FOURTH FIVE-YEAR REVIEW REPORT FOR NIAGARA COUNTY REFUSE SUPERFUND SITE NIAGARA COUNTY, NEW YORK

Prepared by

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

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Date

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LIST OF ABBREVIATIONS & ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
EPA	United States Environmental Protection Agency
FYR	Five-Year Review
ICs	Institutional Controls
LNAPL	Light non-aqueous phase liquid
MCL	Maximum Contaminant Level
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
NYSDEC	New York State Department of Environmental Conservation
O&M	Operation and Maintenance
PPM	Parts per million
PRP	Potentially Responsible Party
RAO	Remedial Action Objective
ROD	Record of Decision
RPM	Remedial Project Manager
SVI	Soil Vapor Intrusion
SVOCs	Semi-volatile Organic Compounds
UAO	Unilateral Administrative Order
VOCs	Volatile Organic Compounds

I. INTRODUCTION

The purpose of a five-year review (FYR) 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. The methods, findings, and conclusions of reviews are documented in FYR reports such as this one. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

The U.S. Environmental Protection Agency (EPA) is preparing this FYR review pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121, consistent with the National Contingency Plan (NCP)(40 CFR Section 300.430(f)(4)(ii)), and considering EPA policy.

This is the fourth FYR for the Niagara County Refuse Superfund Site (Site). The triggering action for this statutory review is the signing date of the previous FYR Report, September 4, 2014. The FYR has been prepared due to the fact that hazardous substances, pollutants or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure (UU/UE).

The Site consists of one operable unit which will be addressed in this FYR.

The Niagara County Refuse Superfund Site FYR was led by Michael Negrelli, EPA Remedial Project Manager (RPM). As of January 2019, Julio Vazquez is the new lead RPM for the Site. Participants included Sharissa Singh, EPA hydrologist, Julie McPherson, EPA human health risk assessor, Mindy Pensak, EPA ecological risk assessor, and Michael Basile, EPA community involvement coordinator. The lead contact for a group of potentially responsible parties (PRPs) for the Site was notified of the initiation of the FYR. Additionally, the local community, as well as elected local officials, were notified of the initiation of the FYR. The review began on 8/14/2018.

Site Background

The Site is a former municipal landfill, comprised of approximately 65 acres, located along the eastern border of the Town of Wheatfield, New York and the western border of the City of North Tonawanda. The Site lies approximately 500 feet north of the Niagara River. To the west of the Site lies former farmland, currently undeveloped; to the north is wooded wetlands, a Niagara-Mohawk Power Corporation transmission line, and a right-of-way owned by the New York State Department of Transportation; to the east are woodlands and low-density housing (approximately 1,000 feet from the Site boundary); and to the south are access roads, railroad tracks, River Road, and the Niagara River. More than 100 waste generators or transporters are thought to have used the Site. Disposed materials included plating-tank sludge, tetrachloroethylene and phenolic resins.

The bedrock zone and the overlying overburden zone (lower till unit) are the primary water-bearing formations. Regional groundwater flow in these two aquifers generally flows in a south/southwesterly direction towards the Niagara River beneath the southern half of the Site and in a north/northwesterly direction towards Black Creek beneath the northern half of the Site. Water level elevations collected within the landfill consistently indicate that there is a radial groundwater flow from the landfill outward in all directions, enabling leachate to migrate to the perimeter collection system.

Based on the results of investigations performed in the early 1980s, the Site was placed on the National Priorities List (NPL) in September 1983. Under EPA oversight, fourteen PRPs performed a Remedial Investigation/Feasibility Study (RI/FS) which served as the basis for the selection of a remedy in the 1993 Record of Decision (ROD) in 1993. The site was deleted from the NPL in July 2004.

Since the completion of the remedial action, Niagara County has given some consideration to potential reuse or redevelopment scenarios for the Site within the restrictions of the institutional controls that have been put in place at the Site (discussed in Section II, below). Although there has not been any formal planning in this regard at this time, the long grasses maintained as cap cover and the revitalized wetland area at the north end of the Site have attracted various wildlife species, particularly native and migrating birds. There has been some preliminary discussion about setting up blinds for bird watching. Regardless of any formally planned reuse or redevelopment, the long grasses of the cap and the wetlands along the north end of the Site serve a useful environmental purpose.

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: Niagara County Refuse		
EPA ID: NYD000514257		
Region: 2	**State:** NY	**City/County:** Wheatfield/Niagara
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]*:**		
Author name (Federal or State Project Manager): Julio Vazquez		
Author affiliation: EPA		
Review period: 9/5/2014 – 5/10/2019		
Date of site inspection: 10/30/2018		
Type of review: Statutory		
Review number: 4		
Triggering action date: 9/4/2014		
Due date *(five years after triggering action date)*: 9/4/2019		

II. RESPONSE ACTION SUMMARY

Basis for Taking Action

Based on the results of the RI report, which measured the levels of volatile organic compounes (VOCs), semi-volatile organinc compounds (SVOCs), pesticides, and metals in various Site media, EPA determined that although contamination was present in the landfill, the low permeability clays beneath and around the Site had prevented the vertical and horizontal migration of contaminants. An analysis of the groundwater around the Site perimeter showed little or no impact from the landfill. Additionally, residents nearby the Site receive municipal water. However, EPA performed a risk assessment for the Site based on the data collected during the RI, and the risk assessment determined that uncontrolled leachate outbreaks, caused by the infiltration of rainwater through the landfill and subsequent seeping out from the sides of the landfill cells, would continue to degrade the quality of perimeter Site groundwater, resulting in a potential future risk from groundwater ingestion. This formed the basis for the decision to cap the landfill and to continue monitoring the groundwater around the perimeter of the Site after the remedial action was completed.

