ALTERNATIVES ANALYSIS REPORT AND
REMEDIAL WORK PLAN
FORMER CITY OF POUGHKEEPSIE
SEWAGE TREATMENT PLANT SITE

Prepared for:

Poughkeepsie Waterfront Development, LLC

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TABLE OF CONTENTS

ALTERNATIVES ANALYSIS REPORT AND REMEDIAL WORK PLAN
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TABLE OF CONTENTS (continued)

TABLES

FIGURES

1.0 INTRODUCTION

This document presents an Alternatives Analysis (RAA) and a Remedial Work Plan (RWP) to address areas of impacted soil identified at the Former City of Poughkeepsie Sewage Treatment Plant (STP) located at the intersection of Rinaldi Boulevard and Hurlihe Street in Poughkeepsie, New York (Figure 1). The new owners of the property intend to restore the site to commercial use and have received approval from the City of Poughkeepsie to construct a hotel, restaurant and catering facility.

The Former City of Poughkeepsie STP consists of two parcels comprising a total of approximately 7.1 acres. The site is bound on the west by the Hudson River; to the north by Hurlihe Street; to the east by Rinaldi Boulevard; and to the south by the former DeLaval Separator property (Figure 2). As shown on Figure 3, ownership of the smaller 1.6 acre parcel will be retained by the City of Poughkeepsie. The site is identified as Tax ID #31-6061-27-752894 on the Dutchess County Tax Maps.

Currently the property contains the remnants of the former sewage treatment plant. There are several abandoned buildings that are no longer functional or useable for the proposed development. The buildings occupy the northern portion of the Site consist of the former administrative and solids treatment building, two sludge digesters, the former filtration building, three settling tanks and a pump station. There is one functioning building, the Pine Street Pump Station, which is located southwest of the former administrative/solids building. The pump station located on the smaller 1.4 acre parcel, is operated and maintained by the City of Poughkeepsie and is not part of the Brownfields Cleanup Program (BCP) for this property. The existing site conditions are shown on Figure 3.

Site elevation varies from approximately mean sea level at the edge of the Hudson River to approximately 50 feet above sea level (NGVD-29) at the far northern end of the property (Figure 3). The elevation of the northern parcel on site is generally flat and slopes gently to the south (Figure 3). The property slopes steeply towards the Hudson River at the edges of the southern property boundary.

2.0 HISTORICAL INFORMATION

Several investigations have been completed at the former STP site. Relatively recent investigations include the following:

- A Phase I Environmental Site Assessment (ESA) (Chazen, 1999)
- A Phase II Subsurface Investigation (Chazen, 2001)
- A Supplemental Phase II Subsurface Investigation (Chazen, 2003)
- Site Characterization and Remedial Investigation Report, (Fuss & O'Neill, 2004)

The findings of the various Site investigations were used to develop the RAWP described herein. The recent Fuss & O'Neill investigation completed in March 2004 is summarized in Section 3 through Section 5.

2.1 Phase I ESA (1999)

The Phase I ESA included an investigation into the historic use of the facility and property preceding and during its operation as the City of Poughkeepsie's sewage treatment facility. Historic use of the property included the following:

- The site was reportedly used for several manufacturing facilities including one which manufactured armaments for the United States Navy during World War II through 1959 when the City of Poughkeepsie retained the property and began construction and operation of the former STP.
- The City used approximately one-quarter acre of the property for the disposal of street cleaning debris. The disposal area was reportedly located in a depression on the south side of the property.
- Sewage sludge was reportedly buried on site along the Hudson River and within a fenced in area located to the south and east of the administrative building.
- Asbestos-Containing Material was identified in pipe wrap and some other minor locations inside the treatment buildings.
- The site has been used for convenience dumping. Some household refuse was deposited on the southern side of the property in the vicinity of the sludge storage/disposal area.

Historical resources reviewed during the Phase I ESA indicated that the STP parcel was first developed for industrial purposes in 1885. The site was occupied by: the Adriance Platt & Company and Buckeye Mower and Reaper Works. The plant was sold to the Moline Plow Company in 1913, which operated until 1936 when the City foreclosed on the plant and took over the land. A fire destroyed many of the Moline Plow buildings in 1939; however, the City leased an undamaged portion of the Moline Plow facility to US Hoffman Machinery Company. U.S. Hoffman reportedly manufactured artillery shells for the U.S. Navy. Hoffman operated at the site until 1959.

In 1959, the City took the property over and began construction and eventual use of the facility as the wastewater treatment plant for the City. The site operated in this capacity until 1977 when the plant was permanently closed and the City moved its operation to the new plant located on North Water Street in Poughkeepsie.

2.2 Phase II Subsurface Investigation (2001)

During the week of December 22, 2000 through January 2, 2001, 29 test pits (STP-TP1 to STP-TP29) were excavated in areas of concern identified in the Phase I ESA. Test pits were excavated in the following areas of concern: landfill area, along the river bank, in the old settling tanks, former UST area, and southern landfill area and in a mound of soil located in the northeast corner of the property (Figure 4). The test pits were generally excavated until native soils were encountered or refusal. The subsurface material was generally characterized as miscellaneous fill consisting of bricks, asphalt, concrete, slag, miscellaneous metal debris and household refuse. The fill was often mixed with a soil matrix. The soil consisted primarily of fine to coarse sand and gravel with varying percentages of silt and cobbles. In those instances

when native material was encountered, it was typically silty sand with little to some gravel and occasional cobbles.

Groundwater was not encountered with the exception of several test pits installed directly inside of the settling tanks in the lower portion of the site. The settling tanks had concrete bottoms and it appeared as if the groundwater was perched within the tanks. Groundwater was not encountered in test pits installed in the same general vicinity outside of the settling tanks.

The information obtained from the test pit program revealed the industrial/manufacturing history of the property. Indications are that some portions of the site had undergone extensive filling or grading. The fill material included old foundations and debris, other miscellaneous construction and demolition debris, sludge, slag and leaf waste.

Representative samples were collected from each of the areas of concern. The results indicated that impacts were confined primarily to two areas: the old landfill area located on the southern side of the property and a mound of soil located in the northeast corner of the STP site where old bottles, bricks and other debris were encountered.

The mound of soil located in the northeast corner of the STP site was contaminated with metals. Mercury and chromium were detected in the samples taken from this area at levels exceeding the New York State Department of Environmental Conservation (NYSDEC) soil cleanup guidance values listed in Technical and Administrative Guidance Memorandum (TAGM) 4046 (Figure 5).

The second area of concern was confined to the portion of the site that was used extensively for disposing sewage sludge, leaf debris, slag and other construction and demolition debris, located on the southern end of the parcel (Southern Landfill Area). Strong petroleum odors were noted in sludge encountered in the test pits installed in this area. Analytical results indicated that the sludge deposits in this area were contaminated with heavy metals, many of which exceeded the soil cleanup guidance values listed in TAGM 4046. Barium, cadmium, chromium, lead and mercury were all detected at levels exceeded the TAGM cleanup levels (Figure 5). Volatile organic compounds (VOCs) commonly associated with fuel oil or gasoline were also encountered at levels exceeding the TAGM 4046 soil cleanup guidance values. One of the samples taken from the sludge layer contained low levels of chlorinated solvents; however, at levels substantially below the TAGM 4046 levels. The source for the VOCs was likely to have been either the sludge material or the residual material generated as part of the street cleaning operations.

There was a 5,000 gallon underground fuel oil storage tank located on the east side of the administrative/solids building. The tank was no longer in use and required proper closure. The tank was removed, cleaned and recycled. Evidence of petroleum-contaminated soil was not observed. Confirmatory samples were collected from the soil surrounding the former tank in accordance with the protocols outlined in the NYSDEC's STARS Memo #1 – Petroleum-Contaminated Soil Cleanup Guidance Policy. The results indicated that the soil was slightly contaminated with heavy fraction petroleum hydrocarbons at levels exceeding the TAGM 4046 Soil Cleanup Guidance Values (Figure 5).

2.3 Supplemental Phase II Subsurface Investigation (2003)

The findings of the Phase II investigation identified the problem areas of the site; however, the investigation did not fully define the nature and extent of contaminated soils. Additional information was required to adequately determine a remedial strategy. The supplemental Phase II Investigation concentrated on defining the nature and extent of the affected material in the northeast corner of the site and in the southern landfill area.

Thirty-two additional test pits (STP-TP30 to STP-TP61) were excavated the week of December 26, 2002, primarily in the areas of concern previously identified during the initial Phase II investigation (Figure 4). The test pit locations were selected to define the edges of the previously defined impacts. The test pits were excavated to between 7 and 16 feet below ground surface. Soils were screened in the field using a photo-ionization detector (PID) for the presence of VOCs. Representative soils exhibiting detectable VOCs with the PID were forwarded to York Analytical Laboratories for confirmatory analysis. Other soil samples not exhibiting PID readings were also forwarded to York for confirmatory analysis if the material exhibited obvious signs of staining or other potential impacts (e.g., previous sampling efforts indicated elevated metals contamination).

The findings of the Supplemental Phase II were consistent with the results of the preliminary investigation. The soil in the two areas of concern were contaminated with metals and VOCs at levels that exceeded the TAGM 4046 soil cleanup guidance values (Figure 5). Metals were found at levels exceeding the soil cleanup guidance values throughout the site; however, the bulk of the actionable impacts were confined to the two areas identified during the previous investigation; the southern landfill area and the northeast soil mound.

The results suggest that the contaminated fill material was confined to reasonably well defined areas located, respectively, in the northeast corner of the site and along the southern edge of the site in the southern landfill area. The contaminated material was primarily associated with the miscellaneous filling activity that occurred historically at the property. The contaminated material was related to the historic use of the property, and included concrete slabs, boulders, bricks, household refuse, miscellaneous metal, glass, ash, slag, asphalt, and wood construction debris. The layer of strongly odorous soil/sludge was encountered in the southern landfill area and the boundaries of the sludge layer clearly delineated. This sludge layer was consistently more contaminated than the material above or below it. Some evidence of heavy metal concentrations were documented in the soil immediately below the sludge layer but at substantially reduced levels compared to the sludge.

The soil was contaminated primarily with chromium, lead and mercury. Arsenic, barium, cadmium and selenium were also detected in some of the test pits at levels exceeding the TAGM 4046 soil cleanup guidance values (Figure 5). Petroleum hydrocarbons were detected in the sludge layer in the southern landfill area and in one test pit excavated in the northeast corner.

The sludge layer in the southern landfill area covers an approximate 115 by 85 foot area. The sludge layer is roughly 1 to 3 feet thick. The volume of sludge is approximately 1,200 cubic

yards. Not all of the sludge was contaminated at actionable levels; however, the sludge material may not be suitable as a construction base material.

The contamination in the northeast corner was primarily related to metals although petroleum-like odors were noted. The sample results indicated that mercury and chromium were the main constituents of concern in this region. Samples taken from test pit TP-56 contained elevated levels of petroleum hydrocarbons and the volume of soil requiring action was estimated to be approximately 1,800 cubic yards.

3.0 FUSS & O'NEILL 2004 SITE CHARACTERIZATION AND REMEDIAL INVESTIGATION

3.1 Pre-Design Investigation

The Site Characterization and Remedial Investigation was completed in the context of the NYSDEC's Brownfields Cleanup Program. The data collected during this investigation were obtained using the rigorous ASP Level B sampling analysis required under the State's BCP.

This investigation verified that the previously obtained results were representative and could be used for remediation design purposes.

3.2 Field Investigation

3.2.1 Test Pits

In March 2004, fourteen test pits (PWD-01 to PWD-14) were excavated in the areas of concern identified during the initial Phase I and Phase II investigations. The location of the test pits are shown on Figure 4. Representative samples were collected from the test pits. Wherever possible, samples were collected at discrete intervals from material that had the potential to have negative environmental consequence (e.g., the sludge layer). In some cases, multiple samples were collected from the test pit for laboratory analysis; in other cases no samples were collected from the test pit, especially when it was observed that the material encountered in one location was similar to material in adjacent test pit. Table 1 summarizes the sampling plan for the recent sampling event completed by Fuss & O'Neill.

Many of the test pits were completed at previously sampled locations that had exhibited elevated levels of heavy metals or other issues of concern (VOC and SVOC contamination). New test pits were completed at or near previous test pit locations where the existing data suggested the presence of potentially hazardous materials. Soil samples were collected from the same horizons where the potentially hazardous materials were previously documented. These samples were analyzed for total metals and Toxicity Characteristic Leaching Procedure (TCLP) metals to determine the potential for the soil to be classified as a hazardous material. The intent of the TCLP and total comparison was to establish thresholds for comparison to the previously obtained data and to verify that hazardous materials were not present.

