Buffalo Outer Harbor Property
Remedial Alternatives Report

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Prepared for:

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Submitted by:

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List of Abbreviations and Acronyms

FS	Feasibility Study
NFTA	Niagara Frontier Transportation Authority
NYSDEC	New York State Department of Environmental Conservation
O & M	operation and maintenance
PAHs	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
PSA	Preliminary Property Assessment
RAR	Remedial Alternatives Report
RCRA	Resource and Recovery Act
RI	Remedial Investigation
ROD	Record of Decision
RTA	radio tower area
SCG	standards, criteria, and guidance
SVOCs	semivolatile organic compounds
TAGM	Technical Assistance Guidance Memorandum
TCL	Target Compound List
USEPA	United States Environmental Protection Agency

1 Introduction

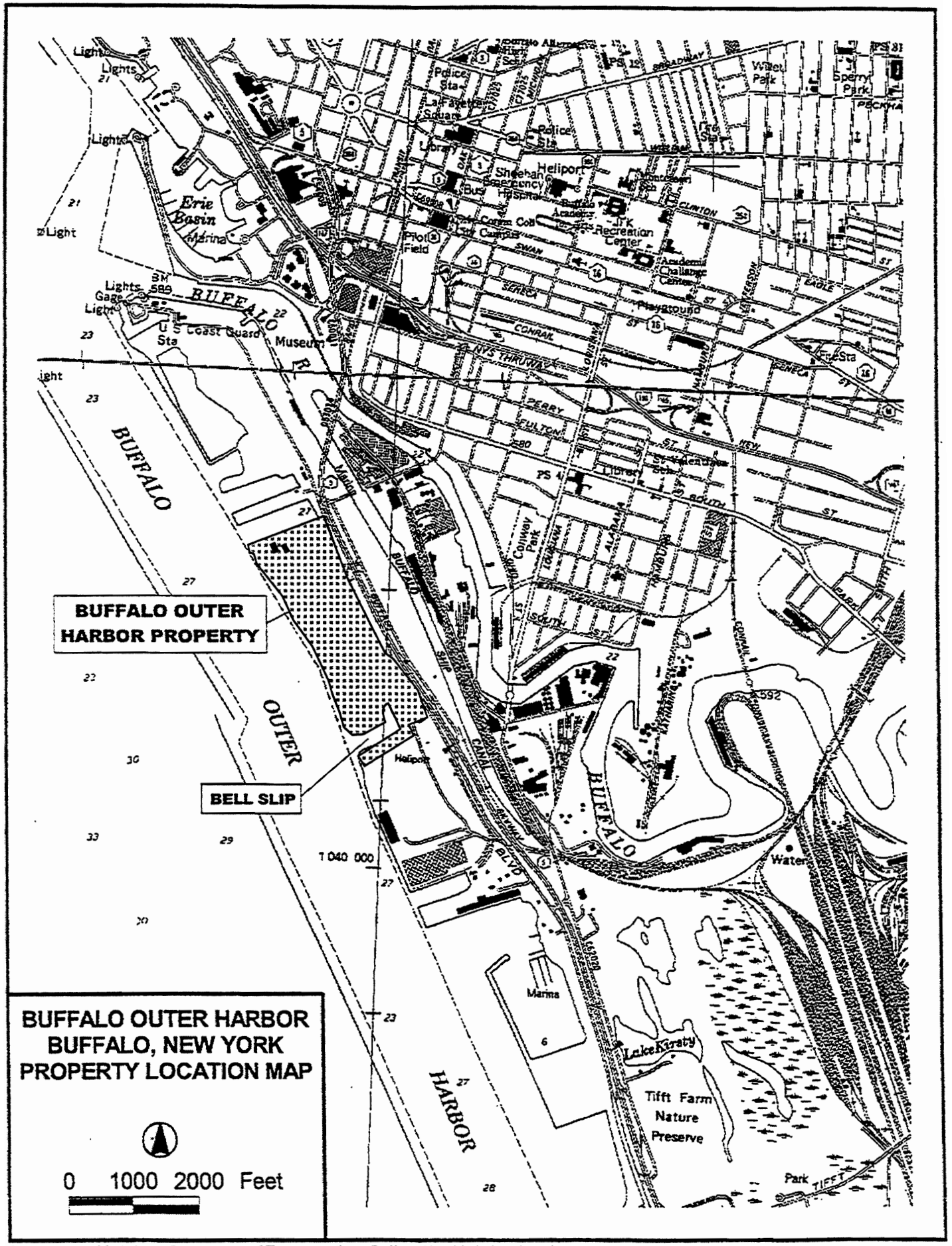
The introductory section of this Remedial Alternatives Report (RAR) was developed using information from the 1995 Outer Harbor Site Phase I/Phase II Remedial Investigation (RI) Report and the 1998 Buffalo Outer Harbor Site Feasibility Study (FS) Report, both prepared for the New York State Department of Environmental Conservation (NYSDEC), and the 1999 Remediation Application under the New York State Clean Water/Clean Air Bond Act, prepared by the Niagara Frontier Transportation Authority (NFTA).

1.1 Purpose and Organization of Report

As part of the 1996 New York State Clean Water/Clean Air Bond Act's Environmental Restoration (Brownfields) Program, the NFTA is proposing a Brownfields Remediation Project for the Buffalo Outer Harbor property, located in the city of Buffalo, Erie County, New York (see Figure 1-1). The property is currently owned by the NFTA. The purpose of the Outer Harbor Remediation Project is to develop a focused, long-term, cost-effective, and environmentally sound remediation plan for the property. Once remediated, the property is expected to be attractive for recreational, commercial, and other types of uses.

The report, which focuses only on a 60-acre portion of the 113-acre property, presents the effectiveness, implementability, and cost of alternative remedial actions developed for the site in the 1998 FS. This 60-acre portion is considered to be the area of the property most likely to be developed first.

The degree of remediation required to protect human health and the environment at the Buffalo Outer Harbor property is a function of site use, which will define potential receptors, possible contaminant migration pathways, and the frequency and intensity of exposure that may occur as a result of contact with existing or residual contamination, which in turn affects the remedy chosen.



Source: New York State Department of Transportation - Buffalo, New York Quadrangle

Figure 1-1

This RAR presents relevant background information on the Outer Harbor site, including its environmental history and the type and extent of environmental investigations that have been conducted on the site over the past ten years. Section 2 discusses the development of remedial alternatives for the site and Section 3 provides a focused analysis of identified remedial alternatives.

1.2 Background Information

1.2.1 Site Description

Located approximately one mile south of downtown Buffalo, the 60-acre portion of the Outer Harbor property is bordered on the west by the Buffalo Outer Harbor (Lake Erie), on the east by Fuhrmann Boulevard, on the north by a commercial development (a former restaurant/bar), and on the south by the Bell Slip (see Figure 1-1). The Buffalo Ship Canal and the Buffalo River are located approximately 500 and 2,000 feet east of the property, respectively.

This RAR deals with an approximately 60-acre area in the northwest portion of the 113-acre property. This report does not cover the 6-acre parcel in the southern portion of the property, site of the NFTA radio transmission tower and commonly referred to as the radio tower area (RTA). The RTA, an area of separate concern, is currently listed on the NYSDEC Registry of Inactive Hazardous Waste Sites as a Class 2 site. The remaining 47 acres of the site will not be discussed in detail in this report.

1.2.2 Site History

The entire Outer Harbor property has a long and complex history of landfilling activities. In the early 1800s, Lake Erie shoreline lay east of present-day Fuhrmann Boulevard and Route 5. In about 1840, a sea wall was constructed along the shoreline at the approximate location of Route 5. During the period from about 1865 to 1890, an outer harbor breakwall was constructed approximately 2,000 feet offshore. During this period, numerous railroad facilities and storage yards were constructed in the area near the foot of Michigan Avenue (see Figure 1-1).