EPA's baseline risk assessment addressed the potential risks to human health by identifying several potential exposure pathways by which the public may be exposed to contaminant releases at the Site under current and future land-use conditions. The greatest carcinogenic risk attributable to the Site is the potential future risk associated with the ingestion of Site perimeter groundwater by area residents. This generated a risk of $2x10^{-4}$, which is at the upper bound of EPA's acceptable risk range. This risk is primarily attributable to the metal arsenic, although the levels detected in Site groundwater wells were below the EPA and New York State Department of Health (NYSDOH) maximum contaminant level (MCL).

Ecological risks attributable to the Site were also considered and evaluated in the ecological risk assessment. The ecological risk assessment established that surface water and sediment concentrations of metals (primarily aluminum, lead, and zinc) and pesticides (primarily 4,4-DDT) may result in adverse acute and/or chronic effects in aquatic organisms within the drainage swales and streams present on the Site or in close proximity. Additionally, stressed vegetation had been observed in the northern wetland area which may be attributable to the Site.

Response Actions

Remedy Selection

Based on the findings of the RI/FS, EPA signed a ROD for the Site on September 24, 1993, selecting the following remedy:

- Construction of a New York State Part 360 Standard Landfill Cap.
- Construction of a clay perimeter barrier wall.
- Construction of a gas venting system beneath the cap.
- Construction of a leachate collection system.
- Removal of the field tile drains located to the west of the landfill.
- Performance of an ecological assessment of the adjacent wetlands.

- Implementation of deed and access restrictions.
- Implementation of a long-term operation & maintenance program for the cap, and gas venting and leachate collection systems.
- Implementation of long-term air and water quality monitoring.

The remedy also calls for an evaluation of Site conditions at least once every five years, beginning from the start of construction, to determine if the selected remedy is operating as intended and remains protective of human health and the environment.

The remedy selected in the ROD meets the remedial action objectives (RAOs) for the Site. The RAOs, as noted in the ROD, are:

- Preventing direct contact with landfill contents.
- Controlling surface water runoff and erosion.
- Collecting and treating landfill leachate.
- Controlling landfill gas.
- Preventing the infiltration of contaminants into groundwater.
- Remediating contaminated wetland areas, if necessary.

Status of Implementation

EPA negotiated a Consent Decree with the PRP group for the design through a remedial action. The Consent Decree became effective on February 3, 1995. The design, approved in 1997, included the use of modern geotextiles for the cap in place of a traditional clay barrier layer and sand drainage layer. The cap liner was tied directly into native clay material outside the leachate collection system, eliminating the need for a clay barrier wall. An ecological assessment of the adjacent wetlands was performed prior to the start of construction and a wetland mitigation plan, calling for limited wetland replanting at the Site and wetland creation off-site at the nearby Gratwick Park Site, was approved in October 1998.

On-site construction commenced in November 1998 under the direction of Niagara County (a PRP at the Site) with EPA providing oversight of the construction activities through an interagency agreement with the U.S. Army Corps of Engineers. The Site was surveyed, cleared and grubbed, a security fence was erected, and erosion and sediment control measures were put in place. Installation of the leachate collection system and its tie-in to the City of North Tonawanda sanitary sewer by forcemain was completed over the winter months. Early spring was devoted to grading the Site and filling the central swales of the landfill with clean fill. Placement of the first layer of the cap (gas vent stone), began in May 1999 and the leachate collection system became operational during the summer of 1999, eliminating any potential pathway for leachate to migrate off-site. The tile drains on the west side of the landfill were removed during the summer. An unusually dry season, along with contractor efficiency, allowed for relatively uninterrupted construction activity throughout the summer and fall. The key trench was constructed concurrently with the multi-layered cap as the two were tied in to complete a uniform seal around the landfill. By November 1999, the cap had been placed over the entire Site and seeding had been completed.

The construction contractor returned to the Site in May 2000 to assess the remaining work to be done. The wetland plantings and some tree perimeter plantings were completed at that time. It was determined that cleaning the drainage swales of accumulated silt and debris, some erosion repair work to the cap surface, and some spot reseeding were the only activities remaining to be completed. This work was

completed during the summer months and in September 2000, EPA conducted a final inspection with NYSDEC and the PRPs. In December 2000, EPA issued its approval of the Remedial Action Report, signifying that the remedial action had been completed in accordance with the ROD and Remedial Design, and the project entered the operation, maintenance, and monitoring phase.

Institutional Control Implementation

The restrictive covenants placed on the real property at the Site by Niagara County and the Town of Wheatfield were filed with the land records on March 19, 2001 and March 23, 2001, respectively. These items complete the institutional controls (ICs) requirement of the ROD.

IC Summary Table

Table 1: Summary of Planned and/or Implemented ICs

Media, engineered controls, and areas that do not support UU/UE based on current conditions	ICs Needed	ICs Called for in the Decision Documents	Impacted Parcel(s)	IC Objective	Title of IC Instrument Implemented and Date (or planned)
Groundwater and Soils	Yes	Yes	Entire site	Restrict installation of ground water wells and groundwater use; preserve the integrity of the cap and all systems associated with waste containment and monitoring; prohibit the erection of any permanent structure on the property with EPA and County approval.	Environmental Protective Easement and Declaration of Restrictive Covenants, March 2001.

Systems Operations/Operation & Maintenance

The Operation, Maintenance and Monitoring Manual was approved by EPA on December 29, 2000. It should be noted that air monitoring is not an included activity in the approved manual in that during the development of the manual, an evaluation of the air around the gas vents was performed and indicated that the gas generation rate in the landfill is very low, primarily due to the age and composition of the wastes. In addition, lateral subsurface gas migration is prevented by the perimeter barrier system. The operation and maintenance (O&M) activities outlined in the manual are being performed by Parsons (formerly Parsons Engineering Science, Incorporated) under contract to Niagara County. O&M activities were initiated in January 2001. The Site is inspected monthly and monitoring data are collected on a pre-set schedule. A summary of O&M data collection activities since the last FYR, and the corresponding report containing the results, is provided in Appendix A.

