13,000
vinyl chloride	5	4,452	2	136	2	270
1, 1-dichloroethane		233	5	3,600	5	7,000
1,1,1-trichloroethane		6,238	5	1,100	5	29
tetrachloroethylene		101	5	29	5	16
chloroform	100	44	7	70	7	93
PCBs		110,000	0.10	10,000	0.09	38,300

Notes: **Data for contaminants detected at both the Fort Edward and Hudson Falls sites in each of the past two decades (1990 through 2012).**

1. This table presents data for contaminants detected at the Fort Edward site in each of the past two decades (1990 through 2012). Other contaminants which were detected at various times in concentrations exceeding WQS are: 1,2,3-trichlorobenzene, chloroethane, napthalene, methylene chloride, ethyl benzene, benzene, 1,1-dichloroethene, and BEHP.

2. Groundwater was only sporadically analyzed for chlorinated benzenes until the 1990s.

3. Cis- and trans-1,2-dichloroethyne were reported as either "sum of cis and trans" or just as "trans" until the 1990s.

2.3 VILLAGE OF STILLWATER WELL FIELD AND SURROUNDING AREA

The Village of Stillwater, New York, lies on the west bank of the Hudson River at River Mile 168. Until recently, the Village of Stillwater obtained its drinking water from a well field consisting of series of six shallow groundwater wells located approximately 120 to 500 feet from the Hudson River. This well field is located on a partially wooded 8-acre parcel, and it is constructed on a point bar of the Hudson River, which is underlain by approximately 30 feet of water-bearing sand and gravel that coarsens with depth. The water bearing zone is overlain by fine-grained flood plain sediment. The groundwater gradient appears to be relatively flat across the well field, with no dominant groundwater flow direction (Malcolm Pirnie 2009).

2.3.1 Description of Pathway and Groundwater Contamination at Stillwater Well Field

Groundwater in the Stillwater well field is hydraulically connected to the Hudson River. As the wells extract groundwater, water from the Hudson River infiltrates into this groundwater (Malcolm Pirnie 2009). In 2006, the NYSDOH, after a review of temperature data from several of the Stillwater water supply wells, provisionally determined that the well field was under the influence of surface water. In making this provisional determination the NYSDOH provided the Village of Stillwater two options: (1) treat the well field as if it indeed is under the influence of surface water (i.e., install filtration or some other form of treatment, or provide an alternate water supply), or (2) test the provisional determination by submitting samples for Microscopic Particulate Analysis (MPA) (NYSDOH 2006).

In the fall of 2006, the Village of Stillwater had samples of its well field analyzed via MPA. Based on the results of those analyses, NYSDOH made a final determination that the well field was under the influence of surface water (NYSDOH 2007). This means that Hudson River surface water is interacting with groundwater in the area of the well field, and that drawing water from the wells may involve drawing Hudson River surface water. Data from level loggers demonstrates the connectivity between the well field and the Hudson River, with an estimated travel time of two to four weeks between the river and the nearest well (Malcolm Pirnie 2009).

The Hudson River in the vicinity of the Stillwater well field is contaminated with PCBs. Over time, pumping of water from the well field pulled PCB-contaminated water from the Hudson River through the aquifer and into the wells. Some of the PCBs pulled from the Hudson River water were removed through the water treatment process at Stillwater's Water Treatment Plant, and some were delivered in finished water; however, over time PCBs also built up in the soils within the well field between the well points and the Hudson River. Recent investigations by the U.S. Army Corps of Engineers indicate that PCB-contaminated aquifer soils, as opposed to the Hudson River surface water, currently contribute the majority of PCBs to groundwater in the vicinity of the well field (Malcolm Pirnie 2009).

2.3.2 Analysis of Groundwater Contamination at Stillwater Well Field

Groundwater in and adjacent to the Village of Stillwater Well Field in Saratoga County, New York is contaminated with PCBs (Malcolm Pirnie 2009). In 2008, the NYSDOH sampled the Village of Stillwater water supply wells to determine if detectable concentrations of PCBs were present. Also in 2008, the U.S. Army Corps of Engineers installed seven groundwater monitoring wells in the vicinity of the well field. The NYSDOH sampling detected PCBs in groundwater at concentrations ranging from 0.082 ppb to 0.164 ppb (Palmer, 2011). The Army Corps monitoring wells displayed groundwater PCB concentrations ranging from