Most of the Buffalo Outer Harbor property was created as a result of land reclamation and filling activities that have occurred from approximately 1870 through the 1980s. The Michigan Avenue pier, located just north of the property, was constructed in 1926. Another pier, situated in the southern portion of the property where present-day Port Terminal A is located, was constructed in 1931. The remaining portions of the property between the Michigan Avenue Pier and Terminal A were filled by various methods.

In 1991, NFTA conducted a Preliminary Property Assessment (PSA) of the entire property and reported the following filling activities:

> From the 1930s through the 1950s, Ford Motor Company owned and occupied Terminal A in the southern portion of the site. The fill area located north of the Terminal A building was allegedly used by Ford to dispose of cafeteria waste and office and general plant refuse. (Unknown quantities of furnace casting sands from the Chevrolet plant in Buffalo were also reportedly disposed of in the area.) The Niagara Frontier Port Authority acquired Ford's interests in the area in 1960.
>
> The PSA indicated that in the mid-1940s four city of Buffalo dumps were in use for the disposal of ashes, noncombustible rubbish, and residue from the city's incineration plant. One of the dump areas described in the report is the Fuhrmann Boulevard landfill.
>
> In the 1950s, the U.S. Army Corps of Engineers was contracted to dredge the Buffalo Outer Harbor Shipping Channel and the diked area north of Terminal A. The spoil dredged from the area near the Union and Lackawanna Canals was placed in the southern portion of the property. Dredging spoil removed from the Outer Harbor Channel was used to fill the northern portion of the property.
>
> From the 1950s through the 1970s, NFTA acquired property in the area from Ford, various railroad companies, and the state of New York.
>
> From approximately 1969 to 1988, William Pfohl Trucking Corporation, as stevedore for NFTA, operated a bulk cargo storage area where dry bulk materials were stored and delivered from the property. The materials included rock salt, zircon and sand, foundry sand (from Chevrolet and the River Road Foundry), iron-ore pellets, ball and china clay, gypsum rock, potash, and scrap metal.

In 1996, because of the PSA prepared by NFTA, it was determined that the existence of hazardous waste on the property presented a potential threat to human health and the environment. Consequently, the entire 113-acre Outer Harbor property was listed on the NYSDEC Registry of Inactive Hazardous Waste Sites as a

Class 2 site. NYSDEC completed a remedial investigation and feasibility study (RI/FS) of the property to determine the nature, extent, and sources of contamination, and the risk posed by the property. The RI/FS evaluated the property using a risk-based land-use approach. This resulted in the development of a Land Use and Remedial Plan Matrix. The preferred remedial alternatives presented in Section 3 of this report all make use of soil (or other material) covers.

Except for the Allen Boat Company, located adjacent to the Bell Slip, the property is currently vacant. The meets and bounds of the Outer Harbor hazardous waste site were revised and the subject 60-acre portion of the property is not included on the NYSDEC Registry of Inactive Hazardous Waste Sites. The RTA to the south remains listed as a Class 2 site.

1.2.3 Nature and Extent of Contamination

The entire Buffalo Outer Harbor property has been extensively investigated as part of the New York State Superfund Program. An RI was completed for the site in 1995 (NYSDEC 1995).

The RI for the Outer Harbor was conducted in two phases. The first phase was conducted between May and November 1994, and the second phase in June 1995. A report entitled *Phase I/Phase II Remedial Investigation Report, Buffalo Outer Harbor Property*, describes the field activities and findings of the RI in detail (NYSDEC 1995).

The Phase I/Phase II RI field programs for the entire Buffalo Outer Harbor Site included the following:

- surface soil sampling;
- monitoring well and piezometer installation;
- test pit excavation;
- subsurface soil sampling;
- surface water sampling;
- groundwater sampling;
- ambient air sampling;
- an air monitoring and radiation survey;

- a wildlife habitat survey; and
- a monitoring well and borehole survey.

To determine which media (soil, groundwater, etc.) contained contaminants at levels of concern, the RI analytical data were compared to New York State Standards, Criteria, and Guidance (SCG)values. Groundwater, drinking water, and surface water SCGs identified for the Buffalo Outer Harbor property were based on NYSDEC Ambient Water Quality Standards and Guidance Values and on Part V of NYS Sanitary Code. NYSDEC Technical Assistance Guidance Memorandum (TAGM) 4046 soil cleanup guidelines for the protection of groundwater, background conditions, and United States Environmental Protection Agency (USEPA) remediation criteria were used as SCGs for the soil. The NYSDEC Division of Fish and Wildlife *Technical Guidance for Screening Contaminated Sediments* was used for surface water sediments.

Comparison of the RI results to the SCGs showed that the vast majority of the 113-acre property contained consequential amounts of hazardous waste (chiefly metals, polycyclic aromatic hydrocarbons [PAHs], and some polychlorinated biphenyls [PCBs]). The concentrations of these wastes are not levels that present a threat to human health or the environment considering environmental exposure routes under current site usage. Therefore, in October 1997, NYSDEC served public notice that over 100 acres of the property would be removed from the area listed on the Registry of Inactive Hazardous Waste Disposal Sites. The RTA was the only part of the property that remained on the registry. The approximately 60 acres that are the focus of this RAR are not included in the registry. Elevated direct contact usage of the 60-acre portion of the property could result in significant threats to human health.

Buffalo Outer Harbor Property Soils

As part of the entire 113-acre site survey, a rectangular sampling grid was established with 100-ft nodes, resulting in 112 surface soil sampling locations. Seventy-one surface soil samples were collected north of the Bell Slip in the 60-acre portion of the site. The samples were analyzed for Target Compound List (TCL) semivolatile organic compounds (SVOCs), pesticides, PCBs, and metals. In general, surface soils north of the Bell Slip were found to contain relatively low levels of PAHs (average concentration less than 3.6 mg/kg), PCBs (1.3 mg/kg average and 12 mg/kg highest concentrations) and low to moderate levels of metals, including:

- lead (157 mg/kg average and 815 mg/kg highest concentrations);
- copper (62 mg/kg average and 29,500 mg/kg highest concentrations); and
- zinc (approximately 200 mg/kg average and 874 mg/kg highest concentrations) (NYSDEC 1995).

One hundred twenty-two subsurface soil samples were collected from 62 soil borings installed across the 113-acre site during the RI. Sixty-five subsurface soil samples were collected from 27 soil borings north of the Bell Slip. All soil borings were continuously sampled with a split spoon and were visually logged by a geologist using the Modified Burmeister Soil Classification System. Results showed that the Outer Harbor consists primarily of hydraulic fill, sand fill, construction and demolition debris, and landfill debris. The area north of the Bell Slip near Fuhrmann Boulevard (described as containing landfill debris) is likely to be part of the former Fuhrmann Boulevard Landfill, which was known to have received incinerator ash. Samples were analyzed for SVOCs (including PAHs), pesticides, PCBs, and metals.

In general, subsurface soils (0 to 8 feet below grade) north of the Bell Slip were found to contain elevated levels of PAHs (average concentration less than 3.8 mg/kg), and metals, including:

- lead (less than 390 mg/kg average and 1200 mg/kg highest concentrations);
- copper (less than 670 mg/kg average and 1,460 mg/kg highest concentrations),;
- arsenic (10.6 mg/kg average and 34 mg/kg highest concentrations);
- nickel (less than 20 mg/kg average and 55.6 mg/kg highest concentrations); and
- zinc (less than 970 mg/kg average and 4,230 mg/kg highest concentrations) (NYSDEC 1995).