Additionally, maintenance is performed on the cap on both a scheduled and as-needed basis. For example, pumps are routinely inspected and pressure-washed, repairs are made to the perimeter fence when needed, weeds and tall grass are trimmed around wells and manhole covers, and the grass cover of the cap is cut once yearly in the late summer. The leachate collection system is monitored both from a control building and a visual inspection of the wet wells and the gas vents are regularly inspected for integrity. The wetland

replacement area of the Site, representing 0.17 acres, is routinely monitored for habitat health and vegetation data is recorded and provided in the annual monitoring report.

Based on the sampling results obtained during the first two years of O&M, and in accordance with the O&M Manual, quarterly groundwater sampling was replaced with semi-annual sampling in 2003 and surface water sampling was discontinued. Semi-annual groundwater sampling continued for three years and, based on the uniform monitoring results obtained during this period and in accordance with the O&M Manual, the sampling frequency became annual in 2006. An Industrial Wastewater Discharge Permit was issued by the City of North Tonawanda for the treatment of Site leachate in February 2007 (and since renewed in 2010 and 2013 and 2016). Based on previous years sampling data, the permit has been revised accordingly, reducing the analytical parameter list and establishing a semi-annual effluent sampling frequency. Additionally, the wetland replacement area of the Site, inspected monthly, is determined to be a productive and diverse wetland community.

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.

III. PROGRESS SINCE THE LAST REVIEW

Table 1: Protectiveness Determinations/Statements from the 2014 FYR

OU #	Protectiveness Determination	Protectiveness Statement
1	Protective	The remedy is protective of human health and the environment.
Sitewide	Protective	The implemented remedy for the site is protective of human health and the environment.

The previous FYR was completed on September 4, 2014, pursuant to OSWER Directive 9355.7-03B-P. That review determined that the remedial action as designed and constructed pursuant to the 1993 ROD was performing satisfactorily and that the remedy implemented was protective of human health and the environment.

Aside from the continuation of operation, maintenance, and monitoring activities, the 2014 FYR recommended the following to ensure a more robust data set for the next FYR:

- Groundwater samples should be collected in the first half of the year when water levels are generally higher (possibly April or May, pending adequate water level in well NCR-5S) and changing collection of the groundwater samples with the pumps that are currently in the wells to using a dedicated disposable HDPE bailer. Due to low required purge volume, the bailer would also be used to purge the well.
- Groundwater samples collected in 2014 would include analysis for total and dissolved metals. After the 2014 annual groundwater sampling, any trends in the concentrations of inorganic analytes would again be evaluated. Note that the wells are designed to monitor the shallow overburden groundwater and with the recommended changes, a greater water column will be available when sampled in the spring. Changing the time of year that groundwater samples are collected and changing the sampling method will likely solve the issue of inadequate water column.

- In order to better evaluate the RAO of preventing the infiltration of contaminants into groundwater, it is recommended that plume maps (isoconcentration maps) be created following each groundwater sampling event for the COCs that are related to the Site. Additionally, groundwater contour maps should be provided to determine groundwater flow direction to be evaluated in conjunction with the isoconcentration maps. Current hydraulic conditions need to be assessed since the dry wells may indicate hydrogeological changes over time.

Each of these recommendations have been carried out since the last FYR with the exception of the isoconcentration maps. It has been determined that by collecting groundwater samples in the spring, the dry well issue has been resolved. Isoconcentration maps will be prepared based on collecting additional data from within the landfill and the perimeter of the landfill. Additionally, it should be noted that due to laboratory error, dissolved metals were not analyzed for in 2016; however, analysis for dissolved metals was performed in subsequent sampling events. Also due to the same lab error, VOCs and SVOCs were inadvertently included in the analysis in 2016; currently VOCs and SVOCs are analyzed in groundwater samples every two years (they had been included in the 2015 analysis and were not to be included again until 2017), therefore they were next included in the analysis in 2018.

IV. FIVE-YEAR REVIEW PROCESS

Community Notification, Involvement & Site Interviews

On October 1, 2018, EPA Region 2 posted a notice on its website indicating that it would be reviewing site cleanups and remedies at 42 Superfund sites in New York and New Jersey, including the Niagara County Refuse Site. The announcement can be found at the following web address: https://www.epa.gov/aboutepa/fiscal-year-2019-five-year-reviews. In addition to this notification, a public notice was made available by posting on the Town of Wheatfield municipal website a public notice titled "U.S. Environmental Protection Agency Reviews Cleanup at the Niagara County Refuse" on 10/9/2018, stating that there was a FYR and providing EPA contact information to address any questions about the FYR process or the Site in general. The results of the review and the report will be made available at the Site information repository located at the North Tonawanda Public Library at 505 Meadow Drive, North Tonawanda, NY and will also be available on the Site's website: https://www.epa.gov/superfund/niagara-county-refuse.

Data Review

As discussed in the Operation and Maintenance section above, the Site is inspected monthly and monitoring data are collected according to a pre-set schedule, the results of which are contained in the quarterly, semi-annual, and annual monitoring reports. The sampling program was developed to confirm that the perimeter collection system and the perimeter barrier system of the landfill cap effectively prevent the migration of contaminants from the Site. Additionally, effluent from the leachate conveyance system is sampled for compliance with the City of North Tonawanda Industrial Wastewater Discharge Permit and water levels are measured within the landfill to confirm that the perimeter collection system provides hydraulic containment of site-related leachate and groundwater. The monthly inspections of the landfill include visual inspections of the perimeter collection system, off-site forcemain, wetlands, perimeter fence, drainage ditches, swale outlets, culverts, gas vents, monitoring wells, and the cap surface.