The test pit nomenclature was (P)oughkeepsie (W)aterfront (D)evelopment (PWD). The new and historical test pit locations are shown on Figure 4. Test pits were excavated adjacent to STP-2 (PWD-11), STP-19 (PWD-02), STP-31 (PWD-06 and PWD-07), STP-39 (PWD-01 and PWD-08), STP-44 (PWD-03), STP-49 (PWD-04), STP-53 (PWD-02) and STP-55 (PWD-01 and PWD-08). These locations exhibited elevated levels of metals, particularly mercury, lead and chromium. Other locations within the areas of concern were selected to provide additional data for remediation design because of the potential presence of former site structures. During the investigation, an old foundation was encountered in the northeast soil mound area. Further test pits were completed to define the limits and nature of the former structure. This structure was determined to be a former sludge processing/burning facility which buried in place under clean fill material by the City.

Soil samples were obtained primarily from the fill material that was likely to be contaminated but also from the native soil beneath the fill material in each of the areas profiled. The samples were analyzed using ASP Level B analytical protocols by Severn Trent Laboratories (STL) of Newburgh, New York, an ELAP certified laboratory.

3.2.2 Groundwater Sampling

Groundwater at the Site would be one of the most direct sensitive receptors for any contamination in the soil. Precipitation theoretically has the potential to leach contaminants from the soil/fill, which could eventually make its way into groundwater. The TCLP testing described above provided a measure of that possibility; however, there were two existing downgradient monitoring wells adjacent to the southern soil deposition area. These monitoring wells were sampled for the constituents of concern.

MW-1, located due south of the southern landfill area on the DeLaval property is a shallow well, approximately 14 feet deep (Figure 4). Groundwater was encountered at roughly five feet below ground surface (bgs). MW-2 is located west and slightly south of the landfill area (Figure 4). This well is installed between the Hudson River and the southern landfill area. The monitoring well is approximately 30 feet deep and appears to be tidally influenced based on fluctuations observed in the water level under non-pumping conditions that could be correlated to the tidal effect in the Hudson River. Groundwater was encountered at approximately 11 feet bgs but never recovered to this level after purging the well for sampling purposes.

The groundwater samples were analyzed for VOCs using EPA method 8260B, for selenium using EPA method 270.2, for Mercury using EPA method 245.1 and other RCRA metals using EPA method 200.7 at Severn Trent Laboratories in Newburgh, New York.

3.3 Data Usability Summary

A data usability summary report (DUSR) was completed on the results of this investigation in accordance with the protocols outlined in draft document DER-10. The results are discussed in the following sections. The suitability of the previously collected data is examined by comparing historical total metal results to the recently obtained ASP Level B data.

The data were analyzed in the context of the applicable Standards, Criteria and Guidelines (SCGs) related to NYSDEC soil cleanup guidance values and groundwater standards. The regulations and guidance values have been developed by the NYSDEC for Environmental Restoration Programs. Applicable regulations include 6 NYCRR 375-4 and final guidance documents TAGM 4058, the recently enacted Brownfields Cleanup Program regulations which provided the regulatory framework for this investigation. Other NYSDEC SCGs associated with this project include groundwater quality standards published in 6 NYCRR, Part 700 – 706 (TOGS 1.1.1) and soil cleanup objectives specified under guidance document NYSDEC/DHWR TAGM #4046.

4.0 ENVIRONMENTAL SETTING

4.1 Existing and Intended Future Use

The property was historically used for industrial purposes until the City of Poughkeepsie built and operated the Sewage Treatment Plant. The plant operated until 1977 when the City shut this plant down. The site has been vacant since it was abandoned in 1977 although an existing pump station in the southeast corner of the property continues to operate.

The Volunteer has vested considerable effort into the proposed redevelopment plan for the property and is in the process of refining the location and layout for the various proposed buildings. The former STP is the future home to a proposed restaurant, catering facility and a hotel. Much of the former STP site will be covered by either buildings or parking areas. The planned development is consistent with the City of Poughkeepsie's Master Plan and has received approval from the City's Mayor and Common Council.

4.2 Geology

The Surficial Geologic Map of New York, prepared by Cadwell (1989), identifies the unconsolidated deposits in the vicinity of the site as either fluvial sand and gravel deposits (along the Hudson River) or glacial till consisting of sand, silt and gravel and exhibiting variable texture. The till deposits are typically poorly sorted and consist primarily of clay, silt-clay and boulder-clay mixes with sporadic bedrock outcrops intertwined.

The majority of the material encountered at the site would be interpreted as fill material. In those instances when native soils were encountered, the material was a silty sand mixture with varying percentages of gravel and cobble sized particles.

According to the Geologic Map of New York, Lower Hudson Sheet, prepared by Fisher et al. (1970), bedrock below the site is likely to consist of the Taconic Mélange Formation or the Austin Glen Formation. The Taconic Mélange is characterized as a chaotic mix of pebble to block sized Cambrian to Middle Ordivician Age rocks in a pelitic matrix. The Austin Glen formation consists of interbedded layers of greywacke and shale. The outcrops observed on site were more consistent with interbedded greywacke and shales. The outcrops appeared to consist of interbedded competent siltstone layers alternating with less competent shale.

Seventy two test pits have been excavated on the property throughout the course of the subsurface investigations. The geologic information obtained from the test pitting activity allowed creation of a subsurface geologic model for the site. The fill boundaries are well defined and the nature and extent of the affected soils also have been well defined. The native undisturbed soils consist mainly of silty, fine to coarse sand mixed with varying percentages of gravel, cobbles and boulders. The fill material typically includes a matrix of native soils intermixed with concrete slabs, boulders, bricks, household refuse, miscellaneous metal, glass, ash, slag, asphalt, and wood construction debris. It is also apparent that some material has been imported to cover the fill/disposal areas. There is also a contiguous to semi-contiguous layer of strongly odorous soil/sludge buried in the southern landfill area.

Depth to bedrock was variable. Outcrops were observed on the southern portion of the site and encountered in the test pits at depths ranging from 7 to 16 feet below ground surface beneath the southern portion of the site. Bedrock may be deeper in the northern portion of the site but is likely to be shallow to the west.

4.3 Groundwater Conditions

Groundwater was typically not encountered in the unconsolidated sediments. In a few instances the soils were moist but appreciable quantities of water were not encountered in any of the test pits.

Groundwater beneath the site is confined primarily to the bedrock. Shallow groundwater flow is likely to be towards the Hudson River but there is likely to be a slight southward radial component that mimics site topography. Based on the observed depth to groundwater in the two monitoring wells, groundwater is anywhere between 12 and 30 feet below ground surface across the site. Overburden soils are relatively porous and readily allow groundwater movement.

Groundwater is not used as a drinking water resource in this region. The municipality provides water and sewer services. Risks associated with impacts to groundwater are expected to be minimal.

5.0 RECENT SAMPLING RESULTS

5.1 Total Metal Results

Total metals were analyzed in samples taken from test pits PWD-01, PWD-02 (2), PWD-03 (2), PWD-04 (2), PWD-05, PWD-06 (2), PWD-09, PWD-11 (2), and PWD-12. The samples and locations are described in Table 1. The sampling locations are depicted on Figure 4 and the results presented in Table 2. The metals detected included mercury, arsenic, barium, cadmium, chromium, lead, selenium and silver. As was the case in the previous investigations, many metals were found at levels that exceeded the NYSDEC's TAGM 4046 soil cleanup guidance values. Soil results exceeding the TAGM 4046 soil cleanup guidance values are shown in bold on Table 2 and on Figure 5. The compounds exceeding the soil cleanup guidance values included mercury, arsenic, chromium, selenium and silver. The results were consistent with

previous findings in terms of the metals detected; however, the results of the recent analysis were generally slightly lower than the results observed during the previous investigations. None of the results were at the levels found during the previous investigations. Generally, we have more confidence in these results because the samples were collected using ASP Level B protocols and the DUSR indicates that the data is reliable.

Mercury was detected in samples taken from test pits PWD-01 (0.3 ppm), PWD-02 (0.16 ppm), PWD-03 (0.5 ppm), PWD-04 (0.5 ppm), PWD-06 (0.43 ppm), PWD-09 (0.5 ppm), PWD-11 (0.17 ppm), and PWD-06 (0.13 ppm) at levels exceeding the soil cleanup guidance value of 0.1 ppm. Arsenic was detected in samples collected from test pits PWD-06 (8.2 ppm), PWD-09 (14.2 ppm), and PWD-11 (9.4 ppm) at levels exceeding the soil cleanup guidance value of 7.5 ppm. Chromium was detected in samples taken from test pit PWD-01 (14.2 ppm), PWD-02 (11.8 ppm), PWD-03 (12.7 ppm), PWD-04 (12.2 ppm), PWD-05 (18.6 ppm), PWD-06 (22.5 and 14.6 ppm), PWD-09 (14.6 ppm), and PWD-11 (11.3 ppm) at levels exceeding the soil cleanup guidance value of 10 ppm. Lead was encountered at numerous locations throughout the site at elevated levels. Lead was found in only two test pits at levels exceeding the USEPA's threshold of 400 ppm for residential developments in urban areas (USEPA/540/F-98/030, Clarification to the 1994 Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities, OSWER # 9200.4-27, August, 1998). Lead was detected in PWD-04 at 405 ppm and PWD-09 at 1,010 ppm. Selenium was detected in a few locations at levels exceeding the soil cleanup guidance value of 2 ppm. However, selenium was essentially detected at levels ranging between 2.2 and 6.4 ppm across the entire site with vary little variation overall and is therefore interpreted to be background condition. Silver was also detected in three test pits. Silver was found slightly above or just below 1 ppm in PWD-01 and PWD-02, which can reasonably be interpreted as site background. Silver was encountered at 3.5 ppm in PWD-06.

5.2 TCLP Metal Results

The data are summarized in Table 2 and compared to the appropriate regulatory standard. Table 1 provides the sampling identification.

No sample exceeded the threshold for hazardous waste determination. All of the metals results were virtually non-detect, with the exception of barium in PWD-02 (0.485 milligrams/liter (mg/l)), PWD-06 (0.68 mg/l), PWD-09 (1.12 mg/l) and PWD-11 (0.649 mg/l). Lead was detected in PWD-06 at 0.212 mg/l and PWD-09 at 0.512 mg/l. Cadmium was also detected at PWD-09 at 0.0419 mg/l.

None of the findings exceeds the applicable toxicity characteristic for hazardous waste listed in 6 NYCRR Part 371.3(e), Table 1. The applicable standards are 100 mg/l for barium, 1.0 mg/l for cadmium, and 5.0 mg/l for both chromium and lead.

5.3 Volatile Organic Compound Sampling Results

One confirmatory sample was taken from the sludge material encountered in PWD-03. The material had a strong petroleum-like odor; however, the only compounds detected in the soil sample were methylene chloride, which was present in the lab blank and trichloroethene at 0.0046 ppm. No petroleum hydrocarbon compounds were detected in this analysis; however, the sample was not analyzed for semi-volatile organic compounds. The detection of trace levels of trichloroethene is consistent with previous findings. Analysis of the sludge material taken from the same approximate location (STP-19) in 2001 detected trace levels of cis,1,2-dichloroethene (0.011 ppm), which is a breakdown product of trichloroethene. None of these compounds exceed the soil cleanup guidance values of 0.1 and 0.7 ppm, respectively, for these two compounds. Previous analysis of the sludge material indicates that petroleum-range hydrocarbons were present at levels exceeding the soil cleanup guidance values in the southern landfill area.

5.4 Groundwater Sampling Results

Groundwater samples obtained from MW-1 and MW-2 were analyzed for volatiles and metals. The results indicate that the groundwater beneath the site is not contaminated with volatile organic compounds. Some metals were detected, specifically. arsenic (14.7 ug/l at MW-1; 18 ug/l at MW-2), chromium (14.3 ug/l at MW-1; 12.2 ug/l at MW-2) and lead (12.2 ug/l at MW-1; 19.1 ug/l at MW-2) were present but at levels below the allowable groundwater concentrations for drinking water of 25 ug/l, 50 ug/l and 25 ug/l, respectively, as listed in the NYSDEC's Technical and Operational Guidance Series (TOGS) 1.1.1.