The highest concentrations of contaminants were generally found in suspected former landfill areas (NYSDEC 1995). Results of

sampling of surface and subsurface soils for the Buffalo Outer Harbor property are presented in Appendix A (NYSDEC 1995).

Groundwater samples were obtained from monitoring wells constructed throughout the Buffalo Outer Harbor property. Groundwater sample results from areas outside the RTA showed low levels of metals and low levels of SVOCs above the Class GA groundwater standards. Detected concentrations of sodium, manganese, magnesium, and iron may be attributed to waste disposal at the former Fuhrmann Boulevard Landfill, bulk storage activities that occurred on site, or general groundwater quality near the site.

Surface Water

Due to the apparently limited migration of groundwater contaminants and the low permeability of the fill material, chemical loading to Lake Erie appears to be minimal under current conditions. The results of the analysis of samples collected from the surface water of Lake Erie (Outer Harbor), Bell Slip, and Michigan Avenue Slip indicate that surface water in the vicinity of the Buffalo Outer Harbor property is not being impacted by contaminants associated with the property.

Sediment

Levels of lead and zinc above NYSDEC sediment criteria were detected in two of the three sediment samples collected from the Bell Slip. These levels may be attributed to runoff from the Outer Harbor property. Consistently low levels of pesticides, PAHs, and PCBs were detected in nearly all sediment samples collected in Lake Erie (Outer Harbor), the Michigan Avenue Slip, and the Bell Slip, including the background sample collected at the harbor entrance. The sediment samples from Lake Erie, with few exceptions, were below the NYSDEC Division of Fish and Wildlife lowest-effect sediment screening criteria. NYSDEC has concluded that such contaminants are ubiquitous in urban industrial settings, and that surface runoff from the Outer Harbor property is not contributing significant amounts of contamination to the Outer Harbor sediments.

1.2.4 Risk Assessment

A Qualitative Health Risk Assessment, dated December 1995, was prepared for the entire 113-acre Buffalo Outer Harbor property. In this assessment, chemicals of concern and potential exposure pathways and receptors at the property were evaluated. The potential exposure pathways include the following (as summarized in NYSDEC 1998):

- ingestion of contaminated soil;
- inhalation of vapors or airborne particulate-bound contaminants;
- dermal absorption of contaminants via direct contact with waste, contaminated soil, or groundwater; and
- direct contact with contaminated runoff.

Potential human receptors in the area of the site include onsite workers, individuals accessing the site for fishing, recreation, or other purposes, and persons in the immediate vicinity of the site. The Health Risk Assessment evaluated each area of the site individually. A summary of the conclusions of the assessment for each of these areas is provided below.

Area East of the Asphalt Road

Only one surface soil sample in this area north of the Bell Slip showed elevated levels of PAHs. This area of the property (see Figure 1-2) is covered with well-tended low grass and has little or no exposed soil or debris. Due to the relatively low concentrations and limited extent of chemicals of concern in this area, and to the low potential for direct human contact with surface soils, health risk appears to be low for this area.

Because of the limited potential for human or wildlife exposure to subsurface soils or groundwater, remediation in this area is not presently warranted. Modification of the site, however, may include excavation, an activity that would require appropriate precautions to limit exposure to chemicals of concern.

Area West of the Asphalt Road

Three localized areas of elevated carcinogenic PAH concentrations in surface soil were found in the Area West of the Asphalt Road in the area north of the Bell Slip. Wind erosion and vehicular traffic may cause air transport of soil particles, creating the potential for inhalation or ingestion of these particles by human or wildlife receptors. Direct contact with these soils is also possible for persons who access this area of the property for parking or recreation. Due to the carcinogenicity of these compounds and to the potential increase in frequency of human exposure should the property be developed, these soils should be considered for remediation. Carcinogenic PAHs were detected in several shallow subsurface samples, but these locations do not appear to correlate with carcinogenic PAHs found in surface soils (NYSDEC 1998).

Under the current conditions of limited potential for human or wildlife exposure to subsurface soils or groundwater, environmental media in this area do not warrant remediation. Modification of the site, however, may include excavation, an activity that would require appropriate precautions to limit exposure to chemicals of concern.

Eastern Portion of Former Restaurant Gravel Parking Area

Wind erosion and vehicular traffic can cause air transport of soil particles in this area north of the Bell Slip, creating the potential for inhalation or ingestion of these particles by human or wildlife receptors. Potential also exists for direct contact by persons who access this area of the property for parking or recreation.

PCBs, lead, arsenic, and carcinogenic PAHs were detected at elevated levels in these surface soils. The potential for human exposure to these chemicals is high under both current and future-use scenarios. Therefore, measures should be taken to remediate or restrict access to the surface soil in this area under both current and future-use scenarios (NYSDEC 1998).

2 Identification and Development of Alternatives

The identification and development of remedial alternatives for the property is based on the FS for the Outer Harbor (NYSDEC 1998).

2.1 Remedial Action Objectives

Remedial action objectives are goals developed for the protection of human health and the environment. Definition of these objectives requires an assessment of the contaminants and media of concern, exposure routes and receptors, and remediation goals for each exposure route. NYSDEC has determined, based on a comparison of the RI results to SCGs and to potential public health and environmental exposure rates, that the vast majority of the property (including the 60-acre area that is the subject of this RAR) does not contain hazardous waste at levels presenting a threat to human health or the environment (NYSDEC 1998). The remedial action objectives for this property, therefore, allow for the development of alternatives that would minimize the likelihood of exposure to the low-level site contamination under reasonably anticipated future land-use scenarios.

The remedial action objectives developed for the Buffalo Outer Harbor property as identified in the FS are:

1. Prevent or reduce, to the extent possible, the potential for direct contact exposure to contaminated soils; and

2. Prevent or reduce, to the extent possible, the potential for surface runoff from surficially contaminated portions of the property to transport contaminated soils to adjacent surface water.

SCGs are also to be considered when formulating, screening, and evaluating remedial alternatives. SCGs may be categorized as contaminant-specific, location-specific, or action-specific. Federal statutes, regulations, and programs may apply to the site where New York State standards do not exist. A summary of preliminary

SCGs for the Buffalo Outer Harbor property is presented in Table 2-1.

Table 2-1 Standards, Criteria, and Guidance Values for the Buffalo Outer Harbor Property

Statute, Regulations or Program	Applicability	Category
NYSDEC Ambient Water Quality Standards and Guidance Values (TOGS 1.1.1)	Applicable to all sources of groundwater and surface water	Action-specific, Contaminant-specific, Location-specific
Water Quality Standard for Groundwater (6 NYCRR Part 703.1)	Applicable to all sources of groundwater	Action-specific, Contaminant-specific, Location-specific
NYSDEC Air Guide-1 (New York State Air Guidelines for the Control of Toxic Ambient Air Contaminants)	Applicable where remedial activities will impact ambient air quality	Action-specific, Contaminant-specific
Clean Air Act	Applicable where remedial activities will impact ambient air quality	Action-specific, Contaminant-specific
National Primary and Secondary Ambient Air Quality Standards	Applicable where remedial activities will impact ambient air quality	Action-specific, Contaminant-specific
NYSDEC Fugitive Dust Suppression and Particulate Monitoring Program at Inactive Hazardous Waste Sites (TAGM 89-4031)	Applicable where remedial activities will impact ambient air quality	Action-specific
NYSDEC Hazardous Waste Treatment Storage and Disposal Facility Permitting Requirements (6 NYCRR Part 373-1)	Applicable to potential treatment, storage and disposal of hazardous wastes	Action-specific, Contaminant-specific
NYSDEC Land Disposal Restrictions (6 NYCRR Part 376)	Applicable to disposal of hazardous wastes	Action-specific, Contaminant-specific
United States Environmental Protection Agency (USEPA) Land Disposal Restrictions (40 CFR Part 268)	Applicable to disposal of hazardous wastes	Action-specific, Contaminant-specific
Occupational Safety and Health Administration (OSHA) Regulations (29 CFR 1900-1999)	Applicable to workers and workplace throughout implementation of investigation activities and remedial actions	Action-specific, Contaminant-specific, Location-specific
Hazardous Materials Transportation (49 CFR 170-189)	Applicable to off-site transport of hazardous materials	Action-specific
New York State Uniform Procedures Act	Applicable to projects requiring a State Pollutant Discharge Elimination System permit	Action-specific, Contaminant-specific