Effluent samples are analyzed by the City of North Tonawanda and the sole purpose of these analyses is for compliance with the Industrial Wastewater Discharge Permit. The permit was renewed in 2016 (the

permit is renewed every three years) and requires that effluent samples be collected on semi-annual basis and has reduced the sampling parameter list compared to the original list.

Effluent sampling results has consistently demonstrated compliance with the requirements of the City of North Tonawanda Industrial Wastewater Discharge Permit. Water level measurements, conducted monthly, generally vary between one and two feet per year, indicating that the operation of the perimeter collection system keeps water levels within the landfill reduced. Two annual surface water sampling events were completed in 2001 and 2002 in accordance with the O&M Manual for the Site. Surface water sampling results indicated that there are no surface water impacts. As per the O&M Manual sampling of surface water has been discontinued since surface water quality remains unimpacted. Monthly inspections of the landfill occasionally show a need for minor erosion repair of the cap or repair to components of the leachate collection system. Inspections of the wetland creation area of the Site have shown that the wetlands are well established, exhibiting substantial growth and propagation.

Shallow perimeter groundwater outside of the landfill boundaries are sampled from monitoring wells located to the north, west and south of the landfill. Since 2006, VOC and SVOC groundwater samples have been collected every other year and total metal samples have been collected every year. In addition, starting in 2014, groundwater samples have been collected and analyzed for dissolved metals annually. Groundwater samples are also analyzed for mercury on an annual basis since the landfill contained brine sludge containing mercury. The data collected from these monitoring wells are used in determining the effectiveness of the remedy in preventing landfill leachate from migrating beyond the landfill and degrading groundwater quality (see Appendix B). In the last five years the average amount of leachate collected has been 3.12 million gallons/year. The average leachate collected historically (in years 2005 and 2006) was 6.75 million gallons per year, indicating that leachate levels have decreased significantly.

Groundwater analytical results during this FYR period did not detect VOCs, SVOCs or mercury above regulatory standards.

Metals such as aluminum, copper, iron, lead, magnesium, manganese, sodium and zinc have been detected in the unfiltered (total) groundwater samples from each of the wells sampled (NCR-3S, NCR-4S, NCR-5S and NCR-13S) during this FYR period. Lead was detected above the federal MCL of 15 ug/L in NCR-4S in 2014, 2016, and 2017 at concentrations of 18 ug/L, 20 ug/L, and 46 ug/L, respectively. EPA established National Secondary Drinking Water Regulations that set non-mandatory water quality standards for fifteen contaminants. These "secondary maximum contaminant levels" include the leachate indicator parameters aluminum, copper, iron, manganese and zinc.

Iron and aluminum from the unfiltered groundwater samples collected within the past five years were detected in NCR-4S at their highest concentrations of 67,000 ug/L (2016) and 22,900 ug/L (2017). Magnesium is consistently detected above these standards in all of the filtered groundwater samples for all of the wells. Dissolved sodium is also consistently detected above EPA guidance level for sodium in drinking water of 20,000 ug/L in monitoring well NCR-4S.

Information provided within the Remedial Investigation report dated 1992 indicates that the Site is underlain by glacial till that is poorly sorted and of variable permeability. The till unit overlies the Lockport Group bedrock in the region. Boring logs from monitoring wells indicate that overburden soils from one to eight feet below ground surface predominantly consist of sand in five wells (NCR-3S, NCR-5S, NCR-6M, NCR-8M, and NCR-9M), and partially sand in three others (NCR-4M, NCR-7M, and NCR-13S). For the deeper wells, Well NCR-5M shows sand from the surface to 50.5 feet; Well NCR-9M shows

sand or silt from the surface to 44 feet and Well NCR-8M shows sand and gravel from two to 43.5 feet below ground surface. The geology of the overburden material indicates that material underlying the Site has variable hydraulic conductivity. While an upgradient groundwater monitoring well was installed as part of the remedial investigation, this well is no longer available for sampling to provide current background concentrations for metals at the Site. Historically, the USGS monitored groundwater quality in the Lockport Group from three monitoring wells within the vicinity of the Site. The wells were identified as WF-1, WF-2 and PN-1, which were located 2.8 miles to the northeast, 1.5 miles due west and 4.5 east of the Site, respectively. All of these wells have reportedly been abandoned. Analytical data collected from these wells in 1988 indicated that sodium, iron, chloride, bromide sulphate and sulfide consistently exceeded regulatory values. However, inorganic concentrations detected in these "background" wells (specifically well WF-1, located hydraulically upgradient and approximately 2.8 miles away from the Site) in 1988 are significantly lower, by orders of magnitude, when compared to recent groundwater monitoring results from the unfiltered groundwater samples during this FYR period. In addition, two rounds of groundwater samples were collected from 23 wells installed at the Site in 1991 during the RI investigation. Round 1 was sampled in March 1991 and Round 2 was sampled in April 1991. Both rounds of analytical data from monitoring well NCR-4S indicate that several leachate indicator parameters were detected significantly lower than the current concentrations.

Site Inspection

The inspection of the Site was conducted on 10/30/2018. In attendance were Gloria Sosa, EPA Remedial Project Manager, Michael Basile, EPA Community Involvement Coordinator, and Eric Felter, a geologist with Parsons Engineering, representing the PRP group. The purpose of the inspection was to assess the protectiveness of the remedy.

During the site inspection, there were no problems or deviations observed with respect to the ongoing operation and maintenance activities.

V. TECHNICAL ASSESSMENT

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

Question A Summary:

The Site is a former municipal landfill. The greatest carcinogenic risk attributable to the Site was associated with the potential ingestion of contaminated groundwater. The remedial actions included capping of the landfill, construction of a gas venting system and leachate collection system, implementation of institutional controls, and long term monitoring of air and water quality.