5.5 Reliability of the Data

The data have been reviewed by Fuss & O'Neill's quality assurance specialist per the protocols outlined in Draft DER-10, Technical Guidance for Site Investigation and Remediation, Appendix 2A and 2B. The data usability summary report (DUSR) was provided in the Site Characterization and Remedial Investigation Summary Report (Fuss & O'Neill, 2004).

Fourteen soil samples and two groundwater samples were collected and analyzed by Severn Trent Laboratories in Newburgh, New York. Samples were analyzed for total RCRA metals (SW846 – 6010B) and RCRA metals using Toxicity Characteristic Leaching Procedure (TCLP via SW846 6010B and EPA 160.3). Mercury was analyzed using SW846 method 7471A for total mercury and using SW846 method 7471A and for TCLP mercury using 7470A and EPA 160.3. Extra volume was provided for two samples which were designated to be analyzed as matrix spike/matrix spike duplicates (MS/MSDs) and are provided with the QA/QC results.

All samples were analyzed within method-specified holding times. No target compounds were reported in the equipment blank. Results of primary and duplicate samples were generally similar. The relative percent difference (RPD) calculated for mass lead was elevated for both samples. This is likely due to sample heterogeneity as opposed to laboratory or field sampling error. An elevated RPD was also reported for mercury in the lab duplicate. The blank spike and lab control sample results were satisfactory with some minor disagreement.

Comparison to the previously obtained results presents a different set of issues. Two different laboratories were used to analyze the data. York Analytical Laboratories of Stamford, Connecticut analyzed the samples from the Phase II and Supplemental Phase II investigations. The samples were not analyzed by York using an ASP Level B protocol. The samples for the most current investigation were analyzed by Severn Trent Laboratories of Newburgh, New York, an ELAP certified ASP Level B laboratory.

The Phase II and Supplemental Phase II results are internally consistent. Samples taken from the same general area typically depict the same general results. The metals, VOCs and petroleum hydrocarbon results were all within the same general range when sample locations were duplicated to the extent possible. There is consistency between this investigation and the previous investigations, as well. Upon comparison of the historic York data to the recently obtained Severn Trent results, it is evident that the Severn Trent results detected the same metals; however, the results were at lower levels than the previously obtained York results.

For example, the samples taken from test pits STP-19 and PWD-03 were from the same general vicinity and the same horizons, although it is important to note that the samples are not and could not be exact replicates. Table 3 compares the RCRA metal results from STP-19 and PWD-03. All results are in parts per million and those values exceeding the NYSDEC's soil cleanup guidance values listed in TAGM 4046 are in bold.

In general, the results are consistent except that the York results are typically higher, with some exceptions. This trend was consistent throughout the historic data record.

A higher level of comfort is present with the recently obtained data because of the rigorous QA/QC process that was utilized for analysis, but the similarity in the data sets suggests that the preliminary results should not be completely discarded when developing remedial alternatives for the site. Using the preliminary data will result in a conservative approach that perhaps over-estimates the volume of actionable material.

6.0 NATURE AND EXTENT OF CONTAMINATION

6.1 Areas of Concern

As a result of the three phases of investigation, three main areas of concern were identified including the Southern Landfill Area, the Northeastern mound of soil and the former UST area (Figure 6). As shown on Figure 6, the Southern Landfill Area and Northeastern Soil Area contain primarily metals and petroleum contaminated soil, and the former UST Area contains primarily petroleum contaminated soil. The areas of concern are discussed further below.

6.1.1 Southern Landfill Area

Actionable levels of metals and petroleum contaminated soil were encountered in the southern landfill area. The recent testing indicates that the soil in this area may not be as contaminated as

previously indicated; however, numerous sample results exceeding the soil cleanup guidance value were documented.

The historical data collected during the Phase II and Supplemental Phase II investigations have provided useful information that was incorporated into the estimation of material requiring action. The bulk of the soil requiring action appear to be confined primarily to a layer of organic rich sludge or road sweepings that were buried in a thin, yet apparently contiguous layer that occupies the eastern half of the southern landfill area (Figure 6). The dimensions of the area of concern are approximately 115 by 85 feet and the layer is approximately 1 to 3 feet thick (Figure 6 and Figure 7). The estimated volume of material in this layer is approximately 1,200 cubic yards. Not all of this material is contaminated at levels exceeding the soil cleanup guidance values.

The sludge layer is buried by approximately 6 to 10 feet of miscellaneous fill consisting mainly of sand and gravel material interspersed with construction and demolition debris (Figure 6). There are also pockets of ash and slag, leaf waste and some household refuse that may have resulted from convenience dumping (Figure 6). Some of this material is unsuitable for construction purposes. Some of the material has the potential to be reused onsite as construction fill material, given the intended re-use of the property.

Soil in the vicinity of PWD-05 and PWD-06 exhibited levels of heavy metals slightly above the TAGM 4046 values. This is the area where the slag material is buried (Figure 6). The volume of impacted material in this region is approximately 1,800 cubic yards.

6.1.2 Mound of Soil: Northeast Corner

The mound of soil located in the northeast corner of the site covers a building that was demolished and buried in place (Figure 6). During previous investigations, petroleum-contaminated soil was encountered in an area where used oil filters and other old automobile parts were discovered (Figure 6). The soil in this region is also contaminated with heavy metals at levels exceeding the soil cleanup guidance values (Figure 6 and Figure 7).

During the recent excavation activity, the boundaries of the buried building were discovered. It was also noted that there was a layer of coal ash or possibly burned sludge material adjacent to the remnants of the building. Information provided by the City suggests that this building was used for the burning of sludge. Samples of the burned sludge or ash material were affected by heavy metal contamination at levels slightly exceeding the soil cleanup guidance values provided in TAGM 4046.

The volume of impacted material in this area is roughly 1,800 cubic yards; however, most of the actionable material is probably confined to the narrow band of coal ash or sludge, thus reducing the volume of impacted material to around 300 to 400 cubic yards. Samples taken directly from this interval (sample ID 624040323-12, PWD-11) were contaminated with metals above the TAGM 4046 levels. Samples taken from the material surrounding the layer of coal ash or burned sludge were not affected at actionable levels (sample ID 624040323-14, PWD-12).

6.1.3 Former UST Area

As discussed in the Phase II and Supplemental Phase II site investigation reports, the former UST area contains petroleum impacted soil; specifically, polynuclear aromatic hydrocarbons (PAHs). Detections of PAHs above the respective TAGM 4046 criteria have been detected in a limited area around the former UST area (Figure 6). An estimated 50 to 75 cubic yards of affected soil will be addressed with the overall site remediation plan.

6.1.4 Groundwater

Groundwater was never encountered in appreciable quantities during the course of site investigations. Some moist soil was encountered but there was no obvious evidence of saturated conditions anywhere beneath the site. Precipitation infiltrates quickly through the relatively permeable fill material and enters the bedrock aquifer system. Groundwater is likely to be present between 12 and 30 feet below ground surface across much of the site. Groundwater is not used as a drinking water resource in this region so impacts, if present, are not a significant issue. It is also important to note that samples obtained from two downgradient monitoring wells were not affected by the contaminants of concern at levels exceeding the standards in TOGS 1.1.1.

6.2 Exposure Pathways

The contaminants of concern are confined primarily to soil located in the two areas of the site described above. There is no evidence that the contaminants are migrating into groundwater. The TCLP results indicate that there is a very low potential for the contaminants of concern to leach from the overburden.

None of the areas of concern represent an adverse health concern for humans who could reasonably be exposed to contaminants originating from the STP site. Exposure pathways will be mitigated based on the proposed future uses of this and surrounding properties. The facility is adjacent to a residential neighborhood; therefore, care must be taken to minimize any dust generated during remedial activities. Properties located in the general site area are serviced by a municipal potable water supply. Properties to the south of the site are currently vacant but will be developed for similar commercial purposes. Surrounding properties are primarily zoned and permitted for commercial use and therefore future residential development/use of surrounding properties is not anticipated, of course, with the exception of the existing residential neighborhood.

Given the current use of this and surrounding properties, and the presence of the adjacent residential property to the north, only one human receptor population has been identified: Visitors/Transients – includes individuals who may visit or otherwise be present on the property for brief periods. Visitors and transient individuals are assumed to include both adults and children.

To evaluate the potential exposure pathways associated with the heavy metals and VOCs in subsurface soil, it is necessary to understand what exposure pathways that are reasonably

expected under anticipated future property uses. An exposure pathway consists of five elements: a source of contamination, transport through an environmental medium, a point of exposure, a route of human exposure, and an exposed population. Several pathways were evaluated in this exposure assessment. An exposure pathway occurs when the five elements of an exposure pathway described above link the contaminant source to a receptor population, resulting in exposure. A potential exposure pathway exists when one or more of the exposure pathway elements are missing or incomplete. If one or more of the pathway elements is missing, the exposure pathway is not considered to be complete and therefore, this pathway is eliminated, as exposure/potential exposure to contaminants is not considered to be present. For example, groundwater contamination is not present so that pathway is ruled out. Table 4 outlines the potential exposure pathways.

6.3 Concentration of Heavy Metals in Soil

The sampling results indicate that heavy metals were present at levels exceeding the soil cleanup guidance values in TAGM 4046. The metals detected included mercury, arsenic, barium, cadmium, chromium, lead, selenium and silver. As was the case in the previous investigations, many metals were found at levels that exceeded the NYSDEC's TAGM 4046 soil cleanup guidance values. Soil results exceeding the TAGM 4046 soil cleanup guidance values are shown in bold on Table 2 and on Figure 5. The compounds exceeding the soil cleanup guidance values included mercury, arsenic, chromium, selenium and silver.

The elevated levels of metals were primarily confined to the mound of soil in the northeast corner of the site and in the southern soil deposition zone. Mercury was detected at levels ranging from 0.16 ppm to 0.5 ppm in the northeast soil pile, exceeding the soil cleanup guidance value of 0.1 ppm. The same range was basically detected in the southern soil consolidation area. Arsenic was detected in test pit PWD-06 at 8.2 ppm in the southern fill area and between 9.4 ppm and 14.2 ppm, exceeding the soil cleanup guidance value of 7.5 ppm. Chromium was found at levels ranging between 11.8 and 22.5 in the southern fill area and between 11.3 ppm and 14.2 ppm in the northeast soil pile, exceeding the soil cleanup guidance value of 10 ppm. Lead was encountered at numerous locations throughout the site at levels exceeding the USEPA's threshold of 400 ppm for residential developments in urban areas (USEPA/540/F-98/030, Clarification to the 1994 Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities, OSWER # 9200.4-27, August, 1998) in one location in the southern fill zone and one location in the northeastern soil pile area. Selenium was also detected in a few locations at levels exceeding the soil cleanup guidance value of 2 ppm. However, Selenium was essentially detected at levels ranging between 2.2 and 6.4 ppm across the entire site with vary little variation overall and is therefore interpreted to be background condition. Silver was also detected in three test pits. Silver was found slightly above or just below 1 ppm in PWD-01 and PWD-02, which can reasonably be interpreted as site background. Silver was encountered at 3.5 ppm in PWD-06.

Much of the elevated metals in the southern fill zone were detected in some slag deposits or in the sludge zone. The elevated metals in the northern soil pile area were confined to a dark colored soil zone adjacent to what appeared to be an old building foundation. Figures 5 and 6 outlined the areas of concern.

The source of the heavy metals is likely tied to the historic filling of certain portions of the property with storm water catch basin cleanout sediments and the historic processing of sludge on the facility. This parcel and region have an extensive industrial past, so the elevated metals could be attributed to past industrial practices. However, there was no direct evidence of industry on the facility. No industrial waste disposal areas were encountered.

6.4 Volatile Organics in Soil

Some petroleum hydrocarbons were detected in a few samples in the southern landfill area, former UST area and northeastern soil mound area at levels exceeding the TAGM 4046 soil cleanup guidance values. A layer of sludge was present in the southern fill zone, having a strong petroleum-like odor. Previous investigations also detected chlorinated volatile organic compounds trichloroethene (TCE) and cis,1,2-dichloroethene (DCE); however, none of these compounds exceeded the respective soil cleanup guidance values of 0.1 ppm and 0.7 ppm.

7.0 CONTAMINANT FATE AND TRANSPORT

Impacts to soil at the former STP site are limited primarily to three areas of concern. The impacts are primarily heavy metals but some petroleum hydrocarbons including volatile organic compounds were detected as well. TCLP analysis of the soil samples indicates that the heavy metals are not particularly mobile. The bulk of the impacts are confined to the areas of concern outlined on Figure 6.

Based on the available data, as discussed in Section 4.3 and Section 6.1.4, overburden groundwater is limited; therefore groundwater transport is not likely to be a significant concern. The documented impacts to soil discussed in Section 6.0, are exposed to infiltrating groundwater. Groundwater exists in the bedrock aquifer system and is likely to discharge towards the Hudson River; however, samples taken in the downgradient well MW-2 were not contaminated with any of the compounds detected in the soil samples at levels exceeding the applicable groundwater standards (TOGS 1.1.1).

The likely source for the documented impacts was the nature of the fill material itself. The fill was primarily transported to these areas or deposited as a consequence of sludge processing. The fill material contained sludge from catch basins, construction and demolition debris, burned and unburned coal ash and other deleterious material. Intentional disposal of waste material to the subsurface were not likely, but over time, routine historical practices resulted in the documented.

Under the current and planned use of the facility, there is no potential exposure route and, therefore, the risk associated with the heavy metals is virtually not present. The area is provided with public water and sewer and the impacted material is not readily accessible and is typically not exposed at the surface. The nearest sensitive receptor is the Hudson River, which is located between 100 and 200 feet away from the site.

8.0 REMEDIAL ACTION OBJECTIVES AND GENERAL RESPONSE

8.1 Introduction

The Remedial Action Objectives (RAOs) for this site are addressed below. Remedial action objectives for protecting human health and the environment are developed considering the exposure pathways and the intended future use of the property.

8.2 Distribution of Contaminants of Concern

The impacted areas are limited to three areas of concern described in detail in Section 6. One is in the vicinity of the former 5,000-gallon fuel oil UST area where slightly elevated levels of semi volatile organic compounds (SVOCs), specifically PAHs, commonly associated with fuel oil were detected at levels slightly above TAGM 4046 soil cleanup guidance values. There was no odor or signs of petroleum staining observed on the soils after the tank was removed. The second area of concern is a mound of soil located in the northeast corner of the property (Northeast Soil Mound Area) and the third is an area that was used for the historic waste disposal and filling (Southern Landfill Area).

The impacted zones are primarily constrained to a layer of sludge found in the southern fill area and a band of dark colored soil adjacent to a buried foundation in the northeastern corner of the property. Samples taken from these horizons typically exceeded the soil cleanup guidance values for both metals and petroleum hydrocarbons in some cases.

Existing data indicates that the groundwater has not been impacted by the contaminants detected in the soil samples. Because the site and surrounding areas are supplied with public water and neither overburden nor bedrock groundwater is used for drinking water, potential impacts to groundwater are not considered significant and are not of concern.

8.3 Remedial Action Objectives

There does not appear to be a significant potential for chronic human exposure to the metals in the soil. Short-term exposure would only occur during excavation activities. The area around the site is serviced by a municipal water system so there is no significant potential for chronic human exposure to water-born contaminants from this site.

The Remedial Action Objectives for this project are to eliminate exposure pathways to contaminated soil, consolidate the impacted material into a well defined area and to limit the potential exposure to dust containing the metals during consolidation and construction efforts at the facility.

8.4 Development of Remediation Goals

The intended use of this facility is commercial. The existing building will be torn down and a new facility with a larger footprint than currently exists on the property will be constructed. Under existing conditions, little to no exposure potential exists from soils. The risk of exposure

to contaminated soil might exist during invasive construction/demolition activities and is likely to be the primary route of exposure to the compounds of concern. There is no potential for long-term exposure via exposure to contaminated soil vapor given the depth of the most significantly impacted soil horizon. However, when the building is constructed, it will extend over the area where the VOC impacted soils were encountered. The proposed remedial goals and action objectives were developed to be protective of site workers and users of the facilities, based on the intended use of the structure.

Goals for the remedial program have been established using the guidelines suggested in the Draft Brownfield Cleanup Program Guide. The overall remedial goal is to protect the users of the facility from potential exposure to the contaminants of concern. At a minimum, the proposed remedy will eliminate or substantially reduce the threat to the public health and to the environment presented by the metal containing soil. The developer wishes to pursue this course of action using an approach consistent with a Track 4 cleanup under the BCP.

8.5 General Response Actions

Since exposure to soil can be eliminated by isolation, the exposure potential will be mitigated. The soil does not contain substantively leachable quantities of metals and the groundwater has not been impacted. Given these conditions, two remedial alternatives are considered: Track 1, which entails removal of the contaminated material to predisposal conditions and a Track 4 alternative, which entails isolation and/or removal of the impacted soil. The sludge layer would be removed because it is not suitable for construction purposes. Contaminated soil that would meet the requirements of construction grade fill will be consolidated in one portion of the site beneath the parking lot and building. Environmental easements or deed restrictions will be employed to ensure that potential future exposure issues are suitable addressed.

8.6 Significant Threat Determination

Consistent with the BCP, the NYSDEC and NYSDOH have performed a significant threat determination for the site. Based on a review of the site investigation data, it has been determined that the site does not pose a significant threat to public health or the environment. However, due to contaminant levels within the soil exceeding the cleanup values specified in TAGM 4046, remediation of the site is required prior to commercial development.

9.0 SCREENING OF ALTERNATIVES

The general types of Remedial Alternatives considered for this "Brownfield Cleanup" site included:

- a no action alternative,
- a Track 1 cleanup to predisposal conditions; and
- a Track 4 approach tailored for the intended future use of the property but designed to ensure that the potential exposure routes are mitigated.

The alternatives were evaluated based on the capacity to meet the RAOs. The remedial alternatives were described and screened on the basis of 1) long-term effectiveness, 2) reduction of toxicity/mobility/volume, 3) short-term effectiveness, 4) implementability, and 5) cost. The preferred remedy is consistent with the NYSDEC's goals for the program in that it remains consistent with the overall program criteria: protect human health and the environment; and to comply, to the extent practical and feasible, with SCGs for the site.

The proposed Remedial Alternative was developed to address environmental conditions at the site; however, consideration is given to the economic reuse of this facility. The focus of this evaluation was to develop satisfactory Remedial Alternatives that will allow this property to be re-developed as intended, and to develop a mitigation plan that would be protective of those persons using the facility.

A key component of the re-development of this parcel is construction of a hotel/restaurant/catering facility on the southern end of the parcel. Much of the area of concern in this portion of the property will be covered by the footprint of the proposed building and the ancillary parking areas.

9.1 Remedial Alternatives

9.1.1 Alternative 1 – No Action

Under this alternative, the property would be developed without directly mitigating the environmental issues. Any reduction in the concentration of metals, VOCs and PAHs would be the result of dispersion or dilution. Dispersion or dilution could potentially result in additional future groundwater impacts and does not meet the SCGs. Risk to human health from contact with the impacted soil is real, especially during construction activity. However, risks of future exposure to the contamination would be minimal because much of the impacted soil would be isolated beneath paved areas or building or below the surface. The isolation would reduce the mobility of the contaminants.

This alternative involves no monitoring. Although this option could be implemented, it provides no direct mitigation to existing problems and relies on naturally occurring processes. There would be no reduction in the toxicity of the contaminants and potential health risk factors would still exist. There are no foreseeable costs associated other than those normally associated with construction activity. However, it is presumed that the NYSDEC would not accept this alternative and would not grant the applicable liability waivers or provide a Certificate of Completion because it does nothing to meet the overall remedial action objectives and does not insure eventual compliance with the SCGs. This alternative can easily be implemented but is not considered further because it has no potential to meet the objectives of the BCP.

9.1.2 Alternative 2 - Complete Removal to Predisposal Conditions

This alternative would incorporate complete removal of impacted soil. Development would occur after the material was removed. To accomplish complete removal of impacted soil above TAGM 4046 guidelines from the site, approximately 4,800 yd^3 (~ 7,200 tons assuming around 1.4 to 1.6 tons per cubic yard) of soil would require removal. The impacted soil is as follows:

- Southern Landfill Area – 2,900 yd^3
- Northeast Soil Mound Area – 1,800 yd^3
- UST Area – 75 yd^3

  Total – 4,475 yd^3

However, for this alternative, it would be necessary to remove the entire mound of fill from both the southern soil disposal area and the mound of soil in the northeast corner because it would be very difficult if not impossible to segregate the impacted soil from the non-impacted soil within the delineated areas. Because segregation would be timely and extensive sampling would be required to verify that the appropriate material had been removed from the areas of concern, this approach would be cost prohibitive. Ultimately, it would be necessary to remove the entire volume of soil from these areas or approximately 7100 yd^3 (~11,000 tons) and also replace it with clean fill material. This volume includes all of the material in all of the areas of concern on site from existing grade to native material as follows:

- Southern Landfill Area – 5,100 yd^3
- Northeast Soil Mound Area – 1,900 yd^3
- UST – 75 yd^3

  Total – 7,075 yd^3

Costs to implement this alternative could be extraordinarily high, considering the magnitude of the problem. Using a range of costs between $85 and $100 per ton to excavate, dispose, replace, grade the clean fill and provide the necessary engineering services, the cost for this alternative would be as follows:

- Potential Minimum Cost – 11,000 tons x $85 per ton = $935,000
- Potential Maximum Cost – 11,000 tons x $100 per ton = $1.1 million

There will be some cost reduction if the remedial work is completed contemporaneously with the site development, which would avoid the mobilization of separate work crews, equipment and supplies.

It would be straightforward to excavate the impacted material with typical construction equipment used for the site development. The soil would be temporarily stockpiled in the soil management area before being disposed of at an appropriate facility. Based on the current sampling results, it would not be that difficult to find a facility that would accept the material; however, it may be difficult to find a facility that would be willing to accept all of the material

unless the timeframe could be extended over several months, which has the potential to increase the costs further.

This alternative certainly meets the remedial objectives of the BCP. It would allow unrestricted use of the property without consideration. It will be evaluated further for comparison to other alternatives but is not cost effective. This alternative has significant drawbacks and would not be practical to implement. The gains from implementing this alternative would be marginal and the costs high compared to the risks present at the site

9.1.3 Alternative 3 – Limited Excavation and Soil Consolidation

Under this alternative, a portion of the most contaminated soil would be disposed off-site and the remainder would be placed in a soil consolidation area located beneath the proposed building and adjacent parking area (Figure 8).

This alternative would include the removal and off-site disposal of the sludge material from the Southern Landfill Area and the black sludge-like material from the Northeast Soil Mound Area because it is unsuitable as construction fill material and contaminated with petroleum and metals. Based on the field testing to date, the approximate volume of material to be removed from the site would be as follows:

- Southern Landfill Area – 1,800 yd^3
- Northeast Soil Mound Area – 400 yd^3
- Former UST Area – 75 yd^3

Total – 2,275 yd^3 (~ 3,400 tons)

Costs to implement this alternative using a range of costs between $85 and $100 per ton to excavate, dispose, replace, grade the clean fill and provide the necessary engineering services, the cost for this alternative would be as follows:

- Potential Minimum Cost – 3,400 tons x $85 per ton = $289,000
- Potential Maximum Cost – 3,400 tons x $100 per ton = $340,000

There will be some cost reduction if the remedial work is completed contemporaneously with the site development, which would avoid the mobilization of separate work crews, equipment and supplies.

Reduction in the concentration of metals, VOCs and PAHs would be through the removal of the most significantly impacted material; however, some soil would remain on site in a zone that eliminated the direct exposure pathway and limited the infiltration potential and, thereby reducing the likelihood of further impacts to the environment. Contaminant mobility is greatly reduced by the use of engineering controls in the soil consolidation area. The potential for subsequent dispersion is greatly reduced and environmental easements will be used to address potential future exposure to the contaminants of concern. This approach makes a significant attempt to meet the SCGs to the extent practical, but also relies on isolation to address the existing and potential future environmental impacts. Risk to human health from contact with

the impacted soil is limited to construction activity but future exposure potential is mitigated by isolation of the impacted soil beneath asphalt and buildings and the use of administrative control in the form of environmental easements that would reduce future exposure potential.

Alternative 3 consisting of limited excavation and environmental isolation proposed as the preferred most-cost effective option. Alternative 3 provides a reduction in the toxicity of the contaminants by off-site disposal of some impacted soil and significant reduction in potential health risk factors by environmentally isolating the remaining soil at the site and is affordable from the Volunteer's perspective.

The proposed grading for the facility requires that extensive fill be brought into this area (Figure 7). To the extent practical and without endangering the patrons and employees of the facility, it is practical to relocate all of the metals impacted soil that can be reused for construction purposes to the southern fill area instead of importing fill material. This entails moving the metals impacted soil encountered at the site to this area and reconfiguring the existing wastes to facilitate construction activity.

This alternative incorporates partial removal of impacted soil followed by backfilling with appropriate soil from different areas of the site and/or imported clean fill and the installation of barriers to prevent direct human contact.

Active sub-slab depressurization systems will be installed beneath all future permanent structures built over the area of consolidation. The sub-slab depressurization system design will be incorporated into the RAWP and reviewed and approved by the NYSDOH.

9.2 Alternatives Screening Summary

Two of the three alternatives have been evaluated and those that are applicable are discussed in detail in the following section. The following considerations were generally applicable:

- The areas of impacted soil are large. For the most part, the soil exceeding TAGM guidelines are not significantly above the applicable guidance value. The impacts are result of intentional filling with waste material or demolished building in areas of the site that were not being used. Some of the soil exceeding TAGM may be representative of background conditions in the region.
- Soil removal and disposal from this site is practical and feasible. Complete removal to predisposal conditions has limited application as a cost-effective measure compared to the potential risks.
- The proposed building and paved areas will effectively isolate the soil and limit infiltration through the mass of contaminated soil. The area is supplied with public water so there are no risks associated with ingesting potentially impacted groundwater.

With these considerations in mind, the preferred approach to rehabilitating the impacts is discussed in the next section.

10.0 ALTERNATIVES ANALYSIS

In this section, the remedial alternative alternatives are evaluated in terms of the following criteria:

- Overall protectiveness of human health and the environment.
- Compliance with SCGs, including action-specific and location-specific SCGs.
- Long-term effectiveness and permanence, focusing on the reliability and adequacy of controls
- Reduction in toxicity, mobility, or volume.
- Short-term effectiveness, focusing on the protection of community, workers, and environment during remedial actions.
- Implementability
- Cost (affordability by the Volunteer is a key consideration)
- Community Acceptance.
- Land Use Criteria.

10.1 Alternative 2 – Complete Removal of Soils Above TAGM #4046

10.1.1 Overall Protectiveness of Human Health and Environment

This alternative is protective of human health and the environment. Up to 30,000 tons of soil exceeding or possibly exceeding TAGM #4046 soil cleanup objectives would be removed from the site.

10.1.2 Compliance with SCGs

This alternative complies with the TAGM 4046 soil cleanup guidance values. Groundwater standards have not been exceeded at the site based on the available sampling results. Groundwater is not used as a resource in this region but generally meets the groundwater quality standards published in 6 NYCRR, Part 703. Some inorganic aesthetic water quality parameters were exceeded but this is likely due to the elevated turbidity levels in the sampled wells. This alternative results in rapid compliance with all chemical-specific SCGs.

10.1.3 Long Term Effectiveness and Permanence

All soil with contaminants above the TAGM #4046 soil cleanup objectives would be removed. This is an effective and long-term solution to the problem. This alternative can be considered to include permanent remediation.

10.1.4 Reduction of Toxicity, Mobility, or Volume

This alternative reduces the toxicity and mobility of the metals by completely removing soil exceeding TAGM.

10.1.5 Short-Term Effectiveness

This alternative would be effective in protecting human health and the environment in the short term. During the short-term construction phase, protection of workers and the environment would be accomplished through adherence to OSHA standards.

10.1.6 Implementability

This alternative can be implemented. Excavation and disposal of all contaminated soil in the three areas of concern is possible.

Given that the source area and associated contaminants in soil and/or groundwater represent very little risk to human health, the consequences of this alternative are not in keeping with the intent of the BCP. This alternative, although implementable, is not technically and administratively feasible.

10.1.7 Cost

This alternative is cost-prohibitive and far exceeds the benefits gained. This alternative also represents a cost burden on the site development. The estimate cost for this alternative is:

- Potential Minimum Cost – 11,000 tons x $85 per ton = $935,000
- Potential Maximum Cost – 11,000 tons x $100 per ton = $1.1 million

10.1.8 Community Acceptance

The planned reuse of this property as a restaurant/catering facility and hotel has received approval through the site plan approval process by the City of Poughkeepsie. The local citizens were given the opportunity to comment on the project in general as part of this process. The citizen's comments regarding the proposed development were addressed as part of that process and have been incorporated into the approved site plan. The remediation plan for the facility incorporates the final layout of the site as proposed to the City. Remediation of the site is coupled to the redevelopment efforts and will result in an improvement in environmental conditions and the elimination of existing potential exposure pathways. The community is not likely to object to an already approved project that results in an improved quality of life and environmental condition.

The local citizens will have the opportunity to comment on the proposed remedial alternatives through the Citizens Participation program. Their comments will be incorporated into the proposed alternative as warranted.

10.1.9 Land Use Criteria

The proposed development is consistent with the City's Master Plan for the Waterfront District. With this alternative no easements are required; therefore, the property could be developed for

any economically viable alternative that was consistent with the Master Plan. This alternative would virtually allow for unrestricted use of the property.

10.2 Alternative 3 – Limited Excavation and Soil Consolidation

10.2.1 Overall Protectiveness of Human Health and Environment

This alternative would include the excavation of impacted soils with metal, VOC and SVOC contaminants confined to the narrowly definable sludge layer in the southern fill zone and the impacted soil adjacent to the demolished building foundation in the northeastern corner of the site. To the extent physically possible, these two soil horizons would be removed completely. Approximately 2,700 tons of soil would be removed. The remaining material exceeding TAGM 4046 would be consolidated in a well defined area that would be capped by the proposed building and paved areas. The combined approach mitigates human health risks and will include methods to limit exposure during construction activity.

10.2.2 Compliance with SCGs

This alternative would not fully meet the soil cleanup objectives in TAGM 4046, some material exceeding TAGM would be moved to the soil consolidation zone. Site controls would be used to limit potential exposure route in the future.

10.2.3 Long Term Effectiveness and Permanence

This alternative provides a long-term means of reducing potential exposure pathways. The remaining material exceeding TAGM is confined to a well defined area and the opportunities for infiltration through this zone are reduced substantially by the construction of the buildings and the parking areas. However, metals contaminants would not be completely removed and are unlikely to decline due to the metals relative immobility.

10.2.4 Reduction of Toxicity, Mobility, or Volume

This alternative removes a fairly significant portion of the impacted material. Test results indicate that the most significant impacts are confined to the sludge layer, which will be removed to the extent possible. This effort will significantly reduce the volume of contaminants at the site. Source removal also reduces toxicity and the consolidation efforts will reduce the potential to remobilize contaminants by capping beneath relatively impermeable surfaces.

10.2.5 Short-Term Effectiveness

This alternative would be effective in reducing contaminant load. There is very little to no potential chance of exposure so there is a benefit to this approach.

10.2.6 Implementability

The alternative can be easily implemented and coordinates well with the planned site development. Excavation that would be employed under this alternative is technically and administratively feasible and the service is available. The consolidation would precede construction of the proposed facility.

10.2.7 Cost

This alternative, although expensive, causes less financial impact to the Volunteer. Less soil would be disposed off-site and the remaining remedial action could be tied into normal site development activity, which could be thought of as a necessary expense even if there were no remediation necessary.

Alternative 3 – Limited Excavation and Soil Consolidation:

- Potential Minimum Cost – 3,400 tons x $85 per ton = $289,000
- Potential Maximum Cost – 3,400 tons x $100 per ton = $340,000

10.2.8 Community Acceptance

The planned reuse of this property as a restaurant/catering facility and hotel has received approval through the site plan approval process by the City of Poughkeepsie. The local citizens were given the opportunity to comment on the project in general as part of this process. The citizen's comments regarding the proposed development were addressed as part of that process and have been incorporated into the approved site plan. The remediation plan for the facility incorporates the final layout of the site as proposed to the City. Remediation of the site is coupled to the redevelopment efforts and will result in an improvement in environmental conditions and the elimination of existing potential exposure pathways. The community is not likely to object to an already approved project that results in an improved quality of life and environmental condition.

The local citizens will have the opportunity to comment on the proposed remedial alternatives through the Citizens Participation program. Their comments will be incorporated into the proposed alternative as warranted.

10.2.9 Land Use Criteria

The proposed reuse of this property is consistent with the City's goals for its Waterfront District and is an allowable development under existing land use criteria. The proposed redevelopment will provide a needed commercial service that will be available to all of the community, assuming they can afford to pay the rates established by the proposed business. The proposed redevelopment alternative provides much needed tax revenues to the community and economic return in the form of job opportunities.

This alternative will incorporate institutional controls which will be incorporated into environmental easements for the property. Those environmental easements will have an impact on the future reuse options for the property. The property will be limited to industrial and commercial reuse consistent with the Zoning Code for the City.

10.3 Recommended Alternative

The preferred alternative is Alternative 3. It provides overall protectiveness of human health and the environment by removing the most significantly contaminated soil mass and isolating the remaining impacted material using institutional controls, provides substantial compliance with SCGs but relies on natural attenuation to a certain extent to address the residual impact. Most of the residual impacted soil will be buried at significant depth beneath the surface, so exposure to the residual impacted soil is not likely to be an issue.

This alternative provides a long-term, manageable solution to the problem and would be permanent. Any subsequent disturbance of the proposed soil consolidation zone would have to be accomplished under the auspices of the Department with the appropriate level of protection in place. This approach also reduces toxicity, mobility and volume of the contaminated soils at the site, although care must be taken if the soil consolidation zone is to be disturbed. The approach is very effective and provides immediate benefit, yet facilitates the proposed site development activity. This alternative is easily implemented and is cost-effective. Alternative 3 removes contaminants from the portions of the site that future users of the property have the potential to come into contact with based on existing site conditions and rapidly provides a level of protection to human health and the environment. The proposed alternative effectively returns the property to productive reuse, promotes economic growth in the region and improves environmental quality.

Implementation of the proposed alternative will consist of the following steps:

- Generation of a Remedial Action Work Plan (RAWP): The RAWP will document the remedial design. It will outline the mechanisms to be used for removing the severely impacted material, isolating the more benign impacted material, implementing the institutional controls necessary to eliminate exposure pathways, the plan to ensure the safety of the community while remediation is underway and the sampling program necessary to verify that the project goals where met.
- Soil Excavation: Impacted soil will be excavated and segregated as necessary for off-site disposal or on-site consolidation.
- Off-site disposal of impacted soil (estimated volume ~3,400 tons).
- On-site consolidation of lesser contaminated soil in the Soil Management Zone (estimated volume between 2,500 and 5,000 tons):
- Construction of the Soil Management Zone and the demarcation barrier
- Site restoration and grading for development of the restaurant/catering facility and hotel.
- Development of a site management plan.
- Imposition of an institutional control in the form of an environmental easement that will: (a) require compliance with the approved site management plan, and (b) require the

property owner to complete and submit to the NYSDEC an annual certification to insure compliance with the use restrictions.

11.0 REMEDIAL WORK PLAN

The field investigations have provided enough data to describe geologic and hydrogeologic conditions, the nature and extent of the contaminants, fate and transport and the primary exposure pathways for the contaminants of concern. Based on the available information, the following remedy was developed to address the impacted soil at the former City of Poughkeepsie Sewage Treatment Plant:

- Prior to beginning the soil remediation, the existing site structures will be demolished and processed to be used on site as fill material. Asbestos-containing material within the site structures will be mitigated prior to demolition.

- Excavate and move the soil pile located in the northeast corner of the site to the proposed soil consolidation area shown on Figure 8. Before moving it to the soil consolidation zone, the soil will be temporarily stockpiled in the soil management zone. The soil will be segregated during excavation to the extent practicable to remove any metal debris, concrete, bricks and other unsuitable material. The brick and concrete will be crushed as warranted to create construction aggregate/fill for the southern portion of the site or to fill in one of the many basements. The metal debris will be transported off-site for recycling.

  The dark lenses of soil found adjacent to an old foundation in this area will be segregated during excavation. This layer of impacted soil will be temporarily stockpiled in the soil management zone to determine the disposal requirements. Pre-disposal characterization samples will be taken and analyzed in accordance with the sampling requirements for the Albany Landfill.

  Post-excavation confirmatory samples will be collected from the base of the excavation to verify that the impacted soil has been removed. The samples will be analyzed for metals, VOCs and SVOCs using ASP Level B protocols. One composite sample will be collected for every 500 square feet of excavation.