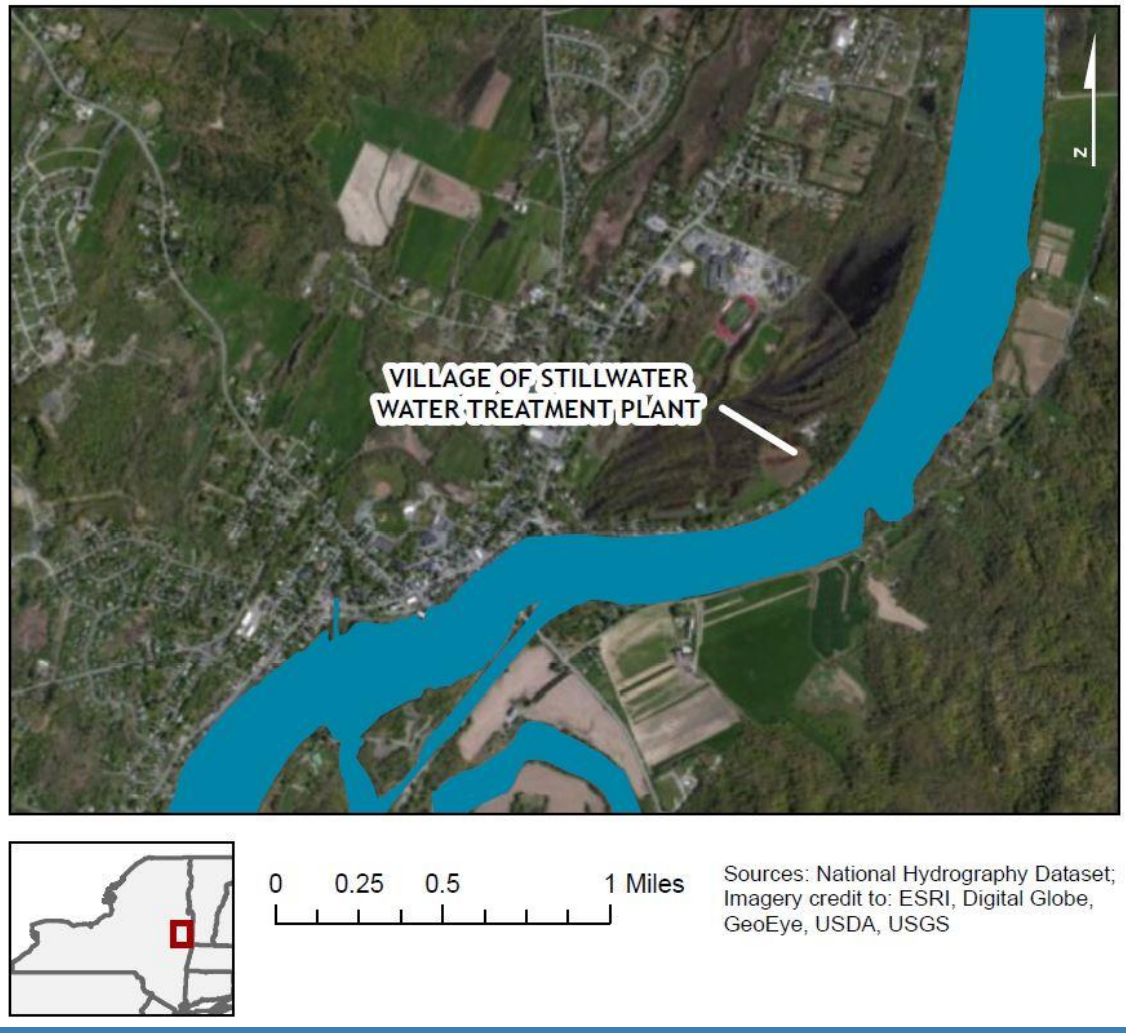
essentially .0001 ppb (concentrations similar to the method blank) to 0.196 ppb (Malcolm Pirnie 2009). NYSDOH and Army Corps data indicate that groundwater in the vicinity of the Stillwater well field exceeds the New York State groundwater standard of 0.09 ppb.

In December 2011, in response to PCB contamination in its well field and the NYSDOH determination, the Village of Stillwater connected to the Saratoga County Water Authority's water system. As of 2012, the Village of Stillwater served approximately 3,200 users in both the Village and Town of Stillwater.