The remedial actions were initiated in 1998 and completed in 2000. O&M activities commenced in 2001 and included monthly inspections and water level measurements, routine cap maintenance, and media monitoring. Air monitoring was discontinued based on an evaluation of the air around the gas vents that determined that the gas generation rate in the landfill is very low and that subsurface gas migration is prevented by the perimeter barrier system. Surface water sampling was discontinued after two years in accordance with the O&M Plan based on favorable sampling results. Initially groundwater was sampled quarterly, then after two years sampling frequency was reduced to semi-annually, and then annually after the fifth year of the O&M program. Visual inspections of the wetland community on the northern border of the Site indicate that it is thriving.

Groundwater quality at the Site appears to show increasing and/or seasonal trends of inorganic constituents related to leachate in the unfiltered samples. The concentrations of leachate indicator parameters in the unfiltered groundwater samples appear to also be above background and historical concentrations. Geology at the Site indicates that there may be potential vertical and/or horizontal migration of leachate from the Site. The average amount of leachate collected in the last five years is 3.12 million gallons/year which has decreased by half since 2005/2006. The ROD anticipated that the selected remedy would prevent further degradation of the groundwater. As indicated previously, concentrations of landfill leachate indicator parameters in groundwater monitoring wells have fluctuated in recent years, indicating the potential that landfill leachate is impacting groundwater quality outside the limits of the landfill barrier.

Institutional controls have been in place since 2001 and the restrictive covenants provide notice that hazardous substances are buried on the property. The use of the property is restricted in perpetuity in that future Site use must not breach the integrity of the cap, cover, liners or any other components of the containment system; must not disturb or disrupt the function of the Site's monitoring systems; nor otherwise increase the potential hazard to human health or the environment posed by the Site. Additional restrictions prohibit the installation of wells on the property and prohibit the erection of any permanent structure or building without the prior approval of EPA and Niagara County. Nearby residents are not exposed to contaminants in groundwater because they utilize the municipal water supply

The landfill cap, fence, drainage system, and monitoring wells are intact and in good repair. Operation and maintenance of the remedy has been performed on a regular basis since January 2001 and is on-going.

QUESTION B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

Question B Summary:

There have been no physical changes to the site that would adversely affect the protectiveness of the remedy. Land use assumptions, exposure assumptions and pathways, and clean up levels considered in the ROD followed the Risk Assessment Guidance for Superfund used by the Agency and remain valid. Although specific parameters may have changed since the time the risk assessment was completed, the process that was used remains valid.

Some chemical specific toxicity values have changed since the Site was originally assessed. In order to account for changes in toxicity values since the baseline human health risk assessment was performed, the maximum detected concentrations (filtered and non-filtered) of the contaminants of concern (COCs) identified during the 2013 - 2018 sampling period were compared to residential groundwater Risk Screening Levels (RSLs), National Primary Drinking Water Standard Maximum Contaminant Levels (MCLs), and their respective York Department of Environmental Conservation (NYSDEC) Groundwater Criteria. The results indicate that the concentrations (non-filtered samples) of aluminum, chromium, iron, lead and manganese exceeded their respective criteria in wells that are used to monitor the groundwater quality outside the boundaries of the landfill. Concentrations of the constituents in filtered samples were significantly less than in non-filtered samples and were found to be below respective screening criteria. Monitoring well 4S was identified as the well with the highest concentration of metals (non-filtered) detected during the past five years and has exhibited the highest concentrations since 2003. This well also detected lead above its respective MCL in unfiltered samples in three sampling events within the past five years (filtered levels were all below the standard). However, there are no private wells in the vicinity of the site and ICs prevent wells from being installed. Therefore, the drinking water pathway is incomplete.

The remedial action objectives identified in the 1993 ROD remain valid. The remedial action objective for groundwater is to control the source of contamination at the Site and to reduce and minimize the migration of contaminants into Site media thereby minimizing any health or ecological impacts.

Soil Vapor Intrusion

Soil vapor intrusion was not assessed in the remedial investigation performed for this Site. However, a potential future exposure pathway based on the conservative (health protective) assumption that buildings are located above the maximum detected concentration of the contaminants of concern in the groundwater was assessed in the 2008 FYR. Based on that 2008 evaluation, and the fact that VOCs were not detected in 2016, it is not anticipated that this exposure pathway is a concern at this Site.

Additionally, the easement prohibits the erection of any permanent structure or building without the approval of EPA and Niagara County. The nearest residential structures to the Site are sufficiently distant to not be impacted by vapor contamination from the Site. Therefore the vapor intrusion pathway is not complete and soil vapor intrusion is not an issue.

Ecological Risk Assessment Evaluation

The ecological risk assessment established that surface water and sediment concentrations of metals and pesticides may result in adverse acute and/or chronic effects in aquatic organisms within the drainage swales and streams present on the Site or in close proximity. Additionally, stressed vegetation had been observed in the northern wetland area which may be attributable to the Site. To account for lost ecological habitat associated with the remedial construction, a wetland mitigation plan was developed and executed which included limited wetland replanting at the Site and wetland creation off-site at nearby Gratwick Park. The ecological risk exposure pathways were eliminated with the construction of the landfill cap.

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

No other information has come to light that would call into question the protectiveness of the remedy.