- Contaminated soil in the former UST area will be excavated and stockpiled in the soil management area. The soil will be grouped together with other soil slated for off-site disposal and characterized accordingly. Post-excavation samples will be collected from the sidewalls and base of the excavation to verify that the impacted material has been removed.

- The soil in the southern landfill area will be handled in stages. The first step will be to expose the sludge layer by removing the overlying fill. Any material not suitable as backfill for construction purposes will be removed to the soil management area for

processing as warranted. The sludge will then be removed and stockpiled with the other material scheduled for off-site disposal. If native material is encountered beneath the sludge, post-excavation samples will be collected to confirm the boundaries of the contaminated soil zone and used for later incorporation into the environmental easement.

Temporary stockpiles will be created in the southern landfill area for the soil taken from above the sludge. Once the sludge layer has been removed, the temporary stockpiles will be graded in place as shown on the cross-sections C-C' and D-D' (Figure 9). The exact dimensions and elevation of the soil consolidation zone may vary from what is shown on Figure 8 and Figure 9. Actual dimensions of the soil consolidation zone will depend on the net volume of material moved into the area after the unsuitable materials are removed (e.g., sludge, debris etc).

- Once the sludge layer has been removed, the soil removed from the northeast corner of the site will be transported to this area and deposited as shown in Figure 8 and Figure 9. Once final grade is achieved and the shape of the proposed soil consolidation zone is consistent with the grading plans for construction at the site, the impacted soil will be covered with plastic sheeting to isolate it from the material above. Orange "snow fence" will be placed in rows extending across the entire soil consolidation mass at 20 feet intervals to demarcate the area. This demarcation will provide warning during future excavation of the soil consolidation zone.

  The soil consolidation area will then be capped with suitable construction grade fill to bring the area to grade. The soil within the consolidation zone will be maintained at a minimum depth of 2 feet below final grade.

- Deed restrictions or environmental easements will be used to control any future activity in the soil consolidation area.

The proposed remedy was based on the intended use of the facility and if the intended use changes to something that is more environmentally sensitive, the NYSDEC will be notified and have the right to require additional mitigation as warranted.

12.0 EVALUATION OF LAND USE CRITERIA

The Volunteer considered the NYSDEC's fifteen land use criteria for the proposed cleanup and redevelopment of the former City of Poughkeepsie Sewage Treatment Plant in the context of how it will affect the local community. The evaluations are provided in Table 5.

The nearest sensitive receptor to the STP site is the Hudson River. Another sensitive receptor of concern is the adjacent neighbors in the apartment complex to the north of the facility. Under the planned use of the facility, the likely potential exposure routes to human populations are through ingestion, skin absorption, and inhalation of dusts generated by the excavation activities proposed for the site. These pathways will be addressed by taking the appropriate precautions to

minimize dust generation (the soil will be kept damp) during site work. Also, no on-site equipment used in the excavation and or transportation of potential contaminated material will leave the site without first being decontaminated.

The facility and surrounding community is serviced by public water and potential impacts to public and private drinking water supplies do not exists. No access to surface or subsurface soil is known to exist without entry onto the site. Appropriate controls will be implemented during site work to keep unauthorized personnel off the site. Also, a Community Air Monitoring Program (CAMP) will be implemented to ensure that dust resulting from site activity is not present in quantities that present a hazard to the adjacent residents.

Any invasive work in the potential source regions in the future also has the potential to put site workers at risk. Appropriate precautions will be taken to ensure that site workers are not exposed and deed restrictions and/or equivalents will be used to limit the possibility for any future activity once the remedial alternative is implemented. Any future invasive action in the suspected source regions will require NYSDEC approval and oversight to ensure adequate protection of those persons performing the work in the suspected source regions.

13.0 PROJECT PLANS AND SPECIFICATIONS

The proposed remedy is described above. The remedy is intended to remove the immediate threats to human health and the environment by removing the most significant surface and subsurface impacts, restoring the site to functional use, provide long-term reduction in metals, PAH and VOC mass by excavating impacted soil. The specifics are discussed in the following sections.

13.1 Construction and Operation of Structures

There will be no structures associated with the proposed remedial approach other than the soil consolidation area. All other proposed structures are temporary in nature. The proposed soil consolidation area is shown graphically in Figure 8 and Figure 9. However, the geometry and volume of the consolidated soil will depend largely on the net volume of impacted soil after the unsuitable material is removed from the site. At a minimum, the sidewalls of the consolidated soil area will slope at a ratio of 1.5 feet (horizontal) to 1 foot (vertical). Given the nature of the fill this should be suitable for construction purposes.

The soil consolidation zone will be constructed in lifts no greater than one foot and compacted as warranted. Once the final disposition of the soil has been reached, the soil will be covered with a demarcation layer consisting of 4 mil thick or greater plastic sheeting. Orange snow fence will be placed on top of the plastic at twenty feet intervals to enhance detection during any subsequent work in the soil management zone.

Once the soil consolidation area is created, construction grade fill will be used to bring the site to final grade. The construction fill should also be compacted to lessen the likelihood of future settlement. The fill will be analyzed before it is delivered to ensure it is not contaminated.

Active sub-slab depressurization systems will be installed beneath all future permanent structures built over the area of consolidation. The sub-slab depressurization system design will be incorporated into the RAWP and reviewed and approved by the NYSDOH.

Samples characteristic of each waste stream, will be collected and sent to an environmental laboratory for analysis.

13.2 Physical Security of the Site

Much of the site is already restricted from access by a fence. Access to the site will be controlled daily and limited to authorized personnel.

13.3 Site Monitoring During Implementation of the Remedial Alternative

Air quality will be monitored per the requirements outlined in the CAMP and will be limited to only the soil remediation activities. Soil excavation will be under the guidance of a site geologist or engineer. The site personnel will be responsible for implementing the work plan and obtaining the necessary confirmatory samples.

Soil and waste characterization samples will be collected in accordance with NYSDEC guidance, based on the generation of potential waste material and the exposure of clean sediments. Typically, waste characterization analyses requirements are pre-determined by the proposed disposal facility but the level and type of contaminants encountered will direct the testing efforts.

14.0 INSTITUTIONAL CONTROLS OR ENVIRONMENTAL EASEMENTS

Institutional controls in the form of an environmental easement will be established at the completion of remedial activities but prior to the Certificate of Completion. At a minimum, the easement would:

- Require compliance with the approved site management plan.
- Limit the use and development of the property to commercial or industrial uses only.
- Restrict use of groundwater as a source of potable or process water.
- Require the property owner to complete and submit to the NYSDEC an annual certification that the Site Management Plan will continue to be met

The Site Management Plan developed shall include an institutional and engineering control plan which details the oversight steps and any media-specific requirements necessary to assure the institutional and/or engineering controls required for the site remain in place and effective. This plan should include but not be limited to:

- A description of all institutional controls and engineering controls as required by the environmental easement;

- A copy of the environmental easement for imposing the institutional controls on site;
- Provisions for the annual certification of the institutional and/or engineering controls;
- Appropriate plans for implementation of an institutional control, such as a soil management plan for handling soils removed from beneath a soil cover or cap; and
- Any provisions necessary to identify or establish methods for implementing the institutional controls required by the site remedy, as determined by the environmental easement.

15.0 REMEDIAL ACTION WORK PLAN

A Remedial Action Work Plan detailing the remedial action activities will be developed for the site which will include the following plans:

- Health and Safety Plan (HASP) - A Health and Safety Plan (HASP) will be developed for the project prior to initiating any remedial activity. It will provide specific guidelines and establishes procedures for the protection of personnel performing remedial activities. A Contingency Plan, to be implemented in the event of a threat to human health or an environmental hazard, is a component of the HASP. The HASP will contain the CAMP, which will provide the details to monitor air quality and minimize dust generation. Air quality will be monitored at the perimeter only while soil is disturbed during remediation. The CAMP outlines a monitoring protocol to monitor and minimize exposure to the public and establishes safe breathing levels surrounding the site during remediation (worker protection is addressed in the HASP).

- Quality Assurance Project Plan (QAPP) - This plan will be generic and germane to all sample collection and analysis. The plan will describe protocols and procedures necessary to assure that specific tasks and actions are planned and executed in a manner consistent with quality assurance objectives. These same protocols and procedures will be implemented during site remediation activities.

- Citizens Participation Plan (CPP) - The CPP will make the reports and documents available to the public for review.

- Soil Management Plan (SMP) and Field Sampling Plan (FSP): This plan shall document how soil will be excavated, screened, processed, stockpiled and relocated as warranted or disposed off-site. The FSP documents the frequency and type of field screening and confirmatory samples required to verify that the remedial objectives have been met.

- Remedial Design Drawings: The remedial design drawings will show the zone of consolidation, and other pertinent information for the remedial action.

16.0 SCHEDULE

16.1 Implementation

The anticipated time schedule for implementation of this plan is Fall 2004. The Volunteer intends to commence site remediation activities within two weeks of NYSDEC approval of the Work Plan.

16.2 Reporting

Quarterly progress reports will be provided to the NYSDEC during remedial activity and until the Certificate of Completion is obtained. Upon completion of the remedial activities, a Remedial Action Report will be provided to the NYSDEC.

17.0 PROJECT ORGANIZATION

The project organization, including functions and responsibilities, are described below.

Project Manager – Lou Russo, P.G.: Mr. Russo will be the primary contact with the NYSDEC. He will be responsible for establishing protocols to be used during the remedial activities, and establishing sampling methods. He will confirm implementation of established protocols, maintain quality and consistency, and monitor the overall work assignment, schedules, and budgets.

Project Director – Jim McIver: Mr. McIver will monitor project status and provide the project team with technical direction. He will assist Mr. Russo with project implementation and client and NYSDEC communications.

Task Manager, Field Operations Leader – Rick Kulzer: Mr. Kulzer will be responsible for executing the scope of work and for task-specific budgeting and scheduling. During field activities, he will be the liaison among field staff, subcontractors, and on-site representatives from NYSDEC.

Quality Assurance Officer – Lynn Matteson: The QAO will assist the project manager in the development of the sampling and analytical portion of the Quality Assurance Project Plan. The QAO or a designee shall conduct periodic field and sampling audits, interface with the analytical laboratory, and develop a project specific data usability report, if required by the NYSDEC.

Health and Safety – Kevin Miller, Ph.D.: The Health and Safety Officer will be responsible for review and approval of the site-specific Health and Safety Plan and ensuring that throughout the duration of the field activities all aspects of the Health and Safety Plan will be complied with. Mr. Miller will have authority to stop work should unacceptable health and safety risks occur.

18.0 REFERENCES

Cadwell, D.H., and E.H. Muller, 1989. Surficial Geologic Map of New York consisting of five sheets: Finger Lakes, Hudson-Mohawk, Niagara, Lower Hudson and Adirondack New York State Museum, Map Series No. 40.

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The Chazen Companies, 1999. Phase I Environmental Site Assessment – Former Sewage Treatment Plant.

The Chazen Companies, 2001. Phase II Subsurface Investigation – Former Sewage Treatment Plant Pine Street, Poughkeepsie, NY. Dated May 2001.

The Chazen Companies, 2003. Supplemental Phase II Subsurface Investigation – Former Sewage Treatment Plant Rinaldi Boulevard, Poughkeepsie, NY. Dated February 2003.

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TABLES

Table 1
Sampling Locations
Alternatives Analysis Report and Remedial Work Plan
Former Poughkeepsie Sewage Treatment Plant
Poughkeepsie, NY

Sample ID	Test Pit	Analysis	Sample Interval (bgs)	Horizon
624040303-01	PWD-1	RCRA 8 Tot/TCLP	4.5' – 6.5'	Fill
624040303-02	PWD-2	RCRA 8 Tot/TCLP	3' – 5'	Fill
624040303-03	PWD-2	RCRA 8 Tot/TCLP	Composite	Fill
624040303-04	PWD-3	RCRA 8 Tot/TCLP	7' – 9'	Fill
624040303-05	PWD-3	RCRA 8 Tot/TCLP	10' – 12'	Native Soil
624040303-06	PWD-4	RCRA 8 Tot/TCLP	0.5' – 4'	Fill (VOCs also)
624040303-07	PWD-4	RCRA 8 Tot/TCLP	6' – 8'	Native
624040303-08	PWD-5	RCRA 8 Tot/TCLP	1' – 3'	Fill
624040303-09	PWD-6	RCRA 8 Tot/TCLP	1' – 4'	Fill
624040303-10	PWD-6	RCRA 8 Tot/TCLP	6' – 8'	?Fill or Native
624040303-11	PWD-9	RCRA 8 Tot/TCLP	Composite	Fill
624040303-12	PWD-11	RCRA 8 Tot/TCLP	1.5' – 3.5'	Black Coal Ash?
624040303-13	PWD-11	RCRA 8 Tot/TCLP	Composite	Fill
624040303-14	PWD-12	RCRA 8 Tot/TCLP	Composite	Fill
624040303-16	PWD-14	STARS VOCs/Semivolatile organic compounds (SVOCs)	6' – 7'	Native

Table 2
Soil Analytical Data Summary
Alternative Analysis Report and Remedial Work Plan
Former Poughkeepsie Sewage Treatment Plant
Poughkeepsie, NY

Constituent	Applicable Criteria		Sample ID	PWD-1	PWD-2	PWD-2	PWD-3
	TAGM 4046	Toxicity	Sample Number	624040323-01	624040323-02	624040323-03	624040323-04
			Sample Depth	4.5' - 6.5'	3' - 5'	composite	7' - 9'
			Date	3/23/2004	3/23/2004	3/23/2004	3/23/2004
Total Metals			Units				
Mercury	0.1	—	mg/Kg	**0.3**	0.1	**0.16**	**1**
Arsenic	7.5 or SB	—	mg/Kg	4.5	4	6	5.7
Barium	300 or SB	—	mg/Kg	49.9	48.9	44.9	191
Cadmium	1 or SB	—	mg/Kg	0.09(u)	0.10(u)	0.094(u)	0.11(u)
Chromium	10 or SB	—	mg/Kg	**14.2**	**10.4**	**11.8**	**12.7**
Lead	SB (400)	—	mg/Kg	59.1	27.4	92.2	405
Selenium	2 or SB	—	mg/Kg	**3.8**	**5.1**	**3.1**	**3.8**
Silver	SB (2-6)	—	mg/Kg	1.3	0.55(u)	0.8	0.62(u)
TCLP Metals							
Mercury	—	0.2	mg/L	ND<0.0005	ND<0.0005	ND<0.0005	ND<0.0005
Arsenic	—	5	mg/L	ND<0.2	0.485	0.431	ND<0.2
Barium	—	100	mg/L	ND<0.4	ND<0.4	ND<0.4	ND<0.4
Cadmium	—	1	mg/L	ND<0.02	ND<0.02	ND<0.02	ND<0.02
Chromium	—	5	mg/L	ND<0.02	ND<0.02	ND<0.02	ND<0.02
Lead	—	5	mg/L	ND<0.2	ND<0.2	ND<0.2	ND<0.2
Selenium	—	1	mg/L	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Silver	—	5	mg/L	ND<0.02	ND<0.02	ND<0.02	ND<0.02
VOCs							
Trichloroethylene (TCE)	0.7	520	mg/kg	NA	NA	NA	NA
cis-1,2-Dichloroethylene	—	1,000	mg/kg	NA	NA	NA	NA

BOLD = value in excess of TAGM 4046 ND = None Detected NA = Not Analyzed — Not applicable
J = estimated value

Table 2
Soil Analytical Data Summary
Alternative Analysis Report and Remedial Work Plan
Former Poughkeepsie Sewage Treatment Plant
Poughkeepsie, NY

Constituent	Applicable Criteria		Sample ID	PWD-3	PWD-4	PWD-4	PWD-5
	TAGM 4046	Toxicity	Sample Number	624040323-05	624040323-06	624040323-07	624040323-08
			Sample Depth	10' - 12'	0.5' - 4'	6' - 8'	1' - 3'
			Date	3/23/2004	3/23/2004	3/23/2004	3/23/2004
Total Metals			Units				
Mercury	0.1	—	mg/Kg	0.054	**0.11**	0.5	0.05
Arsenic	7.5 or SB	—	mg/Kg	2.7	6.1	3.3	6.7
Barium	300 or SB	—	mg/Kg	25.6	129	40.2	22.9
Cadmium	1 or SB	—	mg/Kg	0.091(u)	0.098(u)	0.091(u)	0.094(u)
Chromium	10 or SB	—	mg/Kg	7.9	**12.2**	9.4	**18.6**
Lead	SB (400)	—	mg/Kg	15.7	182	44.3	20.1
Selenium	2 or SB	—	mg/Kg	2.2	**6.4**	2.3	4.6
Silver	SB (2-6)	—	mg/Kg	0.5(u)	0.54(u)	0.5(u)	0.52(u)
TCLP Metals							
Mercury	—	0.2	mg/L	ND<0.0005	ND<0.0005	ND<0.0005	ND<0.0005
Arsenic	—	5	mg/L	ND<0.2	ND<0.2	ND<0.2	ND<0.2
Barium	—	100	mg/L	ND<0.4	ND<0.4	ND<0.4	ND<0.4
Cadmium	—	1	mg/L	ND<0.02	ND<0.02	ND<0.02	ND<0.02
Chromium	—	5	mg/L	ND<0.02	ND<0.02	ND<0.02	ND<0.02
Lead	—	5	mg/L	ND<0.2	ND<0.2	ND<0.2	ND<0.2
Selenium	—	1	mg/L	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Silver	—	5	mg/L	ND<0.02	ND<0.02	ND<0.02	ND<0.02
VOCs							
Trichloroethylene (TCE)	0.7	520	mg/kg	NA	NA	NA	NA
Methylene Chloride	0.1	—	mg/kg	NA	NA	NA	NA

BOLD = value in excess of TAGM 4046 ND = None Detected NA = Not Analyzed — Not applicable

J = estimated value

Table 2
Soil Analytical Data Summary
Alternative Analysis Report and Remedial Work Plan
Former Poughkeepsie Sewage Treatment Plant
Poughkeepsie, NY

Constituent	Applicable Criteria		Sample ID	PWD-6	PWD-6	PWD-9	PWD-11
	TAGM 4046	Toxicity	Sample Number	624040323-09	624040323-10	624040323-11	624040323-12
			Sample Depth	1' - 4'	6' - 8'	composite	1.5' - 3.5'
			Date	3/23/2004	3/23/2004	3/23/2004	3/23/2004
Total Metals			Units				
Mercury	0.1	—	mg/Kg	**0.43**	0.063	**0.5**	0.076
Arsenic	7.5 or SB	—	mg/Kg	**8.2**	6.8	**14.2**	**9.4**
Barium	300 or SB	—	mg/Kg	115	42.2	170	82.1
Cadmium	1 or SB	—	mg/Kg	0.12	0.095(u)	0.89	0.091(u)
Chromium	10 or SB	—	mg/Kg	**22.5**	**14.6**	**14.6**	5.5
Lead	SB (400)	—	mg/Kg	213	21.5	**1010**	69.7
Selenium	2 or SB	—	mg/Kg	**5.7**	**4**	**4.1**	3.8
Silver	SB (2-6)	—	mg/Kg	**3.5**	0.52	0.53	0.50(u)
TCLP Metals							
Mercury	—	0.2	mg/L	ND<0.0005	ND<0.0005	ND<0.0005	ND<0.0005
Arsenic	—	5	mg/L	ND<0.2	ND<0.2	ND<0.2	ND<0.2
Barium	—	100	mg/L	0.68	ND<0.4	1.12	ND<0.4
Cadmium	—	1	mg/L	ND<0.02	ND<0.02	0.042	ND<0.02
Chromium	—	5	mg/L	ND<0.02	ND<0.02	0.512	ND<0.02
Lead	—	5	mg/L	0.212	ND<0.2	ND<0.2	ND<0.2
Selenium	—	1	mg/L	ND<0.05	ND<0.05	ND<0.05	ND<0.05
Silver	—	5	mg/L	ND<0.02	ND<0.02	ND<0.02	ND<0.02
VOCs							
Trichloroethylene (TCE)	0.7	520	mg/kg	0.0046	NA	NA	NA
Methylene Chloride	0.1	NA	mg/kg	0.011	NA	NA	NA

BOLD = value in excess of TAGM 4046 ND = None Detected NA = Not Analyzed — Not applicable
J = estimated value

Table 2
Soil Analytical Data Summary
Alternative Analysis Report and Remedial Work Plan
Former Poughkeepsie Sewage Treatment Plant
Poughkeepsie, NY

	Applicable Criteria		Sample ID	PWD-11	PWD-12	PWD-14
	TAGM 4046	Toxicity	Sample Number	624040323-13	624040323-14	624040323-16
Constituent			Sample Depth	composite	composite	6' - 7'
			Date	3/23/2004	3/23/2004	3/23/2004
Total Metals			Units			
Mercury	0.1	—	mg/Kg	**0.17**	**0.13**	NA
Arsenic	7.5 or SB	—	mg/Kg	6.1	4.6	NA
Barium	300 or SB	—	mg/Kg	71.7	39.5	NA
Cadmium	1 or SB	—	mg/Kg	0.098(u)	0.087(u)	NA
Chromium	10 or SB	—	mg/Kg	**11.3**	9.5	NA
Lead	SB (400)	—	mg/Kg	151	80.6	NA
Selenium	2 or SB	—	mg/Kg	3.6	2.6	NA
Silver	SB (2-6)	—	mg/Kg	0.54(u)	0.55	NA
TCLP Metals						
Mercury	—	0.2	mg/L	ND<0.0005	ND<0.0005	NA
Arsenic	—	5	mg/L	ND<0.2	ND<0.2	NA
Barium	—	100	mg/L	0.649	0.477	NA
Cadmium	—	1	mg/L	ND<0.02	ND<0.02	NA
Chromium	—	5	mg/L	ND<0.02	ND<0.02	NA
Lead	—	5	mg/L	ND<0.2	ND<0.2	NA
Selenium	—	1	mg/L	ND<0.05	ND<0.05	NA
Silver	—	5	mg/L	ND<0.02	ND<0.02	NA
VOCs						
Trichloroethylene (TCE)	0.7	520	mg/kg	NA	NA	ND
Methylene Chloride	0.1	NA	mg/kg	NA	NA	ND
Polynuclear Aromatic Hydrocarbons (PAHs)						
Phenanthrene	50	—	mg/kg	NA	NA	0.210 J
Anthracene	50	—	mg/kg	NA	NA	0.042 J
Fluoranthene	50	—	mg/kg	NA	NA	0.56
Pyrene	50	—	mg/kg	NA	NA	0.56
Benzo(a)anthracene	0.224	—	mg/kg	NA	NA	0.23 J
Chrysene	0.4	—	mg/kg	NA	NA	0.28 J
Benzo(b)fluoranthene	1.1	—	mg/kg	NA	NA	0.29J
Benzo(k)fluoranthene	1.1	—	mg/kg	NA	NA	0.11 J
Benzo(a)pyrene	0.061	—	mg/kg	NA	NA	**0.23 J**
Indeno(1,2,3-cd)pyrene	3.2	—	mg/kg	NA	NA	0.11 J
Benzo(g,h,i)perylene	50	—	mg/kg	NA	NA	0.12 J

BOLD = value in excess of TAGM 4046 ND = None Detected NA = Not Analyzed — Not applicable
J = estimated value

Table 3
Comparison of Historic and Recent Sampling Results
Alternatives Analysis Report and Remedial Work Plan
Former Poughkeepsie Sewage Treatment Plant
Poughkeepsie, NY

ID	Mercury	Arsenic	Barium	Cadmium	Chromium	Lead	Selenium	Silver
PWD-03*	**0.50**	5.7	191	0.11U	**12.7**	**405**	**3.8**	0.62U
STP-19**	**0.635**	ND	**669**	**16.4**	**171**	**693**	**3.4**	**76.8**

*Severn Trent, ** York

Table 4
Exposure Routes
Alternatives Analysis Report and Remedial Work Plan
Former Poughkeepsie Sewage Treatment Plant
Poughkeepsie, NY

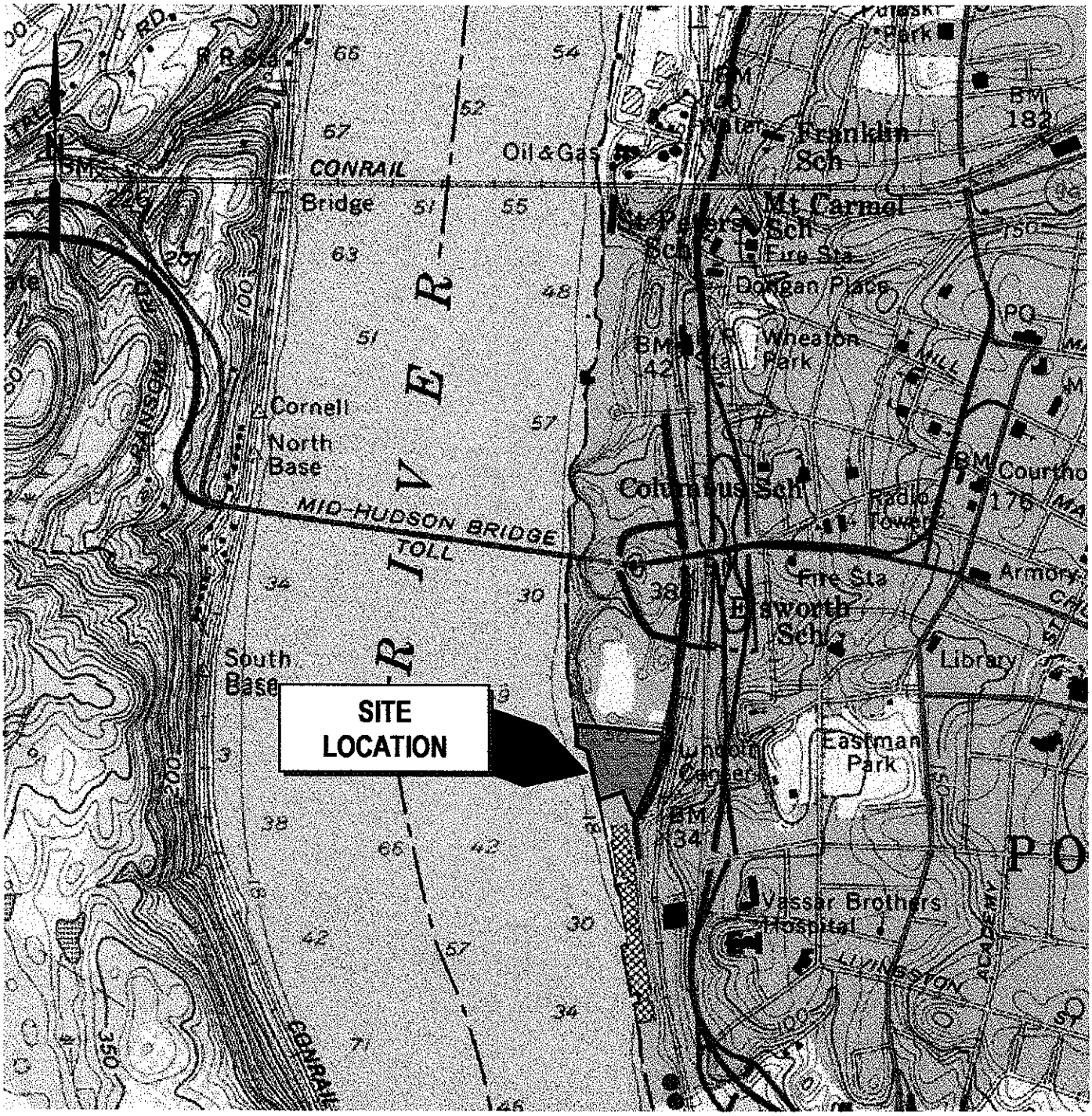
Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Potential COCs	Selected for Evaluation	Reason for Selection or Exclusion of Exposure Pathway
Soil	Subsurface Soil		Adults	Ingestion Dermal	Metals, SVOCs, VOCs	No	No exposure/access to subsurface soils known to exist. Metals bind tightly to soils, migration of metals not expected.
		Visitors	Children	Ingestion Dermal		No	
	Surface Soil		Adults	Ingestion Dermal	Metals	No	No surface exposure to impacted soils known to exist.
		Visitors	Children	Ingestion Dermal		No	

Table 5
Evaluation of Land Use Criteria
Alternatives Analysis Report and Remedial Work Plan
Former City of Poughkeepsie Sewage Treatment Plant
Poughkeepsie, NY

1. Current, intended or reasonably anticipated future land uses of the site	The site was historically used for industrial and commercial purposes including a sewage treatment plant. The proposed site development is for commercial use and is consistent with the historic use, the City of Poughkeepsie's Master Plan and goals of the City.
2. Historical and/or recent development patterns shall be considered;	Historically, this portion of the waterfront was industrial and/or commercial. Recent trends in the City waterfront development have included commercial, residential uses and municipal park land. The proposed site development is complimentary to the waterfront development trend and the facility would support the local population.
3. Brownfield Opportunity Areas - is the site within a BOA, and if so, is it consistent with the land use vision/plan?	The site is currently not part of a Brownfields Opportunity Area.
4. Applicable Comprehensive Community Master Plans including local waterfront revitalization plans	There is a Waterfront Development Plan and a Comprehensive Master Plan for the City of Poughkeepsie. The proposed revitalization of this property is consistent with the City's goals for this region.
5. Proximity to residential property, and urban, commercial, industrial, agricultural and recreational areas	There are residential housing units located immediately to the north of the proposed development. Vacant land currently exists to the south but it is part of a proposed commercial and parkland development. Immediately to the east lies the Metro-North Rail Line. The Hudson River lies west of the site.
6. Environmental Justice Concerns	This project will provide opportunity for all racial, ethnic, and/or socioeconomic groups and is consistent with DEC Policy No. CP-29. The implementation and enforcement of environmental laws, regulations, and policies has not been compromised by the advancement of this project. This project addresses an existing negative environmental consequence resulting from historic placement of the former industrial facility in what was formerly a depressed area of the municipality and as such adjusts an inequity.
7. Federal or State land use designation	This property abuts the Hudson River, which is part of the State's Coastal Management Zone. The portions of the property

	abutting the Hudson are not under the control of the Volunteer and will be part of the Riverwalk created by the City of Poughkeepsie.
8. Population growth patterns and projections	The population of Dutchess County is growing and based on the new housing stats, will continue to grow for the foreseeable future.
9. Accessibility to existing infrastructure;	The parcel is accessible to all existing infrastructure, is close to public transportation and is currently serviced by the local utility provider. There are no significant issues related to infrastructure and access.
10. Proximity to Cultural Resources	The site is in close proximity to the Hudson River, which is considered an important cultural resource. There are no known significant federal or state historic or heritage sites or Native American religious sites on or in close proximity to the site
11. Proximity to Natural Resources	There are no known fish and wildlife resources that presently exist or that existed before the contamination occurred that are endangered by historic activities. Sampling indicates that the potential contaminant migration pathways that affect the local fish and wildlife don't exist.
12. Potential vulnerability of groundwater	Based on available data, groundwater has not been impacted by the release of the contaminants at this site. Additionally, the site is provided with municipal water, so groundwater is not used as a resource. The Hudson River, the nearest sensitive receptor has not been impacted by the release.
13. Proximity to floodplains	The portion of the property that is under consideration for development does not lie within the flood plain of the Hudson River.
14. Geography and geology;	The site conditions are described in detail in the report. There are no unique or unusual geographic or geologic features at the site.
15. Current institutional controls at the site	There are a number of utility easements already in place that will remain. An environmental easement will be implemented at the site as part of the remedial plan.

FIGURES



0 1000 2000

APPROXIMATE SCALE: 1"= 1000'

FIGURE 1

MAP REFERENCE:

THIS MAP WAS PREPARED FROM THE FOLLOWING 7.5 MINUTE SERIES TOPOGRAPHIC MAPS: POUGHKEEPSIE, NEW YORK

Fuss & O'Neill Inc. *Consulting Engineers*
56 QUARRY ROAD, TRUMBULL, CONNECTICUT 06611
(203)374-3748

SITE LOCATION MAP

FORMER SEWAGE TREATMENT PLANT

POUGHKEEPSIE NEW YORK

PROJ. NO. 20040267A1N DATED : September 2004 SCALE: 1"=1000'

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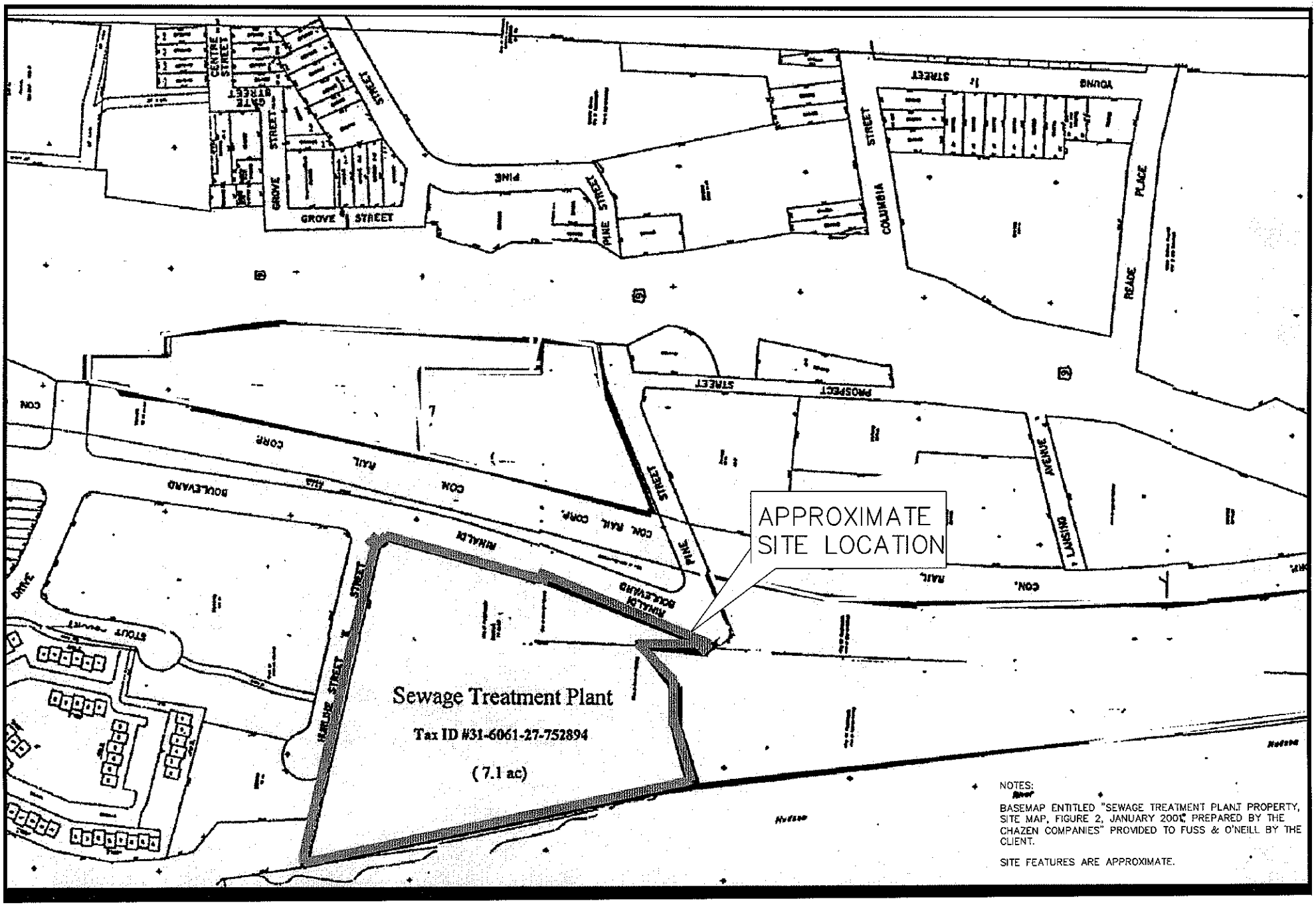

NOTES:

BASEMAP ENTITLED "SEWAGE TREATMENT PLANT PROPERTY, SITE MAP, FIGURE 2, JANUARY 2001", PREPARED BY THE CHAZEN COMPANIES" PROVIDED TO FUSS & O'NEILL BY THE CLIENT.

SITE FEATURES ARE APPROXIMATE.

SCALE:
HORZ.: NTS
VERT.:
DATUM:
HORZ.:
VERT.:
0
GRAPHIC SCALE

FUSS & O'NEILL INC. *Consulting Engineers*
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SITE PLAN
FORMER SEWAGE TREATMENT PLAN PROPERTY
ALTERNATIVES ANALYSIS REPORT
AND REMEDIAL WORK PLAN
POUGHKEEPSIE NEW YORK

PROJ. No.: 20040267A1N
DATE: JANUARY 2005

FIGURE 2