FIRST FIVE-YEAR REVIEW REPORT
TRI-CITIES BARREL SUPERFUND SITE
BROOME COUNTY, NEW YORK

Prepared by

U.S. Environmental Protection Agency
Region 2
New York, New York

September 2016

Approved by:

Walter E. Mugdan, Director
Emergency and Remedial Response Division

Date: Sept. 15, 2016

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Executive Summary

This is the first five-year review for the Tri-Cities Barrel Superfund site, located in the Town of Fenton, Broome County, New York. The purpose of this five-year review is to review information to determine if the remedy is and will continue to be protective of human health and the environment. The triggering action for this statutory five-year review is the signature date of the Record of Decision Amendment on September 27, 2011.

This five-year review concluded that the selected remedy is protective of human health and the environment.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Tri-Cities Barrel Co., Inc.		
EPA ID: NYD980509285		
Region: 2	**State:** NY	**City/County:** Town of Fenton/Broome County

SITE STATUS	
NPL Status: Final	
Multiple OUs? No	**Has the site achieved construction completion?** Yes

REVIEW STATUS
Lead agency: EPA ***[If "Other Federal Agency", enter Agency name]*:** Click here to enter text.
Author name (Federal or State Project Manager): Thomas Mongelli
Author affiliation: EPA
Review period: 9/28/2011 - 9/9/2016
Date of site inspection: 6/1/2016
Type of review: Statutory
Review number: 1
Triggering action date: 9/28/2011
Due date *(five years after triggering action date)*: 9/28/2016

Issues/Recommendations
OU(s) without Issues/Recommendations Identified in the Five-Year Review:
OU1

Protectiveness Statement(s)		
Operable Unit: OU1	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):* N/A
Protectiveness Statement: The OU1 remedy is protective of human health and the environment.		

Sitewide Protectiveness Statement	
Protectiveness Determination: Protective	*Addendum Due Date (if applicable):* N/A
Protectiveness Statement: The sitewide remedy is protective of human health and the environment.	

Introduction

The purpose of a five-year review is to evaluate the implementation and performance of a remedy in order to determine if the remedy is and will continue to be protective of human health and the environment and is functioning as intended by the decision documents. The methods, findings, and conclusions of reviews are documented in the five-year review. In addition, five-year review reports identify issues found during the review, if any, and document recommendations to address them.

This is the first five-year review for the Tri-Cities Barrel Superfund site, located in the Town of Fenton, Broome County, New York. This five-year review was conducted by the Environmental Protection Agency (EPA) Remedial Project Manager (RPM) Thomas Mongelli. The review was conducted pursuant to Section 121(c) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, 42 U.S.C. §9601 *et seq.* and 40 CFR 300.430(f)(4)(ii), and in accordance with the *Comprehensive Five-Year Review Guidance*, OSWER Directive 9355.7-03B-P (June 2001). This report will become part of the site file.

The triggering action for this statutory review is the signature date of the Record of Decision (ROD) amendment. A five-year review is required at the site due to the fact that hazardous substances, pollutants or contaminants will remain at the site above levels that allow for unlimited use and unrestricted exposure. The site consists of one operable unit, which is addressed in this five-year review.

Site Chronology

See Table 1 for the site chronology.

Background

Physical Characteristics

The site is located on a 14.9-acre parcel of land located approximately five miles northeast of the City of Binghamton. The site is situated adjacent to Old Route 7 and is bordered to the north by Osborne Creek and by rural residential areas, farmland, and woodlands on the other sides. The site is bisected by Interstate Highway 88 (I-88). The attached figure shows a site plan.

The southern portion of the site is relatively flat, except in the vicinity of I-88, where the ground surface slopes steeply down to the highway. North of I-88, the ground surface slopes gradually northward toward Osborne Creek before again sloping steeply to the creek and the associated flood plain.

Two small unnamed, intermittent streams parallel the eastern and western sides of the site. The eastern tributary is located outside of the property boundary, while the western tributary is located within the property boundary. Both streams collect surface water runoff from the southern portion of the site, including Osborne Hollow Road, Old Route 7, and the railroad tracks. The streams flow

north, discharging to Osborne Creek.

A man-made pond (a former lagoon) located north of I-88 occupies approximately 6,000 square feet (ft.). However the size of the pond varies greatly with seasonal precipitation and is often dry or nearly dry during the summer months. The pond covers the greatest amount of land surface and is deepest (2-3 ft.) during the spring. The pond receives water from direct precipitation and storm water runoff from I-88 and the area between I-88 and the pond.

Site Geology/Hydrogeology

Based on the results of an electrical resistivity survey, the top of weathered or fractured bedrock is believed to range from 48 to 52 ft. below ground surface (bgs), while the top of competent rock is between 66 and 88 ft. bgs. The bedrock is overlain by a thick till unit consisting predominantly of interbedded silt and clay with little sand and gravel. The site is on a till terrace that is mantled with a thin veneer of colluvium. Silty clay till is exposed along road cuts and in a borrow pit to the south of Old Route 7. The terrace where the site is located is underlain by approximately 60 ft. of dense silty clay till, with the thickness of the till deposits increasing toward Osborne Creek. Sand lenses are present within the till. The amount and continuity of the sand lenses increases to the north, again in the vicinity of Osborne Creek.

The site is approximately 1.3 miles from the eastern edge of the Endicott-Johnson city aquifer. The nearest municipal water well field is developed in this aquifer, approximately 2 miles from the site, on the opposite side of the Chenango River from the confluence of Osborne Creek. The till deposits under the site form an unconsolidated water bearing zone. Due to the slow recharge of the on-site wells and low hydraulic conductivity of the till, the groundwater present in the till is referred to as a water bearing zone and does not qualify as an aquifer. Groundwater in the unconsolidated water bearing zone flows to the north towards Osborne Creek.

Hydraulic conductivity for the water bearing zone at the site ranges from 1.5×10^{-7} centimeters per second (cm/s) to 3.8×10^{-3} cm/s. A review of boring logs for monitoring wells exhibiting higher hydraulic conductivity values (i.e. in the 10^{-3} cm/s range) indicate that the well screens in those locations extend across a sandy lens or till containing sand and gravel rock fragments. Because of the dense nature of the unconsolidated glacial till deposits, the hydraulic connectivity between the unconsolidated water bearing zone and the bedrock aquifer is suspected to be negligible, thereby limiting the vertical movement of groundwater.

Land and Resource Use

The site property is presently zoned residential/agricultural. The former industrial use of the property was a nonconforming use (*i.e.,* the drum reclamation facility was permitted to continue operating after a zoning ordinance that would have prohibited such industrial use had been established for the area). The current land use in the immediate vicinity of the site is residential, agricultural, and recreational.

Currently, the on-site shallow contaminated unconsolidated water bearing zone and the uncontaminated bedrock aquifer are not used for drinking water. Residents living in the vicinity of the site use the deep bedrock aquifer, which was not impacted by the site, as the sole source of

potable water. Groundwater near the site will continue to be used as a source of potable water under future-use scenarios.

History of Contamination

The property was operated as a barrel and drum (hereinafter "drum") reconditioning facility from about 1955 to 1992. The Tri-Cities Barrel Co., Inc., a defunct corporation, owned and operated the property during this period.