VI. ISSUES/RECOMMENDATIONS

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

OTHER SUGGESTIONS

Water level data shows that the remedy is maintaining hydraulic control; however, there are leachate indicator parameters detected in groundwater samples that are above regulatory, background and/or historical concentrations. The following steps would be useful to confirm that leachate is not migrating from the landfill:

- Collect groundwater samples and water level information from the "wet wells" and viable piezometers located within the landfill;
- Compare contaminant concentrations and water level information at the "wet wells" and viable piezometers to perimeter wells currently being sampled;
- Track the concentration of leachate indicator parameters detected in the "wet wells," viable piezometers and the perimeter monitoring wells at the Site over time;
- If determined necessary based on the "wet well" and viable piezometer sampling results, consider developing groundwater contour maps to evaluate groundwater flow and mounding effects across the landfill; and
- Subsequent to the evaluation of the "wet well" data over a period of time, evaluate the usefuleness of installing an upgradient well within the vicinity of the landfill to re-establish and/or confirm background concentrations.

VII. PROTECTIVNESS STATEMENT

Protectiveness Statement(s)		
Operable Unit: OU1	*Protectiveness Determination:* Protective	*Planned Addendum Completion Date:* Click here to enter a date
Protectiveness Statement: The remedy at the site is protective of human health and the environment.		

Sitewide Protectiveness Statement	
Protectiveness Determination: Protective	*Planned Addendum Completion Date:* Click here to enter a date
Protectiveness Statement: The remedy at the site is protective of human health and the environment.	

VIII. NEXT REVIEW

The next FYR report for the Niagara County Refuse Superfund Site is required five years from the completion date of this review.

APPENDIX A – REFERENCE LIST

Documents, Data and Information Reviewed in Completing the Five-Year Review	
Document Title, Author	**Date**
2013 Annual Monitoring Report, Parsons Engineering	February 2014
Quarterly Data Summary Report 1Q14, Parsons Engineering	April 2014
Semi-Annual Data Summary Report, Parsons Engineering	August 2014
Quarterly Data Summary Report 3Q14, Parsons Engineering	October 2014
2014 Annual Monitoring Report, Parsons Engineering	January 2015
Quarterly Data Summary Report 1Q15, Parsons Engineering	April 2015
Semi-Annual Data Summary Report, Parsons Engineering	July 2015
Quarterly Data Summary Report 3Q15, Parsons Engineering	October 2015
2015 Annual Monitoring Report, Parsons Engineering	February 2016
Quarterly Data Summary Report 1Q16, Parsons Engineering	May 2016
Semi-Annual Data Summary Report, Parsons Engineering	July 2016
Quarterly Data Summary Report 3Q16, Parsons Engineering	November 2016
2016 Annual Monitoring Report, Parsons Engineering	February 2017
Quarterly Data Summary Report 1Q17, Parsons Engineering	April 2017
Semi-Annual Data Summary Report, Parsons Engineering	August 2017
Quarterly Data Summary Report 3Q17, Parsons Engineering	October 2017
2017 Annual Monitoring Report, Parsons Engineering	January 2018
Quarterly Data Summary Report 1Q18, Parsons Engineering	April 2018
Semi-Annual Data Summary Report, Parsons Engineering	July 2018
Quarterly Data Summary Report 3Q18, Parsons Engineering	October 2018
2018 Annual Monitoring Report, Parsons Engineering	January 2019

APPENDIX B – GROUNDWATER TABLES

Table 3A: Detected Analytes in Groundwater Samples, Niagara County Refuse Site, November 20, 2013

ANALYTE	NYSDEC AWQS*	NYSDOH MCL	USEPA MCL	UNITS	MW NCR-3S	MW NCR-4S	MW NCR-5S	MW NCR-13S
VOCs					U for all analytes	U for all analytes	U for all analytes	U for all analytes
SVOCs					U for all analytes	U for all analytes	U for all analytes	U for all analytes
METALS:								
Aluminum	-	-	-	ug/L	**1600J**	**1300J**	**12600J**	**5400J**
Barium	1000	2000	2000	ug/L	57	78	310	88
Cadmium	5	5	5	ug/L	U	U	1.5	1.5
Calcium	-	-	-	ug/L	145000	154000	174000	198000
Chromium	50	100	100	ug/L	13	2J	30	24J
Copper	200	-	-	ug/L	10	1.9J	36	12
Iron	300^	300^	-	ug/L	**2800J**	**4700J**	**14200J**	**10700J**
Lead	25	25	15	ug/L	5.1	4J	**27**	8.7
Magnesium	35000(g)	-	-	ug/L	**79500**	**49400**	**78100**	**77400**
Manganese	300^	300^	-	ug/L	200J	240J	**540J**	49J
Nickel	100	-	-	ug/L	25	1.8J	29	13J
Potassium	-	-	-	ug/L	3100J	12300J	3900J	2200J
Sodium	20000	20000	20000	ug/L	8400	**32800**	**25700**	18800
Zinc	2000(g)	5000	-	ug/L	250	91	190	410J

* NYSDEC Ambient Water Quality Standards
^ Sum of iron and manganese should not exceed value
(g) Guidance value
U Analyte not identified above analytical detection limit
J Estimated value
Bold indicates exceedance of one or more criteria

Table 3B: Detected Analytes in Groundwater Samples, Niagara County Refuse Site, April 29, 2014

