REMEDIAL INVESTIGATION
AND FEASIBILITY STUDY

PHASE III FEASIBILITY STUDY

River Road Site, Town of Tonawanda
Erie County, New York
(Site Registry No. 9-15-031)

Dvirka and Bartilucci

Consulting Engineers

JANUARY 1994

Section 1

PHASE III FEASIBILITY STUDY

REMEDIAL INVESTIGATION AND FEASIBILITY STUDY

FOR THE

RIVER ROAD SITE
TOWN OF TONAWANDA
ERIE COUNTY, NEW YORK

(SITE REGISTRY 9-15-031)

PREPARED FOR

NEW YORK STATE DEPARTMENT
OF ENVIRONMENTAL CONSERVATION

BY

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JANUARY 1994

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REMEDIAL INVESTIGATION
AND FEASIBILITY STUDY
RIVER ROAD SITE

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1.0 INTRODUCTION

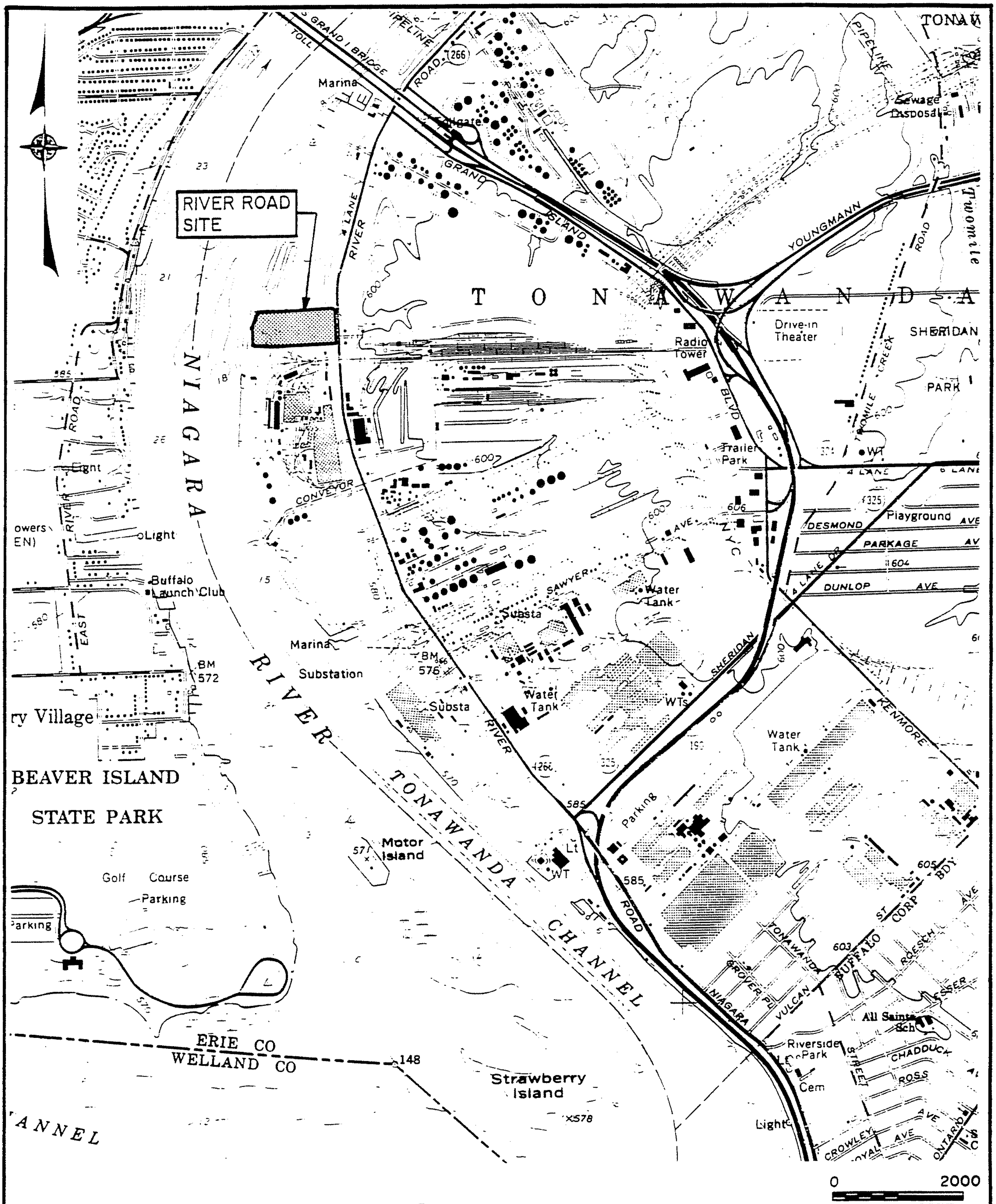
1.1 Purpose

The River Road site, located in the Town of Tonawanda in Erie County, New York, was used for disposal of industrial wastes. Figure 1-1 presents a site location map and Figure 1-2 the site map. As a New York State Class 2 Superfund site (New York State Department of Environmental Conservation [NYSDEC] Registry 9-15-031), the site was initially characterized during a Phase I Remedial Investigation (RI) to determine the nature and extent of contamination at the site. The Phase I RI involved the analysis of existing information and environmental data on this and adjacent sites (Cherry Farm site and Roblin Steel site), and collection and analysis of new data to perform an initial site characterization. A Phase II RI was conducted to provide additional environmental data to refine and further characterize contaminant fate and transport at the site. Together, the Phase I and Phase II RI identified the operable units recommended for remediation.