Table 2-1 Standards, Criteria, and Guidance Values for the Buffalo Outer Harbor Property

Statute, Regulations or Program	Applicability	Category
New York Water Classifications and Quality Standards (6 NYCRR Parts 609; 700-704)	Applicable to alternatives that generate water requiring discharge to surface water	Action-specific; Contaminant-specific
New York Regulations on State Pollution Discharge Elimination System (SPDES) (6 NYCRR Parts 750-758)	Applicable to alternatives that generate water requiring discharge to surface water	Action-specific; Contaminant-specific
Clean Water Act	Applicable for alternatives that generate water residuals requiring treatment with point-source discharges to surface water	Action-specific; Contaminant-specific
Toxic Pollutant Effluent Standards	Applicable to alternatives that generate water residuals containing toxic pollutants that are discharged into navigable water	Action-specific; Contaminant-specific
Wetland Executive Order - Executive Order No. 11990	Potentially applicable to a small area south of the Bell Slip designated as a small intermittent ponded water wetland according to National Wetlands Inventory Mapping	Location-specific
Executive Order on Floodplain Management (Executive Order No. 11988 40 CFRs 6.302[b] and Appendix A)	Potentially applicable to remediate actions that would include the development of a floodplain	Location-specific
Floodplain Management Regulation-Development Permits 6 NYCRR 500	Potentially applicable to remedial actions that are conducted within floodplain areas	Location-specific

Source: NYSDEC 1998.

Several of the contaminant-specific SCGs listed in Table 2-1 do not apply to soil contaminants. Preliminary chemical-specific soil and groundwater SCGs for the Buffalo Outer Harbor property include proposed screening criteria used during the Phase I/Phase II RI to define soil contaminants of concern and New York State Class GA Groundwater Standards and Guidance Values. The soil screening levels for the contaminants of concern are taken from the site FS (NYSDEC 1998).

The following levels, reported in the site FS, were used as screening criteria for the Buffalo Outer Harbor property in the Phase I/Phase II RI Report:

- Surface Soil/Subsurface Soil

Total VOCs	10 mg/kg
Total SVOCs	500 mg/kg
Total PAHs	100 mg/kg
Total Carcinogenic PAHs	10 mg/kg
Total PCBs (Surface)	1 mg/kg
Total PCBs (Subsurface)	10 mg/kg
Nitrobenzene	14 mg/kg
Antimony	20 mg/kg
Arsenic	20 mg/kg
Cadmium	10 mg/kg
Copper	200 mg/kg
Chromium	100 mg/kg
Lead	500 mg/kg
Mercury	10 mg/kg
Nickel	40 mg/kg
Zinc	500 mg/kg

- Groundwater - NYSDEC Class GA groundwater standards and guidance values.

2.2 General Response Actions

The general response actions to achieve the remedial action goals appropriate for the property include removal or containment. Onsite treatment of the contaminated soil is not considered cost-effective because of the relatively low contaminant levels.

As discussed in the FS for the property, there is a strong likelihood that the property will be developed for a mix of residential, recreational, and commercial uses. The most appropriate response action for the site will be highly dependent upon future use. Because the extent and exact nature of future use is presently unknown, it is not possible to accurately determine at this time the area and volume of contaminated media to be reasonably addressed by a general response action.

2.3 Development of Alternatives

In 1996, NYSDEC conducted an FS of the property to identify a series of potential remedial alternatives for the site. The results of the FS, issued in July 1998, indicated that "the majority of the Outer Harbor property, excluding the Radio Tower Area, is not significantly contaminated." The alternatives analysis was conducted on the basis of potential future uses of the property and on the criteria specified in the NYSDEC TAGM 4030. The remedial

alternatives analyzed in the draft FS included the following for the area north of the Bell Slip:

- **Alternative 1 – No Action.** Under this alternative, contaminated soil and groundwater would remain in its present condition. No remedial action would be taken. Access restrictions would not be implemented because the RI concluded that the site poses no significant risk under the current use (see Section 2.1).

- **Alternative 2 –Soil Excavation and Replacement.** Under this alternative, soil would be excavated to approximately 3-feet to 15-feet deep and disposed of off site. Clean soil would then be brought to the site to fill the excavations.

- **Alternative 3 – Soil Cover.** Under this alternative, a 1-foot-thick soil cover would be placed over the portion of the property north of the Bell Slip and west of the asphalt road. A soil cover up to 3-feet-thick would be installed over the remaining portion of the property north of the Bell Slip.

Further discussion of these alternatives is in the following section.

3 Detailed Analysis of Alternatives

3.1 Introduction

The future uses proposed for the Outer Harbor property are identified in NFTA's Outer Harbor Development Plan, approved by the NFTA Board of Commissioners in 1988 (NFTA 1988). Consistent with the conclusions of the plan, NFTA believes the property can be developed for several different types of uses, including a mix of residential, recreational, and/or commercial uses.

Because it is likely that the property will be developed, it is necessary to identify remedial alternatives that will allow for protection of human health and the environment during and after such development. In many cases, development of the property can be consistent with and part of the remedial alternatives. The following section presents the remedial alternatives that meet remedial action objectives for the property without inhibiting future development of the property.

3.2 Alternatives Analysis

It was determined in the FS that levels of contaminants on the property do not pose a significant threat to human health or the environment under current conditions and use. The FS also determined that, under present conditions and use, remedial measures would not be necessary.

As established in the Health Risk Assessment, if land use should change in such a way as to increase exposure to contaminants, remedial measures may, in the interest of protecting human health and the environment, have to be implemented.

Because of the low levels of groundwater contamination at the property and the apparent lack of present or future impacts to the Buffalo Outer Harbor due to groundwater contaminant loadings from the property, it was determined in the FS that groundwater remediation would not have be evaluated as part of the FS. Instead

the FS focused on remediation of soil contamination, based only on potential site use.

3.2.1 Remedial Measures

Although NFTA has a development plan for the property, the property's future has not been determined to a sufficient level of detail as to permit selection of the most appropriate remedial measures for each portion of the property. Moreover, although it is possible to predict near-term use of the property, it is not possible to predict long-term use. For these reasons, selection of remedial alternatives and associated costs are driven by future use of the site. The matrix presented in Table 3-1 addresses various potential future land uses and associated recommended remedial alternatives. By presenting a mix of remedial measures based on proposed land use, it becomes possible to select an appropriate set of remedial measures that allow development of the property while substantially reducing risk to human health and the environment.

Remedial measures determined to be appropriate for the property include:

1. Pavement/Building Cover (as part of site development);

2. Soil Cover;

3. Soil Excavation and Replacement; and

4. Deed and Access Restrictions (Activity and Use Limitations).

The following material, based on the FS, provides a brief description of each of the remedial measures.