ANALYTE	NYSDEC AWQS*	NYSDOH MCL	USEPA MCL	UNITS	MW NCR-3S	MW NCR-4S	MW NCR-5S	MW NCR-13S
METALS:								
Aluminum	-	-	-	ug/L	**3100J**	**11500J**	**6700J**	**930J**
Arsenic	25	10	10	ug/L	U	U	U	U
Barium	1000	2000	2000	ug/L	53	97	250	46
Cadmium	5	5	5	ug/L	0.98J	0.81J	1.0	0.53J
Calcium	-	-	-	ug/L	106000	160000	121000	128000
Chromium	50	100	100	ug/L	31	5.7	19	2.1J
Copper	200	-	-	ug/L	16	12	15	4.2J
Iron	300^	300^	-	ug/L	**6300**	**40600**	**5900**	**1200J**
Lead	25	25	15	ug/L	4.1J	**18**	9.2	U
Magnesium	35000(g)	-	-	ug/L	**54600**	**53300**	**66800**	**52100**
Manganese	300^	300^	-	ug/L	120	**460**	160	54J
Nickel	100	-	-	ug/L	34	8.2J	15	2.8J
Potassium	-	-	-	ug/L	3700	11300	2200	1200
Sodium	20000	20000	20000	ug/L	5400	**28200**	17000	13000
Zinc	2000(g)	5000	-	ug/L	380	640	56	98
DISSOLVED METALS:								
Aluminum				ug/L	U	U	U	U
Arsenic				ug/L	U	U	U	U
Barium				ug/L	36	70	190	48
Cadmium				ug/L	U	U	U	U
Calcium				ug/L	105000	155000	105000	135000
Chromium				ug/L	1.6J	1.5J	1.9J	1.4J
Copper				ug/L	7.2J	2.2J	4.6J	3.7J
Iron				ug/L	U	U	U	U
Lead				ug/L	U	U	U	U
Magnesium				ug/L	**51900**	**48700**	**60200**	**54600**
Manganese				ug/L	59	270	U	11J
Nickel				ug/L	2.2J	1.4J	1.3J	2.1J
Potassium				ug/L	3100	12600	510	1000
Sodium				ug/L	5400	**28400**	16600	16800
Zinc				ug/L	40	U	U	110J

* NYSDEC Ambient Water Quality Standards
^ Sum of iron and manganese should not exceed value
(g) Guidance value
U Analyte not identified above analytical detection limit
J Estimated value
Bold indicates exceedance of one or more criteria

Note: In accordance with the sampling schedule established in the O&M Plan, VOCs and SVOCs are not included in this sampling event.

Table 3C: Detected Analytes in Groundwater Samples, Niagara County Refuse Site, April 24, 2015

ANALYTE	NYSDEC AWQS*	NYSDOH MCL	USEPA MCL	UNITS	MW NCR-3S	MW NCR-4S	MW NCR-5S	MW NCR-13S
VOCs					U for all analytes	U for all analytes	U for all analytes	U for all analytes
SVOCs					U for all analytes	U for all analytes	U for all analytes	U for all analytes
METALS:								
Aluminum	-	-	-	ug/L	U	**660**	**980J**	**150J**
Arsenic	25	10	10	ug/L	U	U	U	U
Barium	1000	2000	2000	ug/L	43	62	130J	55
Cadmium	5	5	5	ug/L	0.55J	0.53J	0.56J	0.78J
Calcium	-	-	-	ug/L	111000	134000	76000J	154000
Chromium	50	100	100	ug/L	U	U	1.2J	1.2J
Copper	200	-	-	ug/L	7.6J	3.0J	6.6J	6.0J
Iron	300^	300^	-	ug/L	290	**1600**	**790J**	220
Lead	25	25	15	ug/L	U	U	U	U
Magnesium	35000(g)	-	-	ug/L	**62000**	**45900**	**41500J**	**51700**
Manganese	300^	300^	-	ug/L	5.7	160	18J	1.7J
Nickel	100	-	-	ug/L	2.1J	1.7J	2.3J	3.3J
Potassium	-	-	-	ug/L	2700	12900	1000	1500
Sodium	20000	20000	20000	ug/L	5600	**27700**	17300J	14100
Zinc	2000(g)	5000	-	ug/L	33	53	29	26
DISSOLVED METALS:								
Aluminum					U	U	U	U
Arsenic					U	U	U	U
Barium					39	61	120	48
Cadmium					0.9J	U	U	0.7J
Calcium					109000	137000	70200	136000
Chromium					U	U	U	1.5J
Copper					3.3J	U	1.7J	U
Iron					U	U	U	U
Lead					U	U	U	U
Magnesium					**62000**	**46200**	**41600**	**56900**
Manganese					1.5J	8.8	0.69J	1.1J
Nickel					1.6J	1.3J	1.3J	1.4J
Potassium					2100	14300	500	1000
Sodium					6400	**29400**	15500J	14600
Zinc					27	22	34J	36

* NYSDEC Ambient Water Quality Standards
^ Sum of iron and manganese should not exceed value
(g) Guidance value
U Analyte not identified above analytical detection limit
J Estimated value; **Bold** indicates exceedance of one or more criteria

Table 3D: Detected Analytes in Groundwater Samples, Niagara County Refuse Site, April 14, 2016

ANALYTE	NYSDEC AWQS*	NYSDOH MCL	USEPA MCL	UNITS	MW NCR-3S	MW NCR-4S	MW NCR-5S	MW NCR-13S
VOCs					U for all analytes	U for all analytes	U for all analytes	U for all analytes
SVOCs					U for all analytes	U for all analytes	U for all analytes	U for all analytes
METALS:								
Aluminum	-	-	-	ug/L	**650**	**22500**	**910J**	**320**
Arsenic	25	10	10		U	8.1J	U	U
Barium	1000	2000	2000	ug/L	48	120	140	55
Cadmium	5	5	5	ug/L	0.73J	0.98J	U	U
Calcium	-	-	-	ug/L	125000	169000	83700	178000
Chromium	50	100	100	ug/L	8.3	11.0	8.9	2.9J
Copper	200	-	-	ug/L	5.0J	35	4.1J	6.2J
Iron	300^	300^	-	ug/L	**1400**	**67500**	**910**	**1100**
Lead	25	25	15	ug/L	U	**20**	U	U
Magnesium	35000(g)	-	-	ug/L	**75200**	**53600**	**44400**	**58100**
Manganese	300^	300^	-	ug/L	35	260	25	32
Nickel	100	-	-	ug/L	11	12	9.5J	6.6J
Potassium	-	-	-	ug/L	2200	10600	660	1400
Sodium	20000	20000	20000	ug/L	6900	**27100**	14900	12500
Zinc	2000(g)	5000	-	ug/L	130	1200	13	19

* NYSDEC Ambient Water Quality Standards
^ Sum of iron and manganese should not exceed value
(g) Guidance value
U Analyte not identified above analytical detection limit
J Estimated value
Bold indicates exceedance of one or more criteria

Note: VOCs and SVOCs are included in the analysis every two years in accordance with the O&M Plan. Due to laboratory error, VOCs and SVOCs were inadvertantly analyzed during this sampling event and are next included in 2018 rather than 2017. Also dissolved metals were omitted from analysis this year due to the same laboratory error.