The drum reconditioning process involved cleaning and reconditioning the interior and exterior of drums through a combination of physical, chemical, and mechanical means. The drums, which were brought to the site from numerous different sources, typically contained residues of a variety of chemical compounds employed in industrial or commercial operations. Depending on the nature of the residues, Tri-Cities Barrel Co. employed various processes to remove such residues, including water and caustic sodium hydroxide solutions, incineration, particle blasting, and scraping. Much of the available property south of I-88 was used for drum storage. As many as 1,000 drums per week were reconditioned at the facility.

From the beginning of the facility's operations to the early 1960s, liquid wastes from the reconditioning process were discharged to the ground and allowed to flow downslope toward Osborne Creek. This practice created a distinctive drainage pattern. From the early 1960s to 1980s, liquid wastes discharged to a series of unlined lagoons on the site. These lagoons were reportedly 3 to 4 ft. deep. Prior to the completion of construction of I-88 in 1968, there were five lagoons located north of the former process building that were aligned along a north-south line in the same general area as their earlier discharge pattern. After the construction of I-88, the liquid wastes were directed from east to west across the site through the lagoons. The discharge from these lagoons flowed to the western tributary.

Initial Response

Tri-Cities Barrel Co. discontinued its practice of discharging liquid wastes to the lagoons in 1980 after negotiations with the New York State Department of Environmental Conservation (NYSDEC). By 1981, the three lagoons south of I-88 had been backfilled with approximately 7,000 cubic yards (CY) of fill. Following the closure of the lagoons, the liquid wastes generated in the drum cleaning process were collected in a holding tank and hauled off-site for disposal. Upon installation of a closed-loop wastewater recirculating system, only infrequent off-site disposal of the liquid wastes was necessary.

Based upon the results of an EPA-performed site investigation and New York State-performed Phase I and Phase II site investigations, the site was added to the National Priorities List on October 4, 1989.

A potentially responsible party (PRP) search conducted by EPA in 1991 resulted in the initial identification of 23 PRPs for the site. In May 1991, EPA notified these parties that it considered them PRPs with respect to the site, and provided those parties with the opportunity to perform a remedial investigation/feasibility study (RI/FS) for the site under an Administrative Order on Consent (AOC).

On May 14, 1992, EPA entered into an AOC with 14 of these parties, under which they agreed to perform an RI/FS to determine the nature and extent of the contamination at and emanating from the site and to identify and evaluate remedial alternatives.

Following issuance of the RI/FS AOC, EPA continued its PRP investigation and, in August 1995, notified 64 additional parties of their potential responsibility at the site. Thirty-one of these parties were determined by EPA to be parties with a minimal, or *de minimis*, share of liability, and were offered participation in a *de minimis* settlement. Of those 31 parties, 26 elected to settle their liability with EPA as respondents in an AOC in March 1996. Three more *de minimis* parties settled with EPA in an AOC in July 1997.

On September 25, 1996, the PRP Group and EPA entered into an AOC whereby it agreed to perform a removal action at the site under EPA oversight. EPA then issued a Unilateral Administrative Order in December 1997 to eight nonconsenting parties, directing them to participate in the removal action along with the AOC parties. The objectives of this action were to locate, characterize the contents, and properly dispose of all containers, drums, tanks, and debris located on-site and decontaminate, demolish, and dispose of all buildings and structures. This work was completed in January 1997.

Basis for Taking Action

An RI was conducted pursuant to the 1992 AOC from 1992 to 1997 and included the sampling of surface and subsurface soils, sediments in Osborne Creek and its tributaries, groundwater, and surface water.

Surface and Subsurface Soil

In the area north of I-88, contaminants of concern (COCs) were detected in the top 2 ft. of the soils and sediments within the boundaries of the former lagoon and the former surficial discharge drainage pattern. They primarily consisted of multiple semi-volatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), and pesticides. In the area south of I-88, several volatile organic compounds (VOCs) and metals were identified as COCs along with many of the same contaminants identified north of I-88. In the area south of Osborne Hollow Road, only one SVOC, bis(2-ethylhexyl)phthalate, and one pesticide, endrin, were identified as COCs.

Sediments

Sediments in the eastern and western tributaries exceeded NYSDEC's sediment criteria for SVOCs, pesticides, PCBs, and metals. With the exception of two pesticides, alpha- and gamma-chlordane, the contaminants in the eastern tributary were not believed to be attributable to the former site operations, but rather to an adjacent former junkyard. No COCs were identified in the sediments of Osborne Creek itself.

Groundwater

The affected groundwater at the site is restricted to the area south of I-88, within the shallow, unconsolidated water bearing zone in isolated zones over an approximate 240-ft. wide by 500-ft. long area. The COCs identified in this area include VOCs, SVOCs, PCBs, pesticides, and metals. The deep bedrock aquifer was found not to be contaminated.

Surface Water

One VOC, carbon disulfide, was detected at a maximum concentration of 13 micrograms per liter (µg/L) in two samples collected from Osborne Creek. However, this contaminant was considered to not be site-related, since no carbon disulfide was detected within the site's soil, sediment, or groundwater. The pesticides alpha- and gamma-chlordane were detected in a sample collected from the western tributary near I-88. Based on these results, it was determined that surface water in the eastern tributary and Osborne Creek were not adversely affected by the former site operations. The western tributary may have been slightly impacted by constituents originating from the site. However, these constituents were not detected in the surface water of Osborne Creek, the receiving stream, indicating that the concentrations are either diluted or not transported to the downstream sampling locations.

Risk Assessment

The baseline human health risk assessment (HHRA) identified 10 metals, 11 VOCs, 12 SVOCs, and four PCBs/pesticides as contaminants of concern (see Tables 2A and 2B). The HHRA evaluated several potential exposure pathways for children and adults, including future residents, site visitors, and on-site workers that could result from current and future direct contact with contaminated soil, groundwater, surface water and sediment, inhalation of airborne particles, and ingestion of vegetables grown in contaminated soil.

Site-wide future use risks from ingestion of groundwater and vegetables grown in contaminated soil and dermal exposure to groundwater and inhalation of volatiles released into indoor air from groundwater exceeded the cancer risk range.

Noncancer hazards exceeded the hazard index (HI) limit of 1 for multiple chemicals including the future resident adult and child in the areas north and south of I-88 through ingestion of soil, groundwater, and vegetables grown in contaminated soil, dermal exposure to surface soil and groundwater, and inhalation of volatiles released into indoor air from groundwater. Current and future workers were also found to have a noncancer risk from ingestion of groundwater both north and south of I-88. In the area south of Osborne Hollow Road, ingestion of soil and vegetables grown in contaminated soil were also found to pose non-cancer risk under the future child resident scenario.

Similarly, a baseline ecological risk assessment (BERA) was conducted to assess potential risk from multiple inorganics, VOCs, SVOCs, pesticides, PCBs, and dioxin. Potential risk to several indicator species through exposure to the COCs in soil, surface water, and sediment were evaluated. For assessment of direct exposure to surface water and sediment, concentrations of

COCs in these media were compared to benchmark values expected to result in adverse biological effects. For assessment of direct exposure to surface soils, plants, soil invertebrates, the eastern cottontail rabbit, and the American robin were selected as indicator species. The major concerns for ecological receptors were found to include: lead, pesticides (primarily chlordane), and PCBs in the area south of I-88, PCBs in the area north of I-88, PCBs and chlordane in the area north of I-88 sediments, PCBs and chlordane in the east tributary sediments, and chlordane in the west tributary sediments.

Remedial Actions

Remedy Selection

Based on the results of the RI/FS, a ROD was signed in March 2000. The major components of the selected remedy included the following:

- Excavation of approximately 50,000 cy of unsaturated (above the water table) soil and sediment exceeding soil/sediment cleanup objectives;
- Backfilling of the excavated areas with clean fill and revegetating such areas, as appropriate. All excavated/dredged material will be characterized and transported for treatment/disposal at an off-site Resource Conservation and Recovery Act (RCRA) and/or Toxic Substances Control Act (TSCA) compliant facility, as appropriate;
- Restoration of any wetlands impacted by remedial activities. The restored wetlands will require routine inspection for several years to ensure adequate survival of the planted vegetation;
- Extraction of contaminated groundwater utilizing a network of recovery wells, and treatment of the extracted groundwater (by air stripping, liquid phase carbon adsorption, and chemical precipitation technologies, or other appropriate treatment), followed by discharge to surface water;
- Implementation of institutional controls (i.e., deed restrictions) to prohibit the installation and use of groundwater wells at the site until groundwater cleanup standards are achieved; and
- Long-term monitoring of groundwater, surface water, and nearby residential private wells to ensure the effectiveness of the selected remedy.

The remedial action objectives (RAOs) established in the ROD were as follows:

- Minimize or eliminate contaminant migration to the groundwater and surface waters to levels that ensure the beneficial reuse of these resources;
- Restore groundwater quality to levels which meet state and federal drinking water standards within a reasonable time frame;
- Reduce or eliminate the direct contact threat associated with contaminated soil, sediment, and groundwater; and
- Minimize exposure of fish and wildlife to contaminants in surface water, sediments, and soils.

Remedy Implementation

Following the signing of the ROD, EPA entered into a consent decree with the PRP Group to perform the design and implementation of the selected remedy. Implementation of the remedy was split into two work elements. Work Element I included excavation and disposal of contaminated soils and sediments, while Work Element II consisted of treatment of the contaminated groundwater.

The ROD called for, among other things, long-term monitoring of surface water to ensure the effectiveness of the selected remedy. The single VOC that was detected in Osborne Creek was considered not to be site-related. It was also determined that surface water in the eastern tributary and Osborne Creek were not adversely affected by the former site operations. While the western tributary may have been slightly impacted by constituents originating from the site, these constituents were not detected in the surface water of Osborne Creek, the receiving stream, indicating that the concentrations are either diluted or not transported to the downstream sampling locations. For these reasons, surface water sampling is not being performed.

Work Element I

After the completion of the remedial design, remedial action for Work Element I began in 2003. During the course of the remedial action 40,000 CY of contaminated unsaturated soil and sediments were excavated and shipped off-site. Some of the soil was deemed RCRA hazardous due to elevated lead concentrations; other soil was deemed to be TSCA hazardous soil due to presence of elevated PCB concentrations.

The presence of a utility pole located on-site just to the north of Osborne Hollow Road prevented the full excavation of the contaminated soil surrounding the pole. In addition, an adjacent area beginning immediately to the west of the utility poll could not be fully excavated without compromising the integrity of Osborne Hollow Road. After limited excavation in these areas, a 30-mil low density polyethylene liner (approximately 120 ft. by 10 ft.) was placed over the remaining contaminated soil before backfilling the excavation with clean fill.[1]

Approximately 17,000 CY of common fill and 4,600 CY of topsoil were imported to reach the final grade site-wide. Common fill was placed in 12-inch loose lifts and compacted, while the top soil was spread into place by a bulldozer. All areas were seeded with grass. Replacement wetlands were established in the area north of I-88 as required by the remedial design documents. An erosion mat was placed over areas of the site where final slopes were greater than 10 percent and riprap was placed in the west tributary to provide for enhanced erosion control.

A Remedial Action Report for Work Element I was approved on March 31, 2004.

[1] EPA is required to publish an Explanation of Significant Differences (ESD) when, after issuance of a ROD, subsequent enforcement or remedial actions lead to significant, but not fundamental, changes in the selected site remedy. An ESD documenting this modification to the remedy will be prepared by EPA in the near future.

A wetland mitigation monitoring program was initiated at the site upon completion of the remedial action. Eighty percent or more of the vegetative cover within the wetland portion of the mitigation area was to be comprised of plant species having an indicator status of facultative or wetter by the end of the fifth growing season. Greater than 90% total coverage was to be established by the proposed wetland community types of shrub swamp, shallow emergent marsh and the combination deep emergent marsh/open water area. At the conclusion of the monitoring program in 2008, 100% of the total established coverage within the mitigation area consisted of shallow emergent marsh and the combination emergent marsh/open areas.

Work Element II

Concurrent with the performance of the Work Element I remedial design and remedial action, from 2001 through 2005, seven rounds of groundwater samples were collected as part of a monitored natural attenuation (MNA) study. The results were documented in a 2007 *Revised Comprehensive Monitored Natural Attenuation Evaluation Report.* The data indicated that the total mass of contaminants had been greatly reduced after the removal of the source of the groundwater contamination in the vadose zone soil. In addition, the presence of reductive microbial metabolic products indicated that the primary MNA mechanism responsible for the decline is biodegradation. With EPA's approval, in 2008, the PRP Group prepared a draft focused feasibility study (FFS) report comparing MNA to the groundwater remedial alternatives evaluated in the ROD. After reviewing the draft FFS report, EPA concluded that while MNA may be feasible for the majority of the site, the data did not demonstrate that MNA would address the groundwater contamination in the "MW-19 Area" (the source of the contamination in this area could not be identified). It was also concluded by EPA that because of the low permeability of the aquifer, groundwater extraction and treatment was not technically viable for the site.

Based upon the recommendations in the draft FFS report, the PRP Group was directed by EPA to implement an enhanced reductive dechlorination (ERD) pilot-scale treatability study in the MW-19 Area. Following the completion of four rounds of performance monitoring events, the PRP Group submitted a draft Pilot Study Report in January 2010. Based upon its review of the report, EPA requested that the PRP Group perform additional investigation to locate the source and, if located, then perform targeted ERD treatment. The PRP Group performed a supplemental investigation from September through December 2010. This work included the performance of a passive soil gas survey, collection of discrete groundwater samples from the silt and sand/gravel zones beneath and around the concrete rubble, permeability testing, and hydraulic conductivity testing. This investigation did not result in the identification of a source of the contamination in the MW-19 Area.

Based on the results of these investigations, a ROD amendment was signed in September 2011 which changed the groundwater component of the remedy selected in the March 2000 ROD. The major components of the selected modified remedy included:

- Monitored natural attenuation of groundwater contamination throughout the site, except in the MW-19 Area;

- Long-term groundwater monitoring to verify that the level and extent of groundwater contaminants are declining within the time frame projected and that conditions are protective of human health and the environment; and
- Periodic monitoring of nearby residential private wells to ensure the effectiveness of the selected remedy.

The ROD amendment noted that the site is zoned residential and is currently vacant. If, in the future, structures are proposed to be built on the property, then a soil vapor intrusion evaluation and, potentially, vapor mitigation may be needed, or alternatively just soil vapor mitigation. As a governmental institutional control, the Office of the Town of Fenton Building Inspector has acknowledged to EPA that such office will notify any person seeking to build residential structures at the site of soil vapor concerns relating to the property, and specifically of the need for a soil vapor evaluation and potentially, soil vapor mitigation systems or, alternatively just soil vapor mitigation.

The following RAOs were established for the site groundwater:

- Restore site-wide groundwater quality to levels which meet state and federal drinking water standards within a reasonable time frame; and
- Reduce or eliminate any direct contact or inhalation threat associated with contaminated groundwater.

The ROD amendment determined that the restoration of the groundwater in the MW-19 area is technically impracticable from an engineering perspective due to the ineffectiveness of active remedies in the low permeable soils found at the site, the limited mobility of the groundwater contamination, and the inability to locate a source of the contamination in that area. Therefore, a technical impracticability waiver was established pursuant to CERCLA §121(d)(4)(C) and NCP §300.430(f)(1)(ii)(C)(3) for the groundwater in this area. The technical impracticability (TI) zone is the approximately 120 ft. by 80 ft. MW-19 Area to a depth of 30 ft. The applicable or relevant and appropriate requirements (ARARs) that are waived for this zone include the federal maximum contaminant levels (MCLs) and NYSDEC Water Quality Regulations for Groundwater for tetrachloroethene (PCE), 1,1,1-trichloroethane (1,1,1-TCA), 1,1-dichloroethane (1,1-DCA), cis-1,2-dichloroethene (cis-1,2-DCE), and vinyl chloride (VC).

MNA commenced with a sampling event in December 2011. The effort is being performed utilizing MNA sampling protocols identified in the EPA-approved PRP Group's Revised Interim Groundwater Monitoring Program.

A Preliminary Close-Out Report was approved on September 28, 2011.

A Remedial Action Report for Work Element II was approved on January 3, 2013.

System Operations/Operation and Maintenance

Short-term operation and maintenance (O&M) related to Work Element I included monitoring of the vegetation to ensure its establishment. The restored wetlands were inspected for five years

following the completion of Work Element I. Periodic inspections of the area located along Osborne Hollow Road where the liner was installed are performed to insure that there is no intrusive activities in this area.

O&M associated with Work Element II consists of a long-term MNA sampling program. The sampling program originally called for the sampling of 14 monitoring wells (MW-2, MW-2S, MW-3, MW-3S, MW-7, MW-7S, MW-16, MW-16S, MW-18, MW-18S, MW-19, MW-20, MW-20S, and PMW-1) on a semiannual basis. The samples are analyzed for VOCs and field parameters[2] during every sampling event. MNA parameters[3] are analyzed every third sampling event beginning with the June 2012 sampling event. On June 3, 2014, EPA agreed to a request from the PRP Group to remove monitoring wells MW-7 and MW-18 from the monitoring program due to the fact that the wells had historically been found to not exhibit adverse impacts from site-related contaminants. EPA also approved changing the monitoring frequency for monitoring wells MW-3 and MW-20 from semiannually to annually. See Table 3 for a summary of the long-term MNA monitoring program.

Maintenance of the monitoring wells is performed on an as needed basis. Since the start of the MNA sampling program, only monitoring well MW-2 has required maintenance. During the December 2014 sampling event, the depth for monitoring well MW-2 was found to be less than what the as-built information indicated. Profiling with a down-hole camera revealed that the well screen was not visible due to sediment accumulation. On June 1, 2015, the well was redeveloped using jetting and purging techniques. Following redevelopment, the well depth was found to be consistent with the as-built information. No further maintenance has been required at this, or any other well.

As noted in the "Site Inspection" section, below, during the 2016 five-year review site inspection, monitoring well MW-16 was found to have a damaged cap. EPA has been advised by the PRP's contractor that a replacement cap has been ordered. In addition, monitoring well MW-1S-A's PVC casing is warped; the warping will not, however, affect the sampling of this well. In addition, monitoring well MW-1S has to be resurveyed due to frost heave.

Potential site impacts from climate change have been assessed, and the performance of the remedy is currently not at risk due to the expected effects of climate change in the region and near the site.

Progress Since Last Five-Year Review

This is the first five-year review of the site.

[2] Field parameters include temperature, pH, specific conductance, dissolved oxygen, oxidation-reduction potential (ORP), and turbidity.

[3] MNA parameters include ferrous iron, total iron, alkalinity, carbon dioxide, ethane, ethene, hydrogen, methane, chloride, nitrate, sulfate, sulfide, and total organic carbon.

Five-Year Review Process

Administrative Components

The five-year review team included Thomas Mongelli (EPA-RPM), Kathryn Flynn (EPA-hydrologist), Marian Olsen (EPA-human health risk assessor), Mindy Pensak (EPA-ecological risk assessor) and Larisa Romanowski (EPA-Community Involvement Coordinator).

Community Involvement

On November 19, 2015, EPA Region 2 posted a notice on its website indicating that it would be reviewing site cleanups and remedies at 32 Superfund sites and four federal facilities in New York and New Jersey, including the Tri-Cities Barrel site. The announcement can be found at the following web address:
http://www2.epa.gov/sites/production/files/2015-11/documents/fy_16_fyr_public_website_summary.pdf.

Once the five-year review is completed, the results will be made available at the local site repositories: the Fenton Town Hall, 44 Park Street, Port Crane, New York and the Fenton Free Library, 1062 Chenango Street, Binghamton, New York. In addition, efforts will be made to reach out to local public officials to inform them of the results.

Document Review

The documents, data and information which were reviewed in completing this five-year review are summarized in Table 4.

Data Review

The private drinking water wells were sampled by the New York State Department of Health (NYSDOH) during the RI; no site-related contaminants were detected. The residential well located closest to the site was resampled in 2005; site-related contaminants were not detected. NYSDOH collected samples at two private wells on August 23, 2011; site-related contaminants were not detected at either location. For these reasons, EPA does not believe that continued monitoring of the private drinking water wells is warranted.

Based on the RI surface water sampling results, surface water in the eastern tributary and Osborne Creek has not been adversely affected by the former site operations, but the surface water in the western tributary may have been slightly impacted by constituents originating from the site. However, these constituents are not detected in the surface water of the receiving stream (Osborne Creek), indicating that the concentrations are either diluted or not transported to the downstream sampling locations.

During the review period, groundwater monitoring was conducted in accordance with the Long-Term MNA Sampling Program. This monitoring revealed COCs above their respective performance standards in shallow, unconsolidated monitoring wells MW-2S, 3S, and 16S and in deep, unconsolidated monitoring wells MW-2, MW-19, and PMW-1. COC concentrations, in general, are significantly lower at present, when compared to concentrations prior to the 2003 contaminated soil and sediment excavation work.

In monitoring well MW-2S, 1,1-DCA (9.3 µg/L) was the only COC detected above its Ambient Water Quality Standard (AWQS) during the most recent monitoring event conducted in December 2015. Previously, cis-1,2-DCE and VC had been observed in monitoring well MW-2S at concentrations above their AWQS and MCL, respectively, although both have achieved their performance standards consistently since the June 2013 groundwater monitoring event.

COC concentrations in monitoring well MW-3S have attenuated significantly over the review period. During the review period, chloroethane, 1,1-DCA, 1,2-DCA, cis-1,2-DCE, and VC were all detected above their performance standards at maximum concentrations of 59 µg/L, 130µg/L, 1.8 µg/L, 160 µg/L, and 55 µg/L, respectively. Benzene (3.5 µg/L) was also observed above its AWQS of 1 µg/L during only one monitoring event in June 2015. During the most recent monitoring event, only 1,1-DCA and cis-1,2-DCE were still above their respective AWQSs at concentrations of 7.2 µg/L and 15 µg/L, respectively.