Pavement/Building Cover

Pavement, in the form of roadways, parking lots or recreational facilities and structures (e.g., commercial and industrial buildings or recreational facilities), would be used as a means to mitigate surface contact with contaminated soils. This cover would also mitigate infiltration of precipitation through the soil.

Soil Cover

A soil cover consisting of up to 2 feet of general fill and topsoil would be placed over the areas of the property east of the asphalt road. A 1-foot thick permeable cover consisting of general fill

Table 3-1 Recommended Remedial Plan, Buffalo Outer Harbor, Land Use and Remedial Plan Matrix

Site Areas	Land Use and Preferred Remedial Alternatives			
	Current Use	Residential	Recreational	Commercial/Industrial
North of Bell Slip				
West of asphalt road	Deed restriction (restricted to current use)	Limited soil cover (1 foot) as part of site development and deed notification	Limited soil cover (1 foot) as part of development and deed notification	Limited soil cover (1 foot) as part of development and deed notification
East of asphalt road	Deed restriction (restricted to current use)	Soil removal and replacement (0-15 feet)[a]	Pavement/building cover (or up to 2-foot soil cover or 2-foot soil excavation and replacement) and deed restriction (activity and use limitations)	Pavement/building cover (or up to 2-foot soil cover or 2-foot soil excavation and replacement) and deed restriction (activity and use limitations)
Eastern gravel parking area	Deed and access restrictions (restricted to current use and fencing)	Soil removal and replacement (0-15 feet)[a]	Pavement/building cover (or up to 2-foot soil cover or 2-foot soil excavation and replacement) and deed restriction (activity and use limitations)	Pavement/building cover (or up to 2-foot soil cover or 2-foot soil excavation and replacement) and deed restriction (activity and use limitations)

Source: Adapted from *Feasibility Study Report, Buffalo Outer Harbor Site, July 1998.*

[a] Complete removal of soil in this area is recommended due to the presence of the former Fuhrmann Boulevard Landfill.

and topsoil would be placed over the areas west of the asphalt road. These barriers would prevent contact by humans or wildlife with the contaminated soil. The topsoil would be seeded with grass. In addition to sealing off the low-level contaminants, this cover would mitigate the potential for runoff from contaminated soil to either the Bell Slip or the Outer Harbor.

Soil Excavation and Replacement

A portion or all of the contaminated soil in the areas of concern would be excavated, disposed of off site, and replaced with clean fill material. The portion of the soil that would be removed would be that to which onsite receptors would most likely be exposed. For most future uses of the property, this would include up to the top first 3 feet of soil. Portions of the property, including the area east of the asphalt road and the eastern gravel parking area, would require more extensive excavation (to a depth of approximately 15 feet if residential use is selected), since this part of the site overlies the former Fuhrmann Boulevard Landfill.

Deed and Access Restrictions

Site access restrictions, such as fencing around the areas of concern and posting signs to notify the public of the presence of contaminated soil, and deed restrictions and notices are potential means for limiting onsite activities and site use. Deed restrictions identifying remedial measures required might also be placed on the property by the owner before any development of the property or change in use.

Deed restrictions (and notices) might include a number of conditions, such as the following:

- land uses to be prohibited or restricted;
- activities to be controlled, such as specific provisions related to disturbance of soil (e.g., grading), installation and maintenance/repair of utilities, and construction of subsurface structures (e.g., building foundations); and
- obligations and conditions necessary to maintain a level of no significant risk.

Reference to the deed restrictions should be included as part of any deed, easement, mortgage, lease, license, occupancy agreement, or any other agreements which indicate a right to use the property. Deed restrictions might be employed for areas where no containment, isolation, removal or treatment of contaminated media is

contemplated, or they might be combined with remedial measures to address residual contamination.

3.3 Detailed Evaluation of Alternatives

3.3.1 Alternative 1: No Action

3.3.1.1 Alternative Description

Under this alternative, no action would be taken for the contaminated soils. No physical restrictions would be put in place.

3.3.1.2 Alternative Evaluation

Overall Protection of Human Health and the Environment

This alternative is protective of human health and the environment. Under the current use scenario, significant risks are not present (see Section 2.1).

Compliance with SCGs

There are no standards that apply to the soil at the site. However, guidance values such as TAGM 4046 criteria would continue to be exceeded under this alternative. No action-specific or location-specific requirements would apply.

Long-term Effectiveness and Permanence

Because there are no significant risks posed by this alternative, it is effective.

Reduction in Toxicity, Mobility, or Volume through Treatment

This alternative does not reduce the toxicity, mobility, or volume of contamination through treatment.

Short-term Effectiveness

Because no action is taken under this alternative, there are no short-term impacts, nor is any time required for implementation.

Implementability

There are no barriers to implementing this alternative.

Cost

There is no cost associated with this alternative.

3.3.2 Alternative 2: Soils Excavation and Replacement

3.3.2.1 Alternative Description

This alternative would remove contaminated soil, 3- to 15-feet deep from the entire 60-acre site and replace it with clean soil.

The area that would be excavated 3 feet deep is the entire 60-acre area. The portion of the site that would be excavated to 15 deep is the area east of the asphalt road and the eastern gravel parking area (see Figure 1-2). Approximately 2,000,000 cubic yards of contaminated material would be excavated and disposed of off site. Excavated material would be sent to a permitted sanitary landfill for disposal. The material would be tested for hazardous characteristics before disposal; however, the soil is presumed to be non-hazardous based on the RI data.

This alternative would require 1,968,000 cubic yards of general-fill soil and 32,000 cubic yards of topsoil (4 inches deep) to replace the material disposed off site.

The area is directly adjacent to Fuhrmann Boulevard and the slope is flat. Therefore, no access problems for trucks and machinery are expected.

Future use of the area would also be unrestricted.

3.3.2.2 Alternative Evaluation

Overall Protection of Human Health and the Environment

By preventing exposure to the contaminants in the soil by removal, this alternative would protect human health and the environment under all expected future use scenarios.

Compliance with SCGs

There are no standards that apply to the soil at the site. However, guidance values such as TAGM 4046 criteria would no longer be exceeded under this alternative. Off-site disposal would have to comply with land disposal restriction action-specific requirements of RCRA. However, none of the soil is expected to be found to exhibit hazardous characteristics, and thus is not expected to require special treatment prior to disposal. Excavated soil would be tested prior to disposal to confirm this assumption.

Action-specific and location-specific requirements for contaminated material handling and disposal, worker safety, and work within a floodplain would apply.

Long-term Effectiveness and Permanence

Because contaminants would not remain on site, the long-term effectiveness of the alternative is high. However, the final disposal

site for the contaminated materials would have to be maintained to continue to effectively isolate the materials.

Reduction in Toxicity, Mobility, or Volume through Treatment

This alternative does not reduce the toxicity, mobility, or volume of the contaminants through treatment. However, because the contaminated material would be placed in an engineered landfill for disposal, the contaminant mobility would be limited by the landfill's liner and cap. Thus, mobility of the contaminants would be practically reduced, if not intrinsically.

Short-term Effectiveness

Some site clearing and significant truck traffic would be required for the implementation of this alternative. Assuming 18-cubic-yard loads, approximately 225,000 truck trips would be required to haul away contaminated materials and bring clean soils to the site. If 100 trucks a day were used, 5 days a week, it would take over 8 years to haul 4,000,000 cubic yards of soil to and from the site. This alternative could be reasonably be implemented within ten years.

Implementability

There are no barriers to the implementation of this alternative.

Cost

The estimated cost of this alternative is shown on Table 3-2. The capital cost of this alternative is estimated at $320 million. There would not be continuing operation and maintenance costs for this alternative.