Table 3E: Detected Analytes in Groundwater Samples, Niagara County Refuse Site, April 18, 2017

ANALYTE	NYSDEC AWQS*	NYSDOH MCL	USEPA MCL	UNITS	MW NCR-3S	MW NCR-4S	MW NCR-5S	MW NCR-13S
METALS:								
Aluminum	-	-	-	ug/L	**200**	**22900**	70J	76J
Arsenic	25	10	10	ug/L	U	6.6J	U	U
Barium	1000	2000	2000	ug/L	37	90	130	42
Cadmium	5	5	5	ug/L	U	0.79J	U	U
Calcium	-	-	-	ug/L	97700	129000	82900	150000
Chromium	50	100	100	ug/L	3.7J	11	U	U
Copper	200	-	-	ug/L	3.1J	29	2.8J	2.1J
Iron	300^	300^	-	ug/L	**370**	**64100**	73	99
Lead	25	25	15	ug/L	3.1J	**46**	U	4.6J
Magnesium	35000(g)	-	-	ug/L	**58200**	**40600**	**46400**	**62300**
Manganese	300^	300^	-	ug/L	4.4	150	1.7J	40
Nickel	100	-	-	ug/L	5.9J	12	3.4J	2.7J
Potassium	-	-	-	ug/L	1800	10000	440J	1000
Sodium	20000	20000	20000	ug/L	7100	**26500**	13700	11000
Zinc	2000(g)	5000	-	ug/L	31	940	3J	2.4J
DISSOLVED METALS:								
Aluminum					U	U	U	U
Arsenic					U	U	U	U
Barium					37	36	120	130
Cadmium					U	U	U	U
Calcium					97100	106000	75200	78000
Chromium					1.2J	U	U	U
Copper					3.8J	U	U	2.8J
Iron					U	U	U	U
Lead					U	U	U	U
Magnesium					**58100**	**35400**	**43700**	**45300**
Manganese					1.1J	U	U	0.41J
Nickel					8.6J	U	1.8J	2.6J
Potassium					1800	9600	440J	480J
Sodium					7500	**27300**	12500	14400
Zinc					35	17	2.1J	2.7J

* NYSDEC Ambient Water Quality Standards
^ Sum of iron and manganese should not exceed value
(g) Guidance value
U Analyte not identified above analytical detection limit
J Estimated value
Bold indicates exceedance of one or more criteria
Note: VOCs and SVOCs are not included in this sampling event; see note from previous table.

Table 3F: Detected Analytes in Groundwater Samples, Niagara County Refuse Site, April 16, 2018

ANALYTE	NYSDEC AWQS*	NYSDOH MCL	USEPA MCL	UNITS	MW NCR-3S	MW NCR-4S	MW NCR-5S	MW NCR-13S
METALS:								
Aluminum	-	-	-	ug/L	**260**	**7200**	**2900**	**250**
Arsenic	25	10	10	ug/L	U	U	U	U
Barium	1000	2000	2000	ug/L	37	81	200	53
Cadmium	5	5	5	ug/L	U	U	U	U
Calcium	-	-	-	ug/L	99900	159000	104000	158000J+
Chromium	50	100	100	ug/L	3J	6.7	9.8	3.3J
Copper	200	-	-	ug/L	4	11	4.8J	1.6J
Iron	300^	300^	-	ug/L	**350**	**25500J+**	**2100J+**	**540J+**
Lead	25	25	15	ug/L	10U	14	6.9J	10U
Magnesium	35000(g)	-	-	ug/L	**49000**	**50900**	**55700**	**67400**
Manganese	300^	300^	-	ug/L	6J	530	88	53J
Nickel	100	-	-	ug/L	5J	5.2J	8.2J	2.5J
Potassium	-	-	-	ug/L	2100	8800	860	830
Sodium	20000	20000	20000	ug/L	5600	**24700**	7300	12000
Zinc	2000(g)	5000	-	ug/L	21	370J	14J+	3.1J
DISSOLVED METALS:								
Aluminum					U	U	U	U
Arsenic					U	U	U	U
Barium					41	58	160	43
Cadmium					0.51J	2U	2U	2U
Calcium					118000	153000	92400	157000
Chromium					U	U	U	U
Copper					4.2J	10U	10U	10U
Iron					53	1200	19J	340J
Lead					10U	3.3J	10U	4.7J
Magnesium					**59300**	**51500**	**52100**	**77100**
Manganese					19J	510	55J	110J
Nickel					5.4J	1.8J	10U	2.4J
Potassium					1700	8700	280J	660
Sodium					6900	**26400**	7000	18400J
Zinc					23	8.4J	3.5J	5.1J

* NYSDEC Ambient Water Quality Standards
^ Sum of iron and manganese should not exceed value
(g) Guidance value
U Analyte not identified above analytical detection limit
J Estimated value J+ Estimated biased high
Bold indicates exceedance of one or more criteria
Note: VOCs and SVOCs are not included in this sampling event; see note from previous table.

APPENDIX C - SITE MAP