Monitoring well MW-16S has been observed, in general, to have the highest and most consistent COC concentrations at the site. Over the past five years, 1,1-DCA, cis-1,2-DCE, TCE, and VC have been consistently observed above their AWQSs at maximum concentrations of 22 µg/L, 940 µg/L, 940 µg/L, and 360 µg/L, respectively, compared to concentrations of 16 µg/L, 730 µg/L, 670 µg/L, and 320 µg/L, respectively, during the most recent monitoring event. Trans-1,2-DCE (37 µg/L) and benzene (2.6 µg/L) were each detected above their AWQSs during one monitoring event over the past five years in June 2012 and December 2013, respectively.

Concentrations of 1,1-DCA, cis-1,2-DCE, TCE, and VC have consistently been observed above their AWQSs in monitoring well MW-2 over the past five years, with maximum concentrations of 13 µg/L, 17 µg/L, 87 µg/L, and 7.7 µg/L, respectively. Chloroethane was detected at concentrations ranging between 5.5 µg/L and 7.5 µg/L during three monitoring events between December 2011 and December 2013, which is above its AWQS of 5 µg/L.

Monitoring wells MW-19 and PMW-1 are both located within the MW-19 Area and are the only monitoring wells with observed concentrations of PCE and 1,1,1-TCA above their respective AWQSs. Concentrations of PCE in monitoring well MW-19 have been steadily increasing, reaching a maximum concentration of 95 µg/L in December 2014 before decreasing slightly to 90 µg/L in December 2015. Concentrations of 1,1,1-TCA similarly increased to a maximum concentration of 85 µg/L in December 2012 before decreasing to 66 µg/L in December 2015. Monitoring well PMW-1 has seen similar increases in PCE to a maximum of 83 µg/L in December 2013 before decreasing to 41 µg/L in December 2015, while 1,1,1-TCA reached a maximum of 77 µg/L in December 2014 before decreasing to 60 µg/L in December 2015. TCE concentrations have been increasing in both wells with it being first detected above its AWQS in June 2014 in monitoring well PMW-1 and in June 2015 in monitoring well MW-19. The highest concentrations of TCE were observed in December 2015 at 6.7 µg/L and 44 µg/L in monitoring wells MW-19 and PMW-1, respectively. Monitoring well MW-19 has had one anomalous detection of 1,1,2-trichloroethane (1,1,2-TCA) (2.1 µg/L) in June 2013 and 1,1-DCA (5.2 µg/L) in December 2013, while monitoring well PMW-1 has had one anomalous detection of 1,1,2-TCA (1.8 µg/L) in June 2013 and several sporadic detections of 1,1-DCA over the past five years with a maximum

concentration of 7.2 µg/L in both June and December 2012. 1,1-DCA was not detected above its AWQS in monitoring well PMW-1 during the most recent monitoring event.

MNA parameters are analyzed during every third monitoring event. The most recent of these monitoring events occurred in June 2015. Ethene concentrations ranged from 4.1 nanograms per liter (ng/l) (monitoring well MW-18S) to 54,000 ng/l (monitoring well MW-16S), and ethane concentrations ranged from 5.3 ng/l (monitoring well MW-16) to 2,400 ng/l (monitoring well MW-16S). Generally, the highest concentrations were measured in samples collected from wells with the highest VOC concentrations (*i.e.,* monitoring wells MW-3S, MW-16S, and MW-2). Ethene and ethane are the reductive degradation products of VC along abiotic and bio-mediated pathways and minor degradation products of higher oxidation state chlorinated compounds along abiotic pathways. Ethane may also be generated be reduction of chloroethane along abiotic and bio-mediated pathways and by concerted abiotic reduction of 1,1,1-TCA. Dissolved ethene and/or ethane were detected in samples collected from all monitoring wells. Carbon dioxide, indicative of bio-oxidation, ranged from 7.4 milligrams per liter (mg/L) in monitoring well MW-19 to 92 mg/L in monitoring well MW-7S. Generally, the highest concentrations of ethene, ethane, and carbon dioxide were collected from wells with the highest VOC concentrations.

Dissolved hydrogen was detected in all samples and ranged from 2.1 nanomolar (nM) to 3 nM in monitoring wells MW-19 and MW-18S, respectively. This range generally indicated an environment conducive to sulfate reduction and reductive dechlorination. Methane was detected in all samples collected and ranged from 0.0011 mg/L in monitoring well MW-16 to 0.74 mg/L in monitoring well MW-16S. Methane concentrations greater than 0.5 mg/L indicate reducing conditions where VC can be reduced to ethene and ethane, while methane concentrations above 0.5 mg/L indicate oxidizing conditions. Ferrous iron, the product of iron reduction, was detected in four wells ranging from 0.3 mg/L in monitoring well MW-19 to 1.4 mg/L in monitoring well MW-16S. Sulfate was found at its lowest concentration in monitoring well MW-2S at 0.72 mg/L (estimated) and at its highest concentration in monitoring well MW-16S at 59 mg/L. Nitrate and sulfide, which can interfere with dechlorination, were either not present or at concentrations which were below the reporting limit for all wells.

Organic carbon, a microbial food source, was detected in all groundwater samples, ranging in concentration from 0.95 mg/L in monitoring well MW-19 to 17 mg/L in monitoring well MW-16S. Higher concentrations were generally observed in the shallow wells. Alkalinity, indicative of microbial activity, was also generally higher in the shallow wells and ranged from 90 mg/L in monitoring well MW-7S to 440 mg/L in monitoring well MW-3S. Dissolved oxygen concentrations were low in all wells, with the highest observed concentration being 0.49 mg/L in monitoring well MW-2S. ORP measurements ranged from -427 millivolts (mV) in monitoring well PMW-1 to -32 mV in monitoring well MW-18S.

Site Inspection

An inspection of the site was conducted on June 1, 2016. In attendance were Thomas Mongelli and Kathryn Flynn, of EPA; Charles Gregory of NYSDEC, and Erin Huntley and Matt Gentoso of WSP-Parsons Brinckerhoff, contractors for the PRP Group. The purpose of the inspection was to assess the performance of the remedy.

The inspection included a walkthrough of the site, visual inspection of the monitoring wells, site fencing, and wetlands. Overall the site appeared to be in good condition. All of the monitoring wells were in good condition with the exception of monitoring well MW-16, which had a damaged well cap. In addition, monitoring well MW-1S-A's PVC casing is warped; the warping will not, however, affect the sampling of this well. Monitoring well MW-1S has to be resurveyed due to frost heave. Fencing along I-88 was down in some areas, but it is unlikely that a trespasser would attempt access from the highway. On the north side of I-88, the restored wetlands appeared to be thriving, with many frogs, several species of birds, dragonflies, and cattails being observed. Two holes created by burrowing animals were observed around the perimeter of the pond. No new residences were observed in the vicinity of the site.

Interviews

During the five-year review process, an interview was conducted with representatives from WSP-Parsons Brinckerhoff during the site inspection. The purpose of the interview was to document any perceived problems or successes with the remedy that has been implemented to date. The interview determined that no significant issues have come up during the past five years of O&M. There has been no interaction with nearby residents during routine sampling events.

Institutional Controls Verification

The 2000 ROD requires the implementation of institutional controls to prohibit the installation of groundwater wells at the site until the groundwater cleanup standards have been achieved.[4] An easement and declaration of restrictive covenants was granted by the Tri-Cities Barrel Co. Inc. to the PRP Group on November 22, 1996 which, among other things, restricts the withdrawal of groundwater underlying the site for drinking water purposes, prohibits the installation of drinking water wells on any part of the site, and prohibits intrusive activities in the "capped area" of the site.[5] This easement was recorded in the Broome County Clerk's Office on January 10, 1997.

If, in the future, structures are proposed to be built on any of the three parcels that comprise the site, then a soil vapor intrusion evaluation and, potentially, vapor mitigation may be needed, or alternatively just soil vapor mitigation. As a governmental institutional control, on January 16, 2014, the Office of the Town of Fenton Building Inspector acknowledged to EPA that its office will notify any party seeking to build residential structures at the site of soil vapor concerns relating to the property, and specifically of the need for a soil vapor evaluation and potentially, soil vapor mitigation systems or, alternatively just soil vapor mitigation.

The presence of a utility pole located on-site just to the north of Osborne Hollow Road prevented the full excavation of the contaminated soil in the area surrounding the pole. An adjacent area

[4] The ROD amendment determined that the restoration of the groundwater in the MW-19 area is technically impracticable; therefore, there is no expectation that groundwater cleanup standards will be achieved in this area. Notwithstanding the requirements of the ROD and ROD amendment, the easement prohibits the installation of drinking water wells on any part of the Site.

[5] The easement was filed by the PRP Group several years before a remedy was selected for the Site. The restrictions delineated in the easement assumed that the contaminated soil would be capped. While capping was considered in the ROD, it was not selected. As was noted above, an approximately 120-foot by 10-foot area of the Site was capped.

beginning immediately to the west of the utility poll could not be fully excavated without compromising the integrity of Osborne Hollow Road. Therefore, a liner was placed over the contaminated soil remaining in this area before backfilling the excavation with clean fill. EPA will require that a diagram be appended to the existing easement delineating the area where the liner was installed.

Technical Assessment

Question A: Is the remedy functioning as intended by the decision documents?

The remedial action at the site was divided into two work elements, and both continue to function as intended by the decision documents.

The first work element was completed as envisioned by the 2000 ROD and included excavation of vadose zone contaminated soils and sediments. These actions were successfully completed in 2003. The presence of a utility pole located on-site just to the north of Osborne Hollow Road prevented the full excavation of the contaminated soil in this area and an adjacent area beginning immediately to the west of the utility poll could not be fully excavated without compromising the integrity of Osborne Hollow Road. Therefore, a 30-mil low density polyethylene liner and soil were placed over the contaminated soil in this area.

The second work element is ongoing and includes MNA of groundwater contamination as selected in the 2011 ROD amendment and long-term monitoring and institutional controls to address the TI zone. Monitoring is occurring on a semiannual basis and has shown decreasing VOC concentrations in two shallow wells and steady VOC concentrations in one shallow monitoring well (monitoring well MW-16S) and one deep monitoring well (monitoring well MW-2). The remaining three shallow and five deep monitoring wells included in the Long Term MNA Sampling Program have not exhibited any VOC detections over the last five years. In the MW-19 Area, subject to the technical impracticability waiver, concentrations of PCE appear to be steady in monitoring well MW-19 and decreasing in monitoring well PMW-1, while TCE concentrations appear to be increasing in both monitoring wells. TCE is a daughter product of PCE.

The easement, among other things, restricts the withdrawal of groundwater underlying the site for drinking water purposes, prohibits the installation of drinking water wells on any part of the site, and prohibits intrusive activities in the "capped area" of the site.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy still valid?

No significant changes in the risk assessment methods were identified that would affect the protectiveness of the remedy. The methods used to develop the baseline HHRA have not changed significantly. Updates to the guidance and the issuance of new guidance have not significantly changed the overall HHRA conclusions.

Vapor Intrusion

The 2011 ROD amendment included an evaluation of the vapor intrusion pathway based on the 2002 Vapor Intrusion Guidance. Updates to the Guidance in 2015 do not change the overall conclusions that there is a potential for vapor intrusion if buildings are constructed. Consistent with this finding, in the event of future construction, a soil vapor intrusion evaluation or, alternatively, soil vapor mitigation system are recommended. The Office of the Town of Fenton Building Inspector acknowledged that they will notify any person seeking to build structures at the site of soil vapor concerns relating to the property and the need for a soil vapor intrusion evaluation. (Section Institutional Controls Verification).

Ecological Risk

The ecological risks to both the benthic and soil invertebrate community, along with several ecological receptors (avian and mammalian herbivores) exposed to contaminated soils and sediment, were identified in the BERA. Although the ecological risk screening values used to support the ROD may not necessarily reflect the current values for terrestrial or aquatic receptors, the exposure assumptions remain appropriate, as both the surface soil and sediment pathways are now incomplete as a result of the excavation (and capping in one small area) of the contaminated material and the placement of clean fill in these areas. Therefore, there are no complete exposure pathways to ecological receptors.

The wetlands were also monitored for five years upon completion of the remedy (2004-2008). Based upon a review of the results, it was concluded that the mitigation effort identified and implemented as part of the ROD has been successful and mitigation goals were appropriately met.

Changes in Exposure Pathways

Land Use: The land use at the property remains residential/agricultural based on discussions with the Town Supervisor.

Routes of Exposure: There are no changes in the receptors evaluated at the site or the exposure factors used in the HHRA that would significantly change the conclusions of the HHRA or the protectiveness of the remedy.

Groundwater: The contaminated shallow aquifer is not currently used as a drinking water source and institutional controls are in place to prevent future exposures. This exposure pathway was interrupted.

Soils: As described in the RI, soil south of Interstate-88 was contaminated with VOCs, PCBs, and lead. Soil north of Interstate-88 was contaminated with PCBs and dieldrin (EPA, 2000). The contaminated soils were removed to a depth of 4 to 32 ft. in the unconsolidated zone and the soils was replaced with certified clean fill. The removal of the contaminated soils to this depth interrupts potential future exposures if the property is used for agricultural or residential purposes. There are

contaminated soils along Osborne Hollow Road that could not be excavated. These soils were covered with a liner and soil. An easement prevents exposure in the future.

The PRPs' consultant reported that post-excavation soil sampling confirmed that all soil cleanup objectives were achieved (ESC Engineering of New York 2004).

Contaminants of Concern: EPA has determined that 1,4-dioxane may be present in the groundwater at sites where 1,1,1-TCA, which was identified as a COC in the RI, is also detected. The presence of this chemical at the site was not previously evaluated, because analysis for this chemical was not performed at the time of the RI. Samples that were collected in early June 2016 were analyzed for 1,4-dioxane; it was not detected.

No new COCs or sources of contamination were identified at the site. No changes in site conditions affecting the protectiveness of the remedy were identified. Fences around the property and the site's location limit potential trespassing onto the site.

Changes in Standards and TBCs

There have been no new standards that call into question the protectiveness of the remedy.