3.3.3 Alternative 3: Soil Cover

3.3.3.1 Alternative Description

This alternative calls for a 1-foot-thick soil cover over the portion of the property north of the Bell Slip and west of the asphalt road. A soil cover up to 3-feet-thick would be installed over the remaining portion of the property north of the Bell Slip (the area east of the asphalt road and the eastern gravel parking area) (see Figure 1-2).

TABLE 3-2 Estimated Project Costs, Alterantive 2: Soil Excavation and Replacement
Erie County, New York, Niagara Frontier Transportation Authority

Capital Costs				
Item Description	Quantity	Unit	Cost/Unit ($)	Cost ($)
Mobilization and Demobilization	1	Lump Sum	1,320,000	1,320,000
Site Preparation				
Clearing and grubbing	60	Acre	3,486	209,175
Survey & Stakeout	60	Acre	430	25,800
Dust Control (assumes 25% of the construction duration)	1,000	Day	850	850,000
Storm Water Runoff Control	1	Lump Sum	7,500	7,500
Total Site Preparation Costs (rounded to the nearest $1,000)				1,092,000
Soil Excavation				
Excavate Soils (3 CY Shovel)	2,000,000	Cubic Yard	1.01	2,020,000
Contaminated Soil Loading	2,000,000	Cubic Yard	2.14	4,280,000
Contmainted Soil Transposrtation (20 CY, 200-mile RT)	20,000,000	Mile	1.44	28,800,000
Contaminated Soil Disposal (nonhazardous)	2,000,000	Cubic Yard	93.50	187,000,000
Total Soil Excavation Costs (rounded to the nearest $1,000)				222,100,000
Soil Replacement				
General Fill (loaded w/3-CY bucket)	1,968,000	Cubic Yard	7.70	15,153,600
Topsoil (loaded w/3-CY bucket)	32,000	Cubic Yard	15.55	497,600
Soil Hauling (20-mile round trip, 20-CY dump trailer)	2,000,000	Cubic Yard	10.78	21,565,992
Place Soil Cover (dozer)	2,000,000	Cubic Yard	1.29	2,586,120
Compact Soil Cover (12-inch lifts, 2 passes)	1,968,000	Cubic Yard	0.21	413,280
Hydroseed, Fertilize, and Mulch (60 acres)	2,614	1,000 SF	38.50	100,624
Total Soil Excavation and Replacement Costs (rounded to the nearest $1,000)				40,317,000
Total Direct Capital Costs (Rounded to Nearest $1,000)				264,829,000
Indirect Capital Costs				
Engineering, Legal, Administrative	10%			26,483,000
Total Indirect Capital Costs				26,483,000
Subtotal Capital Costs				291,312,000
Contingency Allowance	10%			29,131,000
Total Estimated Cost (Rounded to the nearest $1,000,000)				**320,000,000**

The site would be cleared and grubbed and surveyed in preparation for receiving a soil cover. Clean soils would be purchased and delivered to the site where it would be spread and compacted by conventional earth-moving equipment, such as dozers and front-end loaders. An estimated 154,400 cubic yards of soil would be used for the soil cover. No topsoil is included in this alternative because portions of the site are expected to be covered with buildings and paved for parking lots. The costs for topsoil, buildings, parking lots, and other such improvements are not included in this alternative. The entire soil cover would be fertilized, seeded, and mulched to minimize potential erosion as part of this alternative.

3.3.3.2 Alternative Evaluation

Overall Protection of Human Health and the Environment

By preventing exposure to the contaminants in the soil under recreational and commercial/industrial future use scenarios (see Table 3-1), this alternative would protect human health and the environment.

Compliance with SCGs

There are no standards that apply to the soil found at the site. Soil contamination below the covers would remain above guidance values such as the TAGM 4046 criteria. Action-specific and location-specific requirements for contaminated material handling, worker safety, and work within a floodplain would apply.

Long-term Effectiveness and Permanence

Because contaminants would remain on site, the long-term effectiveness of the alternative can not be guaranteed. However, with appropriate maintenance of the cover, and with deed restrictions, protection is expected to be effective for the foreseeable future.

Reduction in Toxicity, Mobility, or Volume through Treatment

This alternative does not reduce the toxicity, mobility, or volume of the contaminants through treatment. However, because the cover restricts transport of materials by the wind and would be somewhat effective in reducing infiltration of precipitation, it would serve to reduce the mobility of contaminants, although not intrinsically.

Short-term Effectiveness

Some site clearing and significant truck traffic would be required for the implementation of this alternative. Assuming 18-cubic-

yard loads, approximately 8,600 truck trips would be required to bring clean cover soil to the site. This alternative could be implemented within two to three years, including design.

Implementability

There are no obstacles to implementing this alternative.

Cost

Table 3-3 presents a cost estimate, for this alternative, to provide one-foot- and an average two-foot-thick soil cover over the 60-acre portion of the property north of the Bell Slip. A 10% contingency is included in the estimate to account for the current conceptual nature of the project.

The capital cost of this alternative is estimated at $4.7 million. Draft versions of the FS estimated the cost of soil cover (1- to 3-feet thick, Alternative 3) at $5,911,000. The estimate presented in Table 3-3 is based on review of the property RI/FS and the Record of Decision (ROD), reducing the maximum soil cover thickness to an average 2 feet, and on typical construction methods for the local area. Cost sources included recent project bids, published construction cost data (RS Means), and engineering experience/judgment.

There are no operation and maintenance (O & M) costs.

Table 3-3 Eestimate Project Costs, Alternative 3: Soil Cover
Erie County, New York, Niagara Frontier Transportation Authority

Capital Costs				
Item Description	Quantity	Unit	Cost/Unit ($)	Cost ($)
Mobilization and Demobilization	1	Lump Sum	160,000	160,000
Site Preparation				
Clearing and grubbing	60	Acre	3,486	209,175
Survey and Stakeout	60	Acre	430	25,800
Dust Control (assumes 25% of the construction duration)	40	Day	850	34,000
Storm Water Runoff Control	1	Lump Sum	7,500	7,500
Total Site Preparation Costs (rounded to the nearest $1,000)				276,000
Soil Cover (average 2-feet thick, approximately 30 acres)				
Purchase Soil (east of asphalt road, average 2-feet thick)	77,000	Cubic Yard	6.45	496,650
Purchase Soil (gravel parking area east of asphalt road, average 2-feet thick)	19,400	Cubic Yard	6.45	125,130
Soil Loading	96,400	Cubic Yard	0.45	43,380
Soil Hauling (20-mile round trip, 20-CY dump trailer)	96,400	Cubic Yard	10.78	1,039,481
Place Soil Cover (dozer)	96,400	Cubic Yard	1.29	124,651
Compact Soil Cover (12-inch lifts, 2 passes)	96,400	Cubic Yard	0.21	20,244
Hydroseed, Fertilize, and Mulch (30 acres)	1,307	1,000 SF	38.50	50,312
Total Average 2-foot Soil Cover Costs (rounded to the nearest $1,000)				1,900,000
Soil Cover (1-foot thick, approximately 30 acres)				
Purchase Soil (west of asphalt road, 1-foot thick)	48,400	Cubic Yard	6.45	312,180
Soil Loading	48,400	Cubic Yard	0.45	21,780
Soil Hauling (20-mile round trip, 20-CY dump trailer)	48,400	Cubic Yard	10.78	521,897
Place Soil Cover (dozer)	48,400	Cubic Yard	1.29	62,584
Compact Soil Cover (12-inch lifts, 2 passes)	48,400	Cubic Yard	0.21	10,164
Hydroseed, Fertilize, and Mulch (30 acres)	1,307	1,000 SF	38.50	50,312
Total 1-foot Soil Cover Costs (rounded to the nearest $1,000)				979,000
Total Direct Capital Costs (Rounded to Nearest $1,000)				3,315,000
Indirect Capital Costs				
Engineering, Legal, Administrative	30%			995,000
Total Indirect Capital Costs				995,000
Subtotal Capital Costs				4,310,000
Contingency Allowance	10%			431,000
Total Estimated Cost (Rounded to the nearest $10,000)				**4,740,000**

4 Comparative Analysis of Alternatives

4.1 Overall Protection of Human Health and the Environment

Alternative 2, Soil Excavation and Replacement, provides the greatest overall protection of human health and the environment through the removal of all soils contaminated above criteria. Through disposal in an approved landfill, future exposures would not be expected. Alternative 3, through covering soil, would provide the next best level of protection of human health and the environment under recreational/commercial/industrial future use scenarios. Alternative 1, which provides no action, is protective only under the existing use scenario.