Based upon the data collected during the Phase I and Phase II field investigations, a Qualitative Health Risk Assessment and Preliminary Feasibility Study (FS) were performed and combined into one document entitled, "Phase I/Phase II Remedial Investigation Report, Qualitative Health Risk Assessment and Preliminary Feasibility Study" (Dvirka and Bartilucci Consulting Engineers, September 1993). The Preliminary FS was conducted to identify and describe available remedial technologies suitable for implementation based upon the operable units identified at the site. The Preliminary FS performed a general review of identified remedial technologies, removing from further consideration those technologies considered to be impractical for the site. Subsequent to the preparation of the draft Preliminary FS and discussions with NYSDEC, an evaluation of remedial actions selected for similar sites, such as the adjacent Cherry Farm site, was performed further identifying and limiting remedial actions selected for detailed evaluation at the River Road site.

The purpose of this Phase III FS is to provide a detailed analysis of potential remedial alternatives based upon consideration of the following seven evaluation criteria for each alternative:

- o Compliance with applicable regulatory standards, criteria and guidelines;
- o Protection of human health and the environment;
- o Short-term impacts and effectiveness;



Source: U.S.G.S. BUFFALO NW, N.Y.-ONTARIO QUADRANGLE

RIVER ROAD SITE
TONAWANDA, NEW YORK

SITE LOCATION MAP

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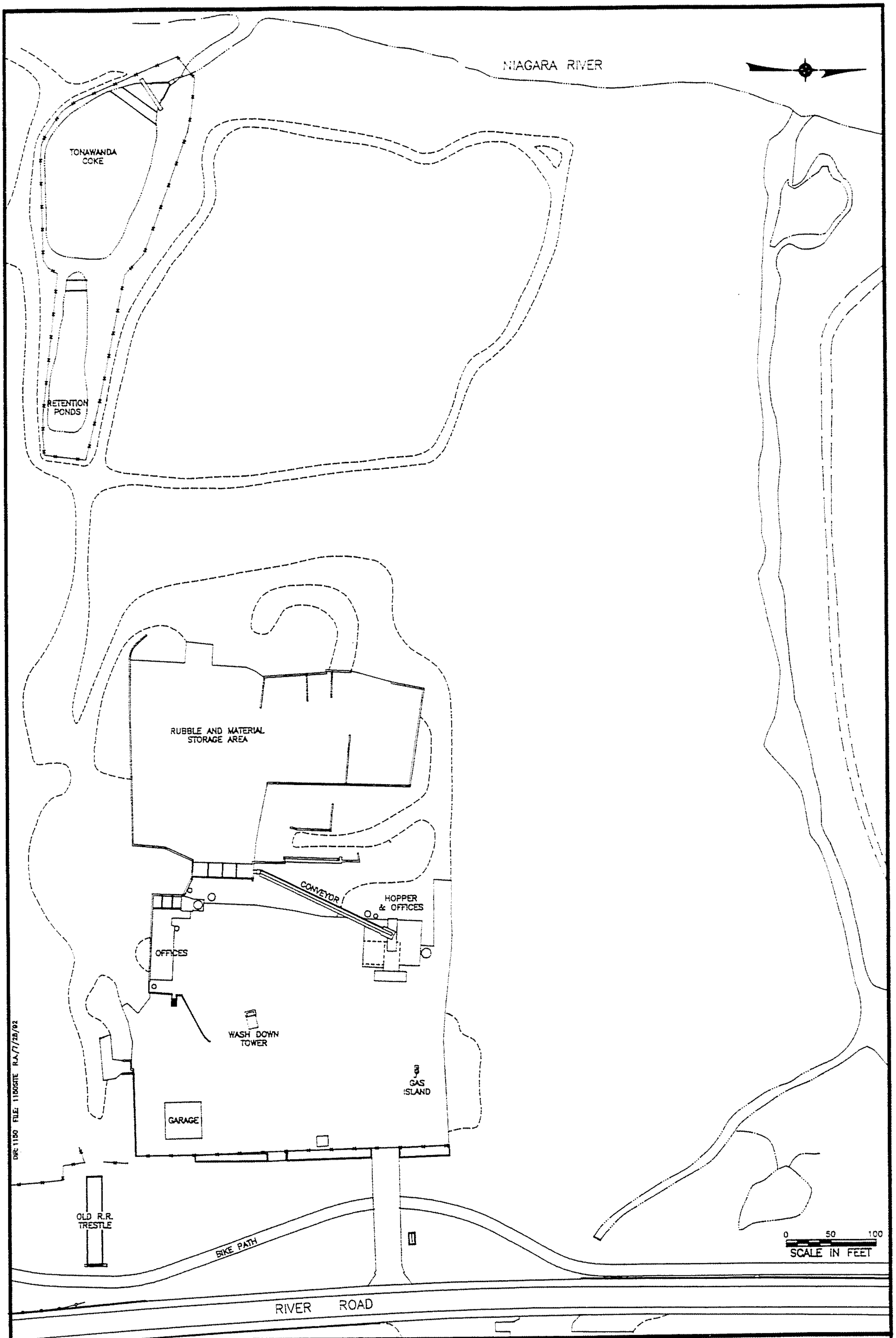
FIGURE 1-1



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RIVER ROAD SITE
TONAWANDA, NEW YORK

SITE MAP

FIGURE 1-2

- Long-term effectiveness and permanence;
- Reduction in toxicity, mobility and/or volume of contamination;
- Implementability; and
- Cost.

This approach conforms with the approved FS methodology described in the relevant Technical and Administrative Guidance Memorandum (TAGM) prepared by NYSDEC and entitled "Selection of Remedial Actions at Inactive Hazardous Waste Sites" (NYSDEC document HWR-90-4030, May 15, 1990 Revision). The objective of this Phase III FS is to recommend a remedial action for groundwater and soil contamination at the River Road site.

1.2 Overview of Evaluation Criteria

Each of the remedial action alternatives identified for analysis will be evaluated on the basis of the seven evaluation criteria listed above. Qualitative and quantitative factors which form the basis for evaluating each criteria were developed from questions in the TAGM score sheet prepared by NYSDEC for this purpose. Although the score sheet and associated scoring system are not utilized in this document, the evaluation factors presented in the TAGM are fully considered for each criteria and discussed individually in Section 3 of this report.

Applicable Federal and New York State Standards, Criteria and Guidelines (SCGs) were identified in the Preliminary FS report and provide both action-specific guidelines for remedial work at the site and compound-specific cleanup standards for the alternatives under evaluation. These guidelines and standards are described in Section 3.1 of this report and should be considered a minimum performance specification for each remedial action alternative under consideration.

Protection of human health and the environment is evaluated on the basis of estimated reductions in both human and environmental exposure to contaminants using each remedial action alternative. An integral part of this evaluation is an assessment of long-term residual risks to be expected after remediation has been completed. Evaluation of the human health protection factor is generally based, in part, on the findings of a site-specific risk assessment. As directed by NYSDEC, the risk assessment performed for this site incorporated the qualitative estimation of the risk posed by carcinogenic and noncarcinogenic contaminants detected during the RI. The results of this risk assessment have been incorporated into this document.

Evaluation of short-term impacts and effectiveness of each alternative examines health and environmental risks likely to exist during the implementation of a particular remedial action. Principal factors for consideration here include the expediency with which a particular alternative can be completed, potential impacts on nearby populations and mitigative measures for short-term risks required by a given alternative during the necessary implementation period.

Examination of long-term impacts and effectiveness for each alternative requires an estimation of the degree of permanence afforded by each alternative. To this end, the anticipated service life of each alternative must be estimated, together with the estimated quantity and characterization for residual contamination remaining on-site at the end of this service life.

Reduction in toxicity, mobility and volume of contaminants is evaluated on the basis of estimated quantity of contamination treated or destroyed, together with the estimated quantity of waste materials produced by the treatment process itself. Furthermore, this evaluation considers whether a particular alternative will achieve the irreversible destruction of contaminants, treatment of the same or merely remove contaminants from the operable unit(s) of concern for disposal elsewhere.

Evaluation of implementability examines the difficulty associated with the installation of each alternative on-site and the proven or perceived reliability with which an alternative can achieve system performance goals (primarily the SCGs discussed above). The evaluation must examine the possible need for future remedial action, the level of ongoing oversight required by regulatory agencies, the availability of certain technology resources required by each alternative and community acceptance of the alternative.

Cost evaluations presented in this report estimate the capital, and operations and maintenance (O&M) costs associated with each remedial action alternative. From these estimates, a total present worth for each option is determined.

1.3 Definition of Remediation Units

Based upon the findings of the Phase I/II RI, Qualitative Health Risk Assessment and Preliminary FS, the following areas of the River Road site will be evaluated as operable units for remediation as indicated in Figure 1-3.

- Coke/Cinder Waste Piles

  Based upon elevated levels of PAHs and carcinogenic PAHs associated with these waste piles, and the potential for human and terrestrial organism contact and, to a lesser extent, off-site migration of contaminants, the waste piles are considered for remediation. These spoil piles are located in the area north of the Tonawanda Coke retention ponds.

- Surficial Soil

  Based on elevated levels of PAHs, PCBs and lead, surface soil in the area north of the Tonawanda Coke retention ponds and the area within the northeastern quadrant of the site adjacent to the creek could pose a potential threat to human health and terrestrial organisms. This, combined with the erosional nature of the area adjacent to the creek and potential adverse impacts to the creek, suggest that the surface soil these areas be considered for remediation. Creek sediments will be included in the remediation activities to be conducted at the Cherry Farm site.

- Subsurface Soil

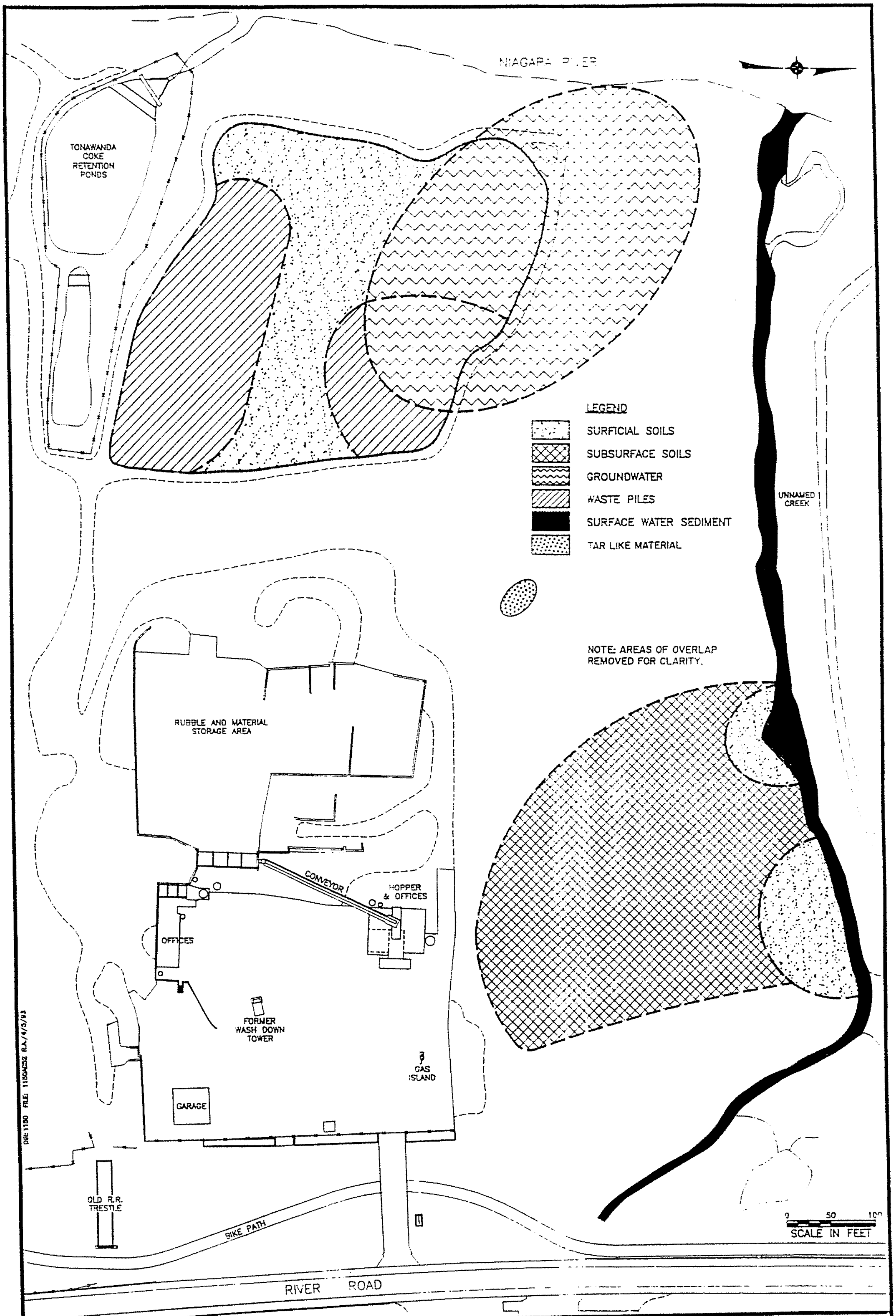
  Data from the subsurface soil fill material and buried waste generally exceeds guidance values for total VOCs, PAHs, CPAHs and PCBs in the northeastern area of the site. However, the groundwater data does not indicate this subsurface soil contamination is significantly affecting groundwater in this area. Although groundwater contamination appears to be impacted primarily to the northwest area of the site, the area of subsurface soil defined by the operable unit includes to the northwest area and a portion of the eastern area.

- Groundwater Underlying the Western Area of the Site

  Based upon elevated levels of PAHs, PCBs, metals and cyanide, as well as the presence of a nonaqueous phase liquid in the northwest quadrant of the site, groundwater could pose a threat to the Niagara River. The data from the light nonaqueous phase liquid (LNAPL) shows extensive contamination of this material with PCBs and semivolatile compounds comprising primarily PAHs, many of which are carcinogenic. Due to the potential for seepage to the Niagara River, both groundwater and LNAPL in this area have been defined as an operable unit considered for remediation.

- Sediments

  Surface water sediment from the creek bordering the Cherry Farm site which exceeded remediation goals has not been evaluated as part of this Feasibility Study. NYSDEC has indicated that the creek sediment will be addressed as part of the Cherry Farm site remediation.



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AREAS OF CONCERN

FIGURE 1 - 3

Each of the operable units under evaluation in the River Road site Phase III FS are described in detail below.

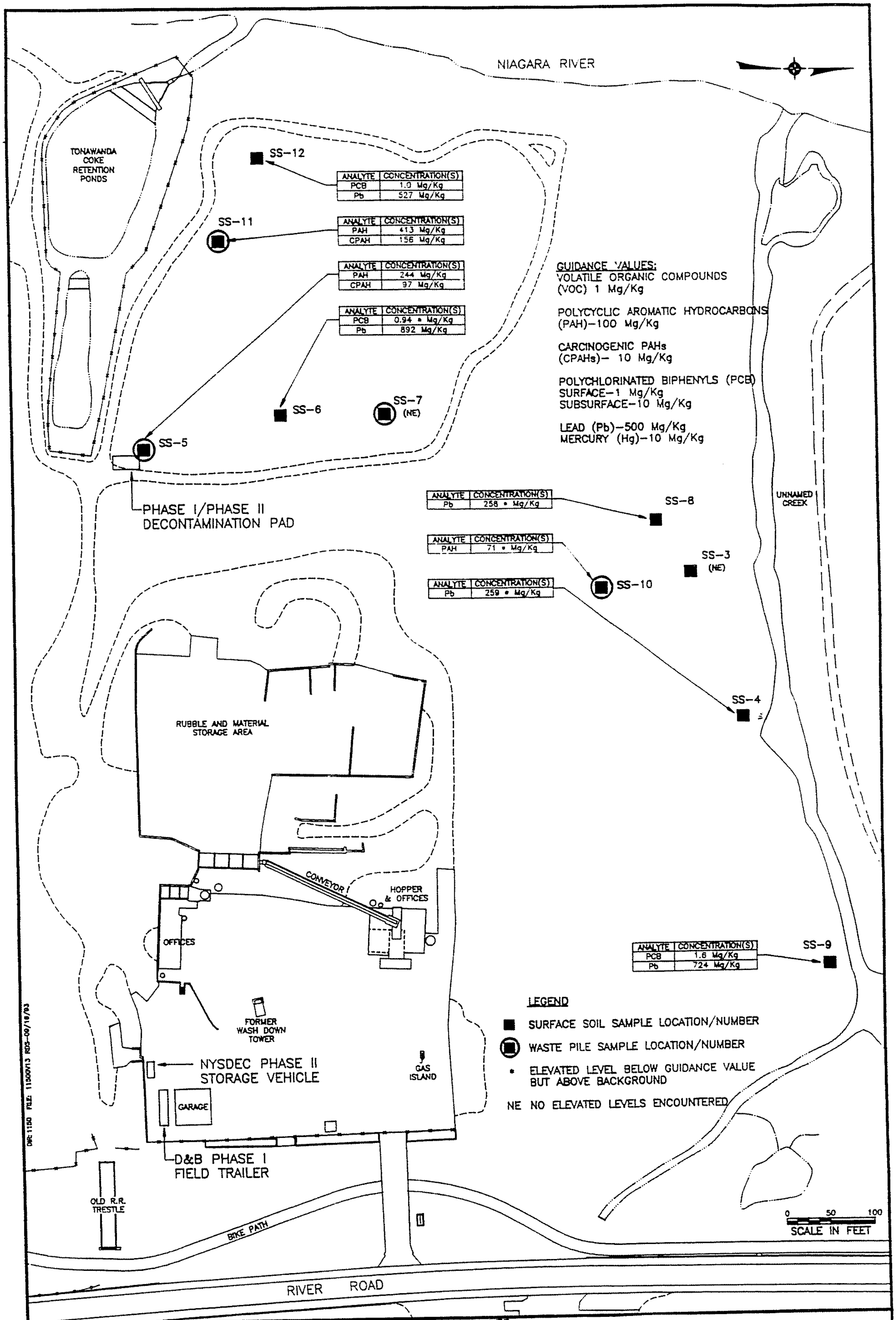
1.3.1 Coke/Cinder Waste Piles

The River Road site contains areas in which disposal of coke/cinder-like spoils (which are characterized as coke fines), miscellaneous debris with metal shards and steel drums has occurred. Figure 1-4 illustrates sampling locations and analytical results for surface soil/waste pile samples and Table 1-1 indicates contaminant detection frequencies and concentration ranges for samples collected during the Phase I and Phase II field investigations. In general, surficial soil on the western portion of the site shows elevated levels of lead and/or polycyclic aromatic hydrocarbons (PAHs). Samples collected from the coke waste piles in the southwestern portion of the site show high concentrations of PAHs, including carcinogenic PAHs. A few soil samples collected in the northeast corner of the site show levels marginally exceeding guidance values for polychlorinated biphenyls (PCBs). In addition, samples of the tar-like material at the center of the site show elevated levels of semivolatile organic compounds (pyrene and bis[2-ethylhexyl]phthalate). No elevated levels of volatile organic compounds (VOCs) were detected in surficial soil and waste pile samples.

Based on these results, the areas of concern on-site regarding surface soil include primarily the area north of the Tonawanda Coke retention ponds and the area within the northeastern portion of the site adjacent to the unnamed intermittent creek which borders the site on the north in the location used for the disposal of drums.

The coke/cinder spoil piles range in thickness from 1 to 2 feet in height to 10 to 12 feet in height. Based upon an estimate of the area of the three spoil piles and an assumption of cinder/fill thickness of 3 feet in the flat areas (surficial soil in the southwest portion of the site), the three waste piles (two are along the Tonawanda Coke retention ponds and portrayed as one area) are estimated to contain approximately 6,000 cubic yards of material and the cinder fill in the flat areas is estimated to be approximately 15,000 cubic yards in volume under and around the spoil piles.

Based upon site observations and chemical data, it does not appear that surficial soil on the site is a significant source of either surface water or groundwater contamination. However, this material is considered a potential threat to human health and terrestrial organisms as a result of direct contact, ingestion or inhalation.



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ONSITE SURFACE SOIL/WASTE PILE SAMPLE LOCATIONS AND EXCEEDENCE OF SOIL REMEDIATION GUIDANCE VALUES

FIGURE 1 - 4

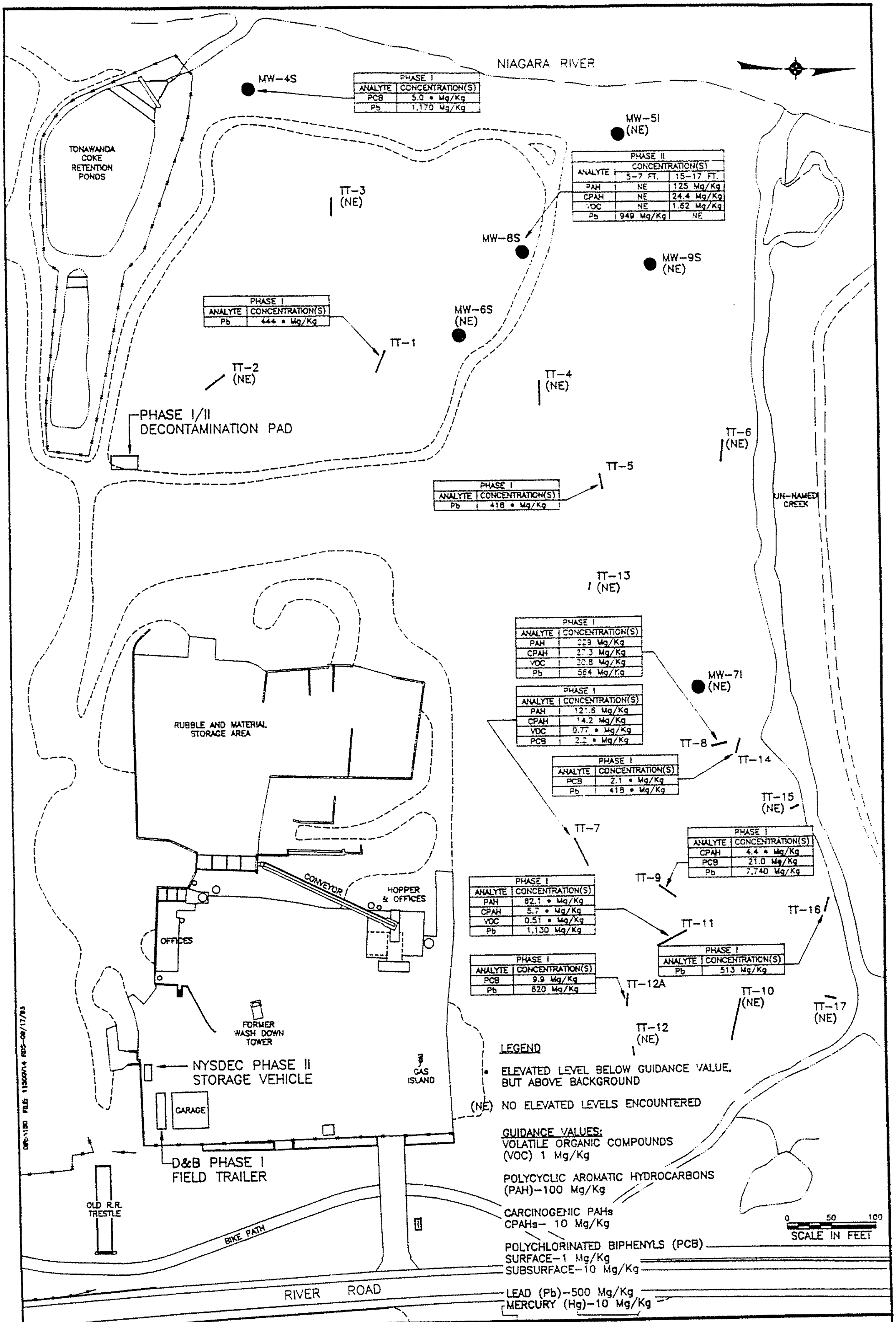
TABLE 1-1
RIVER ROAD SITE
PHASE III FEASIBILITY STUDY
CONTAMINANT DETECTION FREQUENCY AND CONCENTRATION RANGE FOR WASTE PILE AND SURFACE SOIL

CONTAMINANT	Number of detections/ number of samples collected	Concentration Min - Max	Location of Maximum (Sample ID)
VOLATILE ORGANICS (ug/kg)			
Methylene Chloride	12/12	3 – 12	RRSS04 & RRSS07
SEMIVOLATILE ORGANICS (ug/kg)			
Phenol	3/12	26 – 50	RRSS12
4–Methylphenol	4/12	33 – 120	RRSS06
2,4–Dimethylphenol	4/12	43 – 53	RRSS12
Naphthalene	7/12	150–110000	RRSS11
2–Methylnaphthalene	9/12	49–13000	RRSS11
Acenaphthylene	3/12	110–4700	RRSS05
Acenaphthene	3/12	71–3700	RRSS11
Dibenzofuran	8/12	60–6100	RRSS11
Diethylphthalate	1/12	310–310	RRSS01
Fluorene	3/12	180–4000	RRSS11
N–Nitrosodiphenylamine	3/12	30–96	RRSS12
Phenanathrene	11/12	41–31000	RRSS11
Anthracene	9/12	24–5000	RRSS11
Carbazole	6/12	23–5300	RRSS11
Di–n–butylphthalate	8/12	30–1200	RRSS11 & RRSS05
Fluoranthene	10/12	100–43000	RRSS11
Pyrene	11/12	88–71000	RRSS10
Butylbenzylphthalate	2/12	55–100	RRSS04
Benzo(a)anthracene	10/12	44–22000	RRSS11
Chyrsene	10/12	79–32000	RRSS11
bis(2ethylhexyl)phthalate	12/12	1000–500000	RRSS10
Di–n–octylphthalate	1/12	68–68	RRSS12
Benzo(b)fluoranthene	8/12	140–34000	RRSS11
Benzo(k)fluoranthene	8/12	110–17000	RRSS11
Benzo(k)pyrene	8/12	87–28000	RRSS11
Indeno(1,2,3–cd)pyrene	5/12	170–23000	RRSS11
Benzo(ghi)perylene	3/12	110–2300	RRSS11
PESTICIDE/PCBs (ug/kg)			
Heptachlor Epoxide	2/12	4.4–4.7	RRSS05
Endosulfan II	1/12	14–14	RRSS05
4–4' DDT	2/12	6.5–22	RRSS05
Aroclor–1248	2/12	71–250	RRSS07
Aroclor–1254	4/12	79–1600	RRSS09
Aroclor–1260	3/12	40–940	RRSS06
METALS (mg/kg)			
Aluminum	12/12	25.8–24800	RRSS03
Antimony	8/12	14.9–46.7	RRSS11
Arsenic	11/12	4–75.7	RRSS03
Barium	11/12	33.6–461	RRSS03
Beryllium	8/12	0.59–3.9	RRSS03
Cadmium	4/12	1.9–16.6	RRSS09
Calcium	11/12	3790–51100	RRSS02
Chromium	11/12	19.1–130	RRSS04
Cobalt	11/12	4.8–20.8	RRSS03
Copper	11/12	16.1–236	RRSS04
Iron	12/12	92.1–93600	RRSS11
Lead	12/12	4.3–892	RRSS06
Magnesium	11/12	647–15400	RRSS02
Manganese	12/12	2.5–2960	RRSS09
Mercury	3/12	.14–.89	RRSS11
Nickel	12/12	18.8–79.6	RRSS04
Potassium	10/12	517–4320	RRSS02
Selenium	1/12	1.4–1.4	RRSS09
Silver	3/12	2.9–5.5	RRSS04
Sodium	6/12	165–552	RRSS03
Vanadium	12/12	6.4–232	RRSS10
Zinc	12/12	52.6–2460	RRSS09
Cyanide	1/12	1.5–1.5	RRSS11

1.3.2 Subsurface Soil/Fill Material/Buried Waste

Data from the subsurface soil, fill material and buried waste generally reflects an exceedance of guidance values for total VOCs, PAHs, CPAHs and PCBs in the northeastern quadrant of the site in the drum disposal area. See Figure 1-5 for Phase I/II subsurface soil sampling locations and results, and Table 1-2 (Monitoring Well Soil Borings) and Table 1-3 (Test Trench Soil) for contaminant detection frequencies and concentration ranges for subsurface soil samples collected during Phase I and Phase II field investigations. PCB contamination, which did not exceed the guidance value, was also noted sporadically outside this area. On a site-wide basis, elevated levels of lead were detected in subsurface soil with levels well over the guidance value in soil from a monitoring well boring in the southwest quadrant and test trenches in the northeast quadrant of the site. In addition, although not exceeding the guidance value, elevated levels of lead were found in samples collected from test trenches located near the center of the site (TT-1, TT-5 and TT-14). Mercury levels for subsurface soil did not exceed guidance criteria. Only one elevated level of VOCs was encountered above the guidance value in the subsurface soil (test trench 8). PAH levels exceeded the guidance value in soil collected from test trenches in the northeast quadrant of the site. Carcinogenic PAHs also exceeded the guidance value at test trenches in this area, as well as near the river at soil boring MW-8S.

The subsurface soil, fill material and waste, since they are not able to be directly contacted, do not constitute a direct threat to human health. However, since the contaminated material is only a few feet below the ground surface, it does pose a potential risk when disturbed by intrusive activities and to terrestrial organisms inhabiting the site. Also, any excavation into this subsoil would bring contaminants to the surface and create a potential route of exposure. Overall, the low levels of contaminants encountered in the groundwater on a site-wide basis do not suggest that extensive contamination of groundwater is occurring as a result of contaminated subsurface soil and buried waste materials. Key areas of concern for the subsurface soil at the River Road site are in the eastern area and areas that may be affecting groundwater in the northwestern area of the site and possibly areas bordering the creek in the northeastern portion of the site.



RIVER ROAD SITE
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PHASE I/II SUBSURFACE SOIL SAMPLE LOCATIONS AND EXCEEDENCE OF SOIL REMEDIATION GUIDANCE VALUES

FIGURE 1 - 5

TABLE 1-2
RIVER ROAD SITE
PHASE III FEASIBILITY STUDY
CONTAMINANT DETECTION FREQUENCY AND CONCENTRATION RANGE FOR MONITORING WELL SOIL BORINGS

CONTAMINANT	Number of detections/ number of samples collected	Concentration Min - Max	Location of Maximum (Sample ID)
VOLATILE ORGANICS (ug/kg)			
Methylene Chloride	8/8	3-170	RRMW8S(15-17 FT)
Acetone	3/8	10-160	RRMW8S(15-17 FT)
Carbon Disulfide	1/8	1-1	RRMW9S(5-7 FT)
1,1-Dichloroethane	1/8	8-8	RRMW8S(15-17 FT)
Trichloroethene	1/8	5-5	RRMW8S(15-17 FT)
Benzene	3/8	2-3	RRMW9S(5-7 FT)
2-Hexanone	1/8	220-220	RRMW8S(15-17 FT)
Tetrachloroethene	1/8	9-9	RRMW8S(15-17 FT)
Toluene	4/8	2-290	RRMW8S(15-17 FT)
Ethylbenzene	1/8	140-140	RRMW8S(15-17 FT)
Total Xylenes	1/8	1100-1100	RRMW8S(15-17 FT)
SEMIVOLATILE ORGANICS (ug/kg)			
Phenol	6/8	130-2600	RRMW8S(5-7 FT)
bis(2-chloroethyl)ether	2/8	770-1100	RRMW7IA
1,4-Dichlorobenzene	1/8	52-52	RRMW8S(5-7 FT)
2-Methylphenol	5/8	6-780	RRMW8S(5-7 FT)
4-Methylphenol	8/8	32-3200	RRMW8S(5-7 FT)
2,4-Dimethylphenol	6/8	63-1300	RRMW6S
1,2,4-Trichlorobenzene	1/8	420-420	RRMW8S(5-7 FT)
Naphthalene	8/8	49-10000	RRMW8S(15-17 FT)
4-Chloroaniline	1/8	3200-3200	RRMW8S(15-17 FT)
2-Methylnaphthalene	8/8	32-7000	RRMW8S(15-17 FT)
Dimethylphthalate	1/8	50-50	RRMW8S(5-7 FT)
Acenaphthylene	3/8	42-270	RRMW9S(5-7 FT)
2,6-Dinitrotoluene	1/8	510-510	RRMW9S(5-7 FT)
Acenaphthene	6/8	9-6900	RRMW8S(15-17 FT)
Dibenzofuran	5/8	45-1400	RRMW7IA
Fluorene	7/8	82-6500	RRMW8S(15-17 FT)
4,6-Dinitro-2-methylphenol	1/8	500-500	RRMW8S(5-7 FT)
N-Nitrosodiphenylamine	3/8	100-570	RRMW9S(5-7 FT)
Phenanathrene	8/8	10-44000	RRMW8S(15-17 FT)
Anthracene	7/8	22-5600	RRMW8S(15-17 FT)
Carbazole	3/8	19-140	RRMW6S
Di-n-butylphthalate	7/8	7-290	RRMW4S
Fluoranthene	7/8	46-45000	RRMW8S(15-17 FT)
Pyrene	7/8	40-8000	RRMW8S(15-17 FT)
Butylbenzylphthalate	5/8	65-270	RRMW4S
Benzo(a)anthracene	5/8	150-5600	RRMW8S(15-17 FT)
Chyrsene	6/8	210-8700	RRMW8S(15-17 FT)
bis(2ethylhexyl)phthalate	7/8	120-11000	RRMW4S
Di-n-octylphthalate	7/8	5-370	RRMW8S(15-17 FT)
Benzo(b)fluoranthene	5/8	170-3800	RRMW8S(15-17 FT)
Benzo(k)fluoranthene	5/8	81-4100	RRMW8S(15-17 FT)
Benzo(a)pyrene	4/8	140-2500	RRMW8S(15-17 FT)
Indeno(1,2,3-cd)pyrene	1/8	1100-1100	RRMW8S(15-17 FT)
4-Chlorophenol	2/8	780-6880	RRMW8S(15-17 FT)

TABLE 1-2 (continued)
RIVER ROAD SITE
PHASE III FEASIBILITY STUDY
CONTAMINANT DETECTION FREQUENCY AND CONCENTRATION RANGE FOR MONITORING WELL SOIL BORINGS

CONTAMINANT	Number of detections/ number of samples collected	Concentration Min - Max	Location of Maximum (Sample ID)
PESTICIDE/PCBs (ug/kg)			
Endosulfan II	1/8	2.4–2.4	RRMW9S(10–12 FT)
Methoxychlor	1/8	99–99	RRMW8S(15–17 FT)
Endrin aldehyde	2/8	4.2–150	RRMW8S(15–17 FT)
Aroclor–1242	1/8	780–780	RRMW7S
Aroclor–1248	3/8	300–3500	RRMW8S(5–7 FT)
Aroclor–1254	5/8	240–5000	RRMW4S
Aroclor–1260	2/8	570–1500	RRMW8S(5–7 FT)
METALS (mg/kg)			
Aluminum	8/8	1000–15000	RRMW4S
Antimony	7/8	5.5–133	RRMW9S(5–7 FT)
Arsenic	7/8	4.68–44.3	RRMW9S(5–7 FT)
Barium	8/8	13.4–163	RRMW8S(5–7 FT)
Beryllium	4/8	0.37–1.25	RRMW4S
Cadmium	3/8	10.6–60.1	RRMW4S
Calcium	8/8	4040–66700	RRMW4S
Chromium	8/8	12.7–416	RRMW9S(5–7 FT)
Cobalt	6/8	5–53.8	RRMW9S(5–7 FT)
Copper	8/8	8.1–491	RRMW9S(5–7 FT)
Iron	8/8	7730–407000	RRMW9S(5–7 FT)
Lead	8/8	11.3–1170	RRMW4S
Magnesium	8/8	439–2870	RRMW4S
Manganese	8/8	159–4020	RRMW4S
Mercury	2/8	0.239–0.275	RRMW4S
Nickel	8/8	5.69–267	RRMW9S(5–7 FT)
Potassium	6/8	273–1250	RRMW8S(5–7 FT)
Selenium	2/8	1.5–2.38	RRMW7IA
Silver	2/8	2–7.75	RRMW4S
Sodium	7/8	103–527	RRMW4S
Vanadium	7/8	1.1–24.6	RRMW9S(5–7 FT)
Zinc	8/8	34–4370	RRMW4S
Cyanide	3/8	0.31–6.39	RRMW4S

TABLE 1-3
RIVER ROAD SITE
PHASE III FEASIBILITY STUDY
CONTAMINANT DETECTION FREQUENCY AND CONCENTRATION RANGE FOR TEST TRENCH SOIL

CONTAMINANT	Number of detections/ number of samples collected	Concentration Min - Max	Location of Maximum (Sample ID)
VOLATILE ORGANICS (ug/kg)			
Methylene Chloride	10/14	2–920	RRTT08
Acetone	1/14	22–22	RRTT12A
Carbon Disulfide	2/14	5–7	RRTT07
4-Methyl-2-Pentanone	1/14	40–40	RRTT11
Tetrachloroethene	1/14	530–530	RRTT08
Toluene	4/14	2–6400	RRTT08
Ethylbenzene	3/14	68–1900	RRTT08
Total Xylenes	3/14	250–11000	RRTT08
SEMIVOLATILE ORGANICS (ug/kg)			
Phenol	3/14	130–7500	RRTT08
2-Methylphenol	1/14	360–360	RRTT12A
4-Methylphenol	7/14	41–1600	RRTT12A
2,4-Dimethylphenol	4/14	140–440	RRTT07
Naphthalene	11/14	74–27000	RRTT08
2-Methylnaphthalene	13/14	72–12000	RRTT08
Acenaphthylene	2/14	50–59	RRTT06
Acenaphthene	2/14	160–13000	RRTT07
Dibenzofuran	10/14	22–12000	RRSS11
Diethylphthalate	2/14	96–310	RRTT12A
Fluorene	3/14	510–12000	RRSS11
Hexachlorobenzene	1/14	430–430	RRTT09
Pentachlorophenol	1/14	80–80	RRTT05
Phenanathrene	13/14	110–86000	RRTT08
Anthracene	12/14	19–17000	RRTT08
Carbazole	4/14	8–16000	RRTT08
Di-n-butylphthalate	11/14	59–8500	RRTT08
Fluoranthene	13/14	89–49000	RRTT08
Pyrene	13/14	85–14000	RRTT08
Benzo(a)anthracene	10/14	54–6700	RRTT08
Chyrsene	10/14	79–9500	RRTT08
bis(2ethylhexyl)phthalate	14/14	330–23000	RRTT09
Di-n-octylphthalate	4/14	56–430	RRTT12A
Benzo(b)fluoranthene	7/14	86–5400	RRTT08
Benzo(k)fluoranthene	7/14	58–3600	RRTT08
Benzo(k)pyrene	6/14	60–2100	RRTT08
Indeno(1,2,3-cd)pyrene	2/14	580–770	RRTT07
Benzo(ghi)perylene	1/14	580–580	RRTT09
PESTICIDE/PCBs (ug/kg)			
Aroclor-1248	3/14	350–5900	RRTT12A
Aroclor-1254	10/14	33–21000	RRTT09
Aroclor-1260	3/14	430–2100	RRTT14

TABLE 1-3 (continued)
RIVER ROAD SITE
PHASE III FEASIBILITY STUDY
CONTAMINANT DETECTION FREQUENCY AND CONCENTRATION RANGE FOR TEST TRENCH SOIL