Changes in Toxicity and Other Contaminant Characteristics

Since the original HHRA was developed, there have been updates to the toxicity values used in the HHRA for soil and groundwater. Toxicity values were updated for trichloroethylene, and tetrachloroethylene but the updates do not change the overall conclusions of the HHRA and the protectiveness of the remedy. In addition, a number of chemicals are currently being updated by the Integrated Risk Information System process, EPA's consensus toxicity database. Chemicals being updated include PCBs, benzo-a-pyrene and PAHs, Chromium VI, arsenic, cadmium, manganese, mercury, and nickel. Any updates to these values will be evaluated in the next five-year review.

Changes in Contaminant Characteristics

No changes in contaminant concentrations that affect the protectiveness of the remedy were identified.

Protectiveness of the RAOs

The RAOs identified in the "Remedy Selection" section, above, are still valid.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No new information was identified that would call into question the protectiveness of the remedy.

Technical Assessment Summary

Based upon the results of the five-year review, it has been concluded that the implemented remedial actions have adequately addressed all exposure pathways that could result in unacceptable risks.

Issues, Recommendations and Follow-Up Actions

Table 5 (attached) summarizes several suggestions stemming from this five-year review.

Protectiveness Statement

Operable Unit 1

The operable unit 1 remedy is protective of human health and the environment.

Sitewide

The sitewide remedy is protective of human health and the environment.

Next Review

The next five-year review report for the Tri-Cities Barrel Superfund site is required five years from the completion date of this review.

Tables

Table 1: Chronology of Site Events	
Event	**Date(s)**
Tri-Cities Barrel Co. Inc. Years of Operation	1955-1992
NYSDEC Phase I Investigation Report	1983
NYSDEC Phase II Investigation Report	1986
Final NPL Listing	1989
PRP Search	1991
RI/FS AOC	1992
Removal Action AOC	1996
Removal Action UAO	1997
RI/FS Complete	1999
ROD Signature	2000
RD/RA Consent Decree	May 2001
RD Start-Work Element I	November 2001
RD Complete-Work Element I	2002
RA Construction Start – Work Element I	June 2003
RA Construction Complete-Work Element I	November 2003
Comprehensive MNA Evaluation	2007
Focused FS Complete	July 2011
ROD amendment Signature	September 2011
RA Construction Start-Work Element II	September 2011
Preliminary Close-Out Report	September 2011
RA Construction Complete-Work Element II	August 2012

Table 2A: Remediation Goals for Soil from OU1 ROD (Concentrations in mg/kg)	
Contaminants of Concern	**Remediation Goals**
Inorganics	
Antimony	52
Arsenic	18.45
Beryllium	518
Cadmium	21
Chromium (VI)	736
Iron	545,733
Lead	400
Manganese	2,039
Mercury	10
Nickel	2,212
Volatile Organic Compounds	
2-Butanone	0.3
1,1-Dichloroethane	0.2
1,1-Dichloroethene	0.3
Methylene Chloride	0.1
Tetrachloroethene	1.4
Toluene	1.5
Trichloroethene	0.7
Vinyl Chloride	0.2
Semi-Volatile Organic Compounds	
Benzo(a)anthracene	0.33
Benzo(a)pyrene	0.33
Benzo(b)fluoranthene	0.33
Benzo(g,h,i)perylene	134
Bis(2-ethylhexyl)phthalate	2
Dibenz(a)anthracene	0.33
Indeno(1,2,3-cd)pyrene	0.33
2-Methylnapthalene	440
Phenanthrene	521
PCB/Pesticides	
Aldrin	0.0002
Alpha-chlordane	0.06
4,4'-DDD	0.08
4,4'-DDE	0.07
Delta-BHC	0.3
Dieldrin	0.0033
Gamma-chlordane	0.06
Heptachlor	0.01
Polychlorinated biphenyls, total (2 feet or less)	1
Polychlorinated biphenyls, total (greater than 2-foot depth)	10

Table 2B: Remediation Goals for Groundwater from OU1 ROD (Concentrations in µg/L)			
Contaminants of Concern	**National Primary Drinking Water Standards (Federal MCLs)**	**New York State Water Quality Standards for Class GA (Groundwater) (NYCRR, Title 6 Part 701-703)**	**New York Public Water Supply Regulations (NYCRR, Title 10 Part 5-1)**
Volatile Organic Compounds			
2-Butanone (MEK)	-	50	50
1,1-Dichloroethane	-	5	5
1,2-Dichloroethane	5	0.6	5
1,1,1-Trichloroethane	200	5	5
cis-1,2-Dichloroethene	70	5	5
Methylene Chloride	5	5	5
Tetrachloroethene	5	5	5
Toluene	1	5	-
Trichloroethene	5	5	-
Vinyl Chloride	2	2	2
Semi-Volatile Organic Compounds			
Bis(2-ethylhexyl)phthalate	6	5	6
Inorganics			
Cadmium	5	5	5
Iron	-	300	300
Manganese	-	300	300

Table 3: Monitored Natural Attenuation Sampling Program			
Monitoring Well	**Volatile Organic Compounds[6]**	**Field Parameters[7]**	**MNA Parameters[8]**
MW-2	Semi-Annual	Semi-Annual	Every Third Event[9]
MW-2S	Semi-Annual	Semi-Annual	Every Third Event
MW-3	Annual	Annual	Every Third Event
MW-3S	Semi-Annual	Semi-Annual	Every Third Event
MW-7S	Semi-Annual	Semi-Annual	Every Third Event
MW-16	Semi-Annual	Semi-Annual	Every Third Event
MW-16S	Semi-Annual	Semi-Annual	Every Third Event
MW-18S	Semi-Annual	Semi-Annual	Every Third Event
MW-19	Semi-Annual	Semi-Annual	Every Third Event
MW-20	Annual	Annual	Every Third Event
MW-20S	Semi-Annual	Semi-Annual	Every Third Event
PMW-1	Semi-Annual	Semi-Annual	Every Third Event

Table 4: Documents, Data and Information Reviewed in Completing the Five-Year Review

Document Title, Author	Submittal Date
Final Remedial Investigation Report, Revision No. 3, ESC	March 25, 1999
Draft Feasibility Study Report (Revision 3), ESC	August 25, 1999
Tri-Cities Barrel Superfund Site Feasibility Study Report Addendum, EPA	December 9, 1999
Record of Decision: Tri-Cities Barrel Superfund Site, EPA	March 31, 2000

[6] Volatile Organic Compounds (VOCs) by EPA Method 8260B

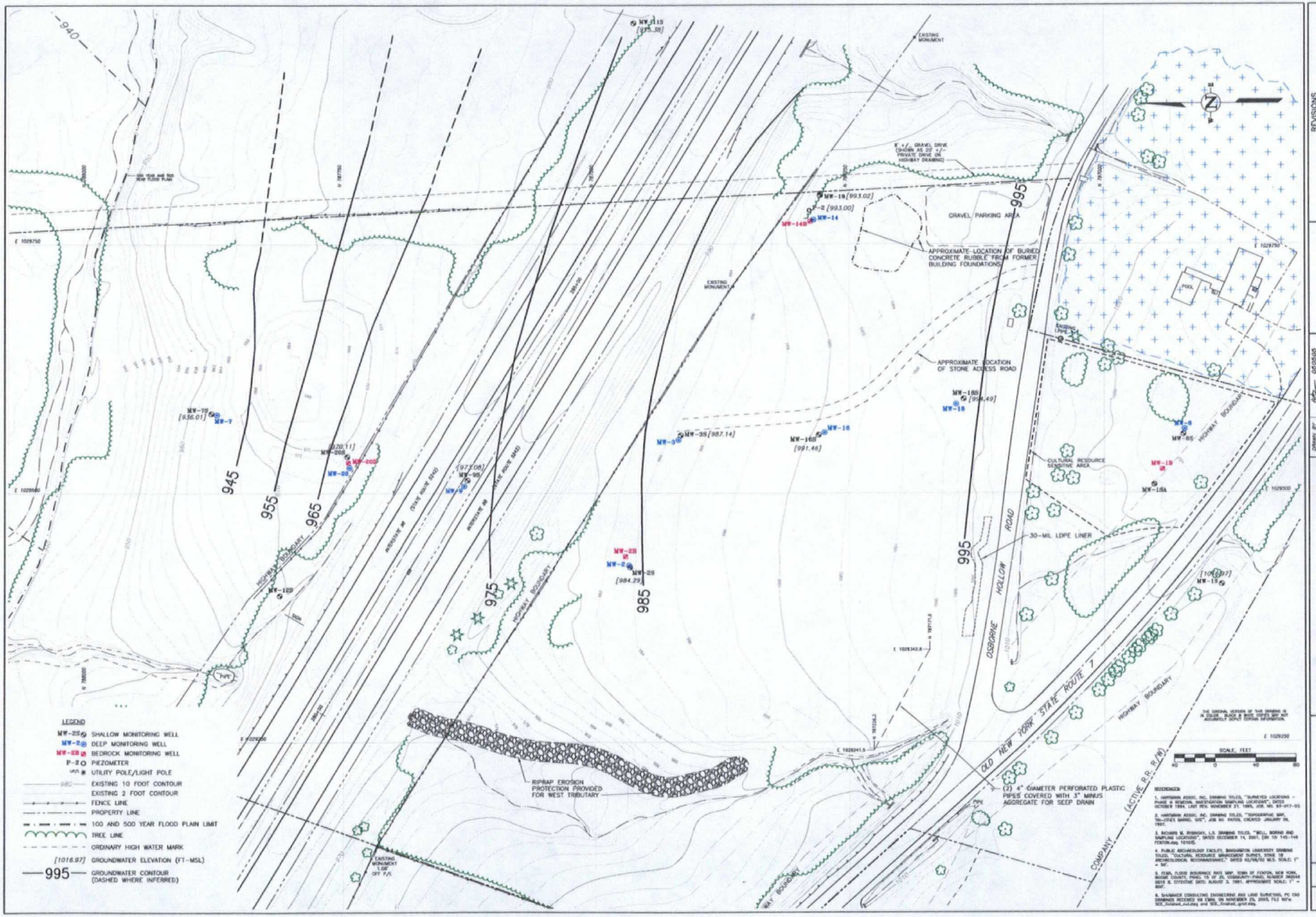
[7] Field parameters include the following: temperature, pH, specific conductance, dissolved oxygen, oxidation-reduction potential (ORP), and turbidity

[8] MNA parameters include the following: ferrous iron, total iron, alkalinity, carbon dioxide, ethane, ethene, hydrogen, methane, chloride, nitrate-N, sulfate, sulfide, and total organic carbon

[9] MNA parameters are analyzed during every third sampling event starting in June 2012, followed by December 2013, June 2015, etc.

Table 4: Documents, Data and Information Reviewed in Completing the Five-Year Review	
Pre-Final Design Report Tri-Cities Barrel Superfund Site, ESC	August 16, 2002
Draft Final Design Report Tri-Cities Barrel Superfund Site, ESC	December 20, 2002
Work Element I Remedial Action Report Tri-Cities Barrel Superfund Site, ESC	January 21, 2004
Final Revised Comprehensive Monitored Natural Attenuation Evaluation Tri-Cities Barrel Superfund Site, ESC	August 16, 2007
Final Focused Feasibility Study (Revision 2) Tri-Cities Barrel Superfund Site, WSP	July 21, 2011
Amendment to the Record of Decision: Tri-Cities Barrel Superfund Site, EPA	September 27, 2011
Long Term Monitored Natural Attenuation Sampling Program, WSP	January 11, 2012
Remedial Action Report-Final, Remedial Work Element II Groundwater Tri-Cities Barrel Superfund Site, WSP	November 29, 2012
Groundwater Monitoring Reports	June 2011-December 2015

Table 5: Other Comments on Operation, Maintenance, Monitoring, and Institutional Controls	
Comment	**Suggestion**
Monitoring well MW-16 has a damaged cap.	The cap should be replaced.
Monitoring well MW-1S has to be resurveyed due to frost heave.	Resurvey monitoring well MW-1S.
Fencing along I-88 is down in some areas.	The damaged fencing should be repaired.
The presence of a utility pole located on-site just to the north of Osborne Hollow Road prevented the full excavation of the contaminated soil in this area and an adjacent area beginning immediately to the west of the utility poll could not be fully excavated without compromising the integrity of Osborne Hollow Road. Therefore, a liner was placed over the contaminated soil remaining in this area before backfilling the excavation with clean fill.	EPA will require that a diagram be appended to the existing easement delineating the area where the liner was installed.


POTENTIOMETRIC SURFACE MAP – SHALLOW UNCONSOLIDATED WELLS (JANUARY 2005)
MNA EVALUATION REPORT
TRI-CITIES BARREL SUPERFUND SITE
FENTON, NEW YORK
PREPARED FOR
TRI-CITIES BARREL SITE RESPONDENTS
REVISIONS
DATE
DESCRIPTION
BY
LEGEND
SHALLOW MONITORING WELL
DEEP MONITORING WELL
BEDROCK MONITORING WELL
PIEZOMETER
UTILITY POLE/LIGHT POLE
EXISTING 10 FOOT CONTOUR
EXISTING 2 FOOT CONTOUR
FENCE LINE
PROPERTY LINE
100 AND 500 YEAR FLOOD PLAIN LIMIT
TREE LINE
ORDINARY HIGH WATER MARK
[1016.97] GROUNDWATER ELEVATION (FT-MSL)
995 GROUNDWATER CONTOUR (DASHED WHERE INFERRED)
APPROXIMATE LOCATION OF BURIED CONCRETE RUBBLE FROM FORMER BUILDING FOUNDATIONS
GRAVEL PARKING AREA
APPROXIMATE LOCATION OF STONE ACCESS ROAD
CULTURAL RESOURCE SENSITIVE AREA
OSBORNE HOLLOW ROAD
OLD NEW YORK STATE ROUTE 7
HIGHWAY BOUNDARY
30-MIL LDPE LINER
RIPRAP EROSION PROTECTION PROVIDED FOR WEST TRIBUTARY
(2) 4" DIAMETER PERFORATED PLASTIC PIPES COVERED WITH 3" MINUS AGGREGATE FOR SEEP DRAIN
EXISTING MONUMENT
SCALE, FEET
ESC ENGINEERING OF NEW YORK, P.C.
9 Albany Street
Cazenovia, NY 13035
315-655-3900
FIGURE
Drawing Number
148932-D13
U:\AutoCAD DWGs\140\148932 TriCities\MNA report 111706\148932D13.dwg, 11/15/2006 2:38:44 PM