4.2 Compliance with SCGs

Only Alternative 2, which removes the soil from the site, complies with TAGM 4046 soil guidance values. This alternative could be designed and implemented to comply with all action- and location-specific SCGs.

4.3 Long-term Effectiveness and Permanence

Alternative 2 provides the best long-term effectiveness as it permanently removes the contamination from the site. Alternative 3, which covers the contamination, is also effective in the long term but relies on site use and deed restrictions. However, Alternative 3 does not present a permanent remedy.

4.4 Reduction in Toxicity, Mobility, or Volume through Treatment

None of the alternatives provide reductions in toxicity, mobility, or volume through treatment.

4.5 Short-term Effectiveness

Alternative 2 will have huge short-term impacts because of the estimate 225,000 truck-trips required to implement this alternative.

Alternative 3 would also have short-term impacts because of the estimate 8,600 truck-trips required to implement. However, this is far less than that of Alternative 2. Alternative 1 is not expected to have short-term impacts.

4.6 Implementability

Alternatives are implementable. However, Alternative 2 with its 225,000 truck-trips to move 4,000,000 cubic yards of soil, would be a huge undertaking requiring significant coordination and support to implement.

4.7 Cost

Alternative 1, which involves no action, incurs no costs. Alternative 2, which provides a permanent remedy, is hugely expensive at $320 million. Alternative 3 is estimated to cost $4.7 million.

5 Conclusions

The 60-acre portion of the property was excluded from the small portion of the site (the RTA) that remained on the New York State Registry of Inactive Hazardous Waste Sites in 1998. Through the analysis of alternatives presented in sections 3 and 4, it is obvious that if development is to occur at this site, Alternative 3, Soil Cover is the most practical and must be implemented in some way. The recommended Land Use and Remedial Plan Matrix depicted in Table 3-1 provides cover selection guidance for use during development planning for this site. The matrix identifies remedial measures that provide for protection of human health and the environment under various future use scenarios.

The FS made the following recommendations:

- To address concerns regarding potential exposure to contaminated surface soils in the eastern gravel parking area, access to this area should be restricted by placement of a chain-link fence, or potential exposure reduced by placement of a soil cover.

- Deed restrictions should be implemented for all areas of the property. Deed restrictions will ensure long-term protection and implementation of the remedial plan. These deed restrictions (and deed notices) can either prohibit or guide certain types of land uses and activities, and would also serve to notify potential owners, developers, or tenants of the presence of contaminants remaining on the property at levels incompatible with all property uses. The Land Use and Remedial Plan Matrix should be incorporated into the deed restriction, combined with information regarding soil/groundwater quality, to provide future property owners/developers with information so that appropriate evaluations may be made prior to developing and using the property.

5.1 Summary

The Outer Harbor property is an essential part of the overall redevelopment of Buffalo's waterfront. Once the property is remediated and developed, it will offer multiple environmental, recreational, and economic benefits to the city of Buffalo and the Western New York region. Focusing on a mixed-use scenario, the Outer Harbor Development plan provides appropriate remedial measures to make land available for economic redevelopment as well for open space, parks, and recreation. Benefits and opportunities to be achieved through the redevelopment of this Brownfield property are described below.

5.1.1 Environmental Benefits

An expeditious remediation program for the Outer Harbor property is the final step in returning the property to safe and productive use and ultimately realizing substantial environmental benefits. The principal environmental benefit to be realized from the remediation of contaminated areas is the removal of any potential risk to human health or the environment. Elimination of the potential for contact with onsite contaminants will result in other important environmental benefits as well. These include:

- ensuring safe public access to property resources, including the Lake Erie waterfront;
- elimination of the potential for contaminants to migrate off-property to surrounding properties and to nearby Lake Erie; and
- resultant elimination of potential environmental impact upon aquatic life in Lake Erie.

5.1.2 Economic Benefits

The potential economic benefits of the overall Outer Harbor project to New York State, the Western New York region, and the City of Buffalo are substantial. The economic and related benefits of the remediation and associated redevelopment of the property include the following:

- attraction of private-sector investment into the Western New York region of the city of Buffalo;
- increased economic activity in the waterfront region, potentially sparking additional waterfront development;
- creation of employment opportunities through the development of new offices; and

- creation/expansion of retail/commercial development opportunities.

5.1.3 Public Recreational Opportunities

The Outer Harbor property provides the opportunity for a regional lakefront recreational facility and improvement of public access to Lake Erie. The property's prime location would potentially allow for the following public recreational opportunities:

- a full-service public marina;
- a public waterside park with passive uses and picnic areas; and
- a public promenade overlooking Lake Erie.

The amenities would be surrounded by and linked to the property's potential mixed-use recreational and commercial development by open space and landscaped greenway trails.

5.2 First-Phase Development

Although the ultimate redevelopment of the Buffalo Outer Harbor property envisions a multitude of land uses developed over time, the first phase of the project will focus on the development of a lakefront promenade traversing the western edge of the waterfront property adjacent to the areas identified as potential development sites (see Figure 5-1). The promenade would essentially be a landscaped pathway that would give public access to the waterfront. It would be designed to be integrated into the overall site as it develops, linking the seaway piers to the north to the Bell Slip Tower area on the south. Development of this publicly accessible recreational amenity is consistent with NFTA's development plan and will serve as attraction and "set the stage" for the following phases of project development.

Design of the lakefront promenade will require the completion of a site survey to appropriately delineate the physical boundary of the promenade site. In addition, phase one will also include the following site improvements:

- bulkhead renovation;
- site regrading;
- minor site landscaping;

- development of sidewalks/pathways; and
- public parking improvements.

The preliminary plan for this is shown in Figure 5-1. The estimated cost for this first phase is $2.7 million and is detailed in Table 5-1. This plan and cost estimate were developed for NFTA by DiDonato Associates.

Table 5-1 Outer Harbor Greenbelt Preliminary Engineers Estimate

Item	Quantity	Unit	Unit Cost	Total
Mobilization/Demobilization	1	LS	$56,000.00	$56,000.00
Survey and Layout	1	LS	$10,000.00	$10,000.00
Removal of existing embankment	23,000	CY	$8.00	$184,000.00
Asphalt Top - 1-1/2"	3,000	SY	$5.00	$15,000.00
Asphalt Binder - 2"	3,100	SY	$5.50	$17,050.00
Asphalt Binder - 4"	1,100	SY	$11.00	$12,100.00
Gravel Base	2,100	CY	$22.00	$46,200.00
Topsoil	22,000	CY	$23.50	$517,000.00
Seeding and Mulching	30,000	YD	$0.75	$22,500.00
Crushed Stone Fill/Select Backfill	17,100	CY	$22.00	$376,200.00
Concrete - Crushed OnSite	17,125	CY	$18.00	$308,250.00
Heavy Stone Fill	14,000	CY	$40.00	$560,000.00
Storm Drainage Inlet	4	EA	$1,250.00	$5,000.00
Storm Sewer	1,700	LF	$30.00	$51,000.00
Subtotal				**$2,180,300.00**
25% Contingency				**$545,075.00**
Total				**$2,725,375.00**

Source: DiDonato Associates, PE, PC, 2001

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Contaminant Summary, Buffalo Outer Harbor Property

Table 2
CONTAMINANT SUMMARY
BUFFALO OUTER HARBOR PROPERTY

SITE AREAS	MATRIX	TOTAL NUMBER OF EXCEEDANCES	CONTAMINANT SUMMARY				
			CONTAMINANT	HIGHEST LEVELS(2)	SCREENING LEVELS	AVERAGE LEVELS	NO. OF EXCEEDANCES
SOUTH OF BELL SLIP **Radio Tower Area**	Surface soil (0 to 6 inches)	5 out of 8 samples above the screening level	PCBs Cadmium Lead Zinc Nickel	8.2 mg/kg 12 mg/kg 777 mg/kg 2350 mg/kg 47.9 mg/kg	1 mg/kg 10 mg/kg 500 mg/kg 500 mg/kg 40 mg/kg	2.4 mg/kg 5.8 mg/kg 390 mg/kg 1164 mg/kg 24.6 mg/kg	4 out of 8 1 out of 8 4 out of 8 5 out of 8 1 out of 8
	Shallow Subsurface soil (6 inches to 8 feet)	5 out of 13 samples above the screening level	CaPAHs Lead Antimony	112 mg/kg 1170 mg/kg 29 mg/kg	10 mg/kg 500 mg/kg 20 mg/kg	13.2 mg/kg 314 mg/kg 11.5 mg/kg	2 out of 13 2 out of 13 1 out of 13
	Deep Subsurface soil (8 to 20 feet)	7 out of 15 samples above the screening level	Total VOCs Nitrobenzene PAHs CaPAHs Antimony Lead Chromium Nickel Copper Zinc TCLP Nitrobenzene TCLP 2,4-Dinitrotoluene	351 mg/kg 13,000 mg/kg 5600 mg/kg 16 mg/kg 5470 mg/kg 1720 mg/kg 2820 mg/kg 123 mg/kg 1480 mg/kg 1290 mg/kg 91 mg/l 0.6 mg/l	10 mg/kg 1 mg/kg 100 mg/kg 10 mg/kg 20 mg/kg 500 mg/kg 100 mg/kg 40 mg/kg 200 mg/kg 500 mg/kg 2 mg/l 0.3 mg/l	92.7 mg/kg 79.4 mg/kg 406 mg/kg 2.9 mg/kg 439 mg/kg 296 mg/kg 218 mg/kg 23 mg/kg 140 mg/kg 253 mg/kg — —	2 out of 7 5 out of 15 2 out of 15 1 out of 15 6 out of 15 2 out of 15 2 out of 15 1 out of 15 1 out of 15 1 out of 15 1 out of 2 1 out of 2
	Groundwater (depth to groundwater 8 feet)	1 out of 1 samples above the screening level for Phase I investigation 3 out of 5 samples above the screening level for the Phase II investigation	Benzen Toluene Chlorobenzene 1,3 Dichlorobenzene 1,4 Dichlorobenzene 1,2 Dichlorobenzene Napthalene 4-Chloroaniline Antimony Lead Arsenic	15 ug/l (Phase I) 7 ug/l (Phase I) 170 ug/l (Phase I) 150 ug/l (Phase II) 33 ug/l (Phase II) 150 ug/l (Phase II) 890 ug/l (Phase I) 3600 ug/l (Phase II) 244 ug/l (Phase I) 28.4 ug/l (Phase II) 159 ug/l (Phase II)	0.7 ug/l 5 ug/l 5 ug/l 5 ug/l 4.7 ug/l 4.7 ug/l 10 ug/l 5 ug/l 3 ug/l 25 ug/l 25 ug/l	— — — — — — — — — — —	— — — — — — — — — — —
Remaining Area	Surface soil (0 to 6 inches)	20 out of 43 samples above the screening level	CaPAHs Arsenic Zinc Lead Cadmium Chromium Cooper	80 mg/kg 1301 mg/kg 3080 mg/kg 834 mg/kg 27 mg/kg 133 mg/kg 456 mg/kg	10 mg/kg 20 mg/kg 500 mg/kg 500 mg/kg 10 mg/kg 100 mg/kg 200 mg/kg	10 mg/kg 8 mg/kg 414 mg/kg 220 mg/kg 2.7 mg/kg 29 mg/kg 81 mg/kg	11 out of 43 2 out of 43 8 out of 43 4 out of 43 1 out of 43 2 out of 43 3 out of 43
	Shallow Subsurface soil (6 inches to 8 feet)	8 out of 12 samples above the screening level	CaPAHs Arsenic Lead Nickel Zinc	16 mg/kg 36 mg/kg 1260 mg/kg 63 mg/kg 834 mg/kg	10 mg/kg 20 mg/kg 500 mg/kg 40 mg/kg 500 mg/kg	5.7 mg/kg 8.7 mg/kg 345 mg/kg 24 mg/kg 372 mg/kg	4 out of 12 1 out of 12 2 out of 12 1 out of 12 4 out of 12
	Deep Subsurface soil (8 to 20 feet)	6 out of 13 samples above the screening level	CaPAHs PAHs Lead Antimony Arsenic Copper Nickel Zinc	31 mg/kg 104 mg/kg 2200 mg/kg 74 mg/kg 21.4 mg/kg 247 mg/kg 53 mg/kg 1880 mg/kg	10 mg/kg 100 mg/kg 500 mg/kg 20 mg/kg 20 mg/kg 200 mg/kg 40 mg/kg 500 mg/kg	9.6 mg/kg 25.8 mg/kg 283 mg/kg 19 mg/kg 7.8 mg/kg 43 mg/kg 23 mg/kg 317 mg/kg	4 out of 13 1 out of 13 2 out of 13 1 out of 13 1 out of 13 1 out of 13 1 out of 13 1 out of 13
	Groundwater (depth to groundwater 8 feet)	5 out of 11 samples above the screening level for the Phase I investigation 0 out of 1 samples above the screening level for the Phase II investigation	Chloroform Endrin 4,4-DDT 4,4-DDD Arsenic	15 ug/l (Phase I) 0.024 ug/l (Phase I) 0.039 ug/l (Phase I) 0.069 ug/l (Phase I) 95 ug/l (Phase I)	7 ug/l Non-detect Non-detect Non-detect 25 ug/l	— — — — —	— — — — —
NORTH OF BELL SLIP **West of Asphalt Road**	Surface Soil (0 to 6 inches)	4 out of 34 samples above the screening level	CaPAHs Lead Zinc	18 mg/kg 815 mg/kg 671 mg/kg	10 mg/kg 500 mg/kg 500 mg/kg	3.6 mg/kg 157 mg/kg 151 mg/kg	3 out of 34 2 out of 34 1 out of 34
	Shallow Subsurface Soil (6 inches to 8 feet)	6 out of 19 samples above the screening level	CaPAHs Lead Copper Nickel Zinc	18.4 mg/kg 1160 mg/kg 753 mg/kg 55.6 mg/kg 1010 mg/kg	10 mg/kg 500 mg/kg 200 mg/kg 40 mg/kg 500 mg/kg	3.8 mg/kg 173 mg/kg 123 mg/kg 15.4 mg/kg 190 mg/kg	3 out of 19 1 out of 19 2 out of 19 1 out of 19 1 out of 19