2.3.3 Methodology

The methodology utilized in groundwater sampling at the Stillwater well field was subjected to quality assurance/quality control protocols generally accepted at the time the sampling was performed and/or was scientifically verified and documented. Groundwater samples were collected from wells constructed according to generally accepted methods at the time of construction (See, for example, O'Brien and Gere, 1997). The Trustees' use of these data in making this injury determination is therefore in compliance with the NRDA regulatory requirements set forth at 43 CFR §11.64.

FIGURE 6 VILLAGE OF STILLWATER WELL FIELD



3.0 INJURY DETERMINATION

DOI's NRDA regulations at 43 CFR §11.62 (c) provide that groundwater is injured when the following conditions are met:

1. The concentrations and duration of hazardous substances measured in the groundwater are in excess of applicable water quality regulatory standards or guidance criteria established by section 1401(1)(d) of the Safe Drinking Water Act (SDWA), section 304 (a)(1) of the Clean Water Act (CWA), or by other Federal or State laws or regulations that establish such criteria for public or domestic water supplies (43 CFR §11.62 (c)(1)(ii),(iii));
2. The groundwater met the regulatory standard or guidance criteria before the discharge or release of the hazardous substance (43 CFR §11.62 (c)(1)(ii),(iii));
3. The groundwater has a committed current or planned public use as a public or domestic water supply under applicable Federal or State laws or regulations that establish such criteria (43 CFR §11.62 (c)(1)(ii), (iii)); and
4. Concentrations of hazardous substances are measured in (a) two groundwater samples from the same geohydrologic unit, obtained from two properly constructed wells separated by a straight-line distance of not less than 100 feet, (b) a properly constructed well and a natural spring or seep separated by a straight-line distance of not less than 100 feet, or (c) two natural springs or seeps separated by a straight-line distance of not less than 100 feet (43 CFR §11.62 (c)(2) (i)-(iii)).

The Trustees have determined that groundwater in the assessment area is injured within the meaning of 43 CFR §11.62 (c) based on the information provided in this report and summarized in the following sections.

3.1 EXCEEDANCE OF APPLICABLE WATER QUALITY CRITERIA

Groundwater in the vicinity of the Hudson Falls plant site and the Fort Edward plant site contains PCBs in excess of the applicable water quality standard (currently 0.09 ppb) contained in 6 NYCRR 703.5 for public or domestic water supplies. Also, groundwater in the vicinity of the Hudson Falls plant site and the Fort Edward plant site contains VOCs in excess of the applicable water quality standard (typically 5 ppb) contained in 6 NYCRR 703.5 for public or domestic water supplies. New York State water quality standards have been exceeded in the plant sites' groundwater for over 20 years.

The Village of Stillwater well field contains PCBs in excess of the applicable water quality standard (currently 0.09 ppb) contained in 6 NYCRR 703.5 for public or domestic water supplies. This standard has been exceeded since at least 2008.

3.2 CONDITION OF THE GROUNDWATER PRIOR TO THE RELEASE

PCBs and VOCs are man-made chemicals that do not occur naturally in the environment. GE released PCBs and VOC at and in the vicinity of the Hudson Falls and Fort Edward plant sites, resulting in contamination of the groundwater and the aquifer soils in the assessment area. Absent GE's releases, the groundwater would exist in the baseline condition.

3.3 COMMITTED USE DETERMINATION

The State of New York has established a committed use for all Class GA fresh groundwater as a source of potable water supply (6 NYCRR 701.15). Groundwater in the vicinity of Hudson Falls, Fort Edward, and Stillwater is Class GA fresh groundwater, and is a source of potable water supply.

3.4 SAMPLE CHARACTERISTICS

At the Hudson Falls and Fort Edward Sites, groundwater samples in excess of the criteria provided at 6 NYCRR 703.5 were collected from multiple properly constructed wells separated from one another by distances greater than 100 feet. Groundwater collected at the Village of Stillwater well field wells MW 4 and MW 6 (approximately 150 feet apart) exceed the criteria provided at 6 NYCRR 703.5.

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INJURY DETERMINATION REPORT:
HUDSON RIVER GROUNDWATER RESOURCES


U.S. DEPARTMENT OF THE INTERIOR
MARCH 3, 1849


NEW YORK
STATE OF
OPPORTUNITY.
Department of
Environmental
Conservation


NOAA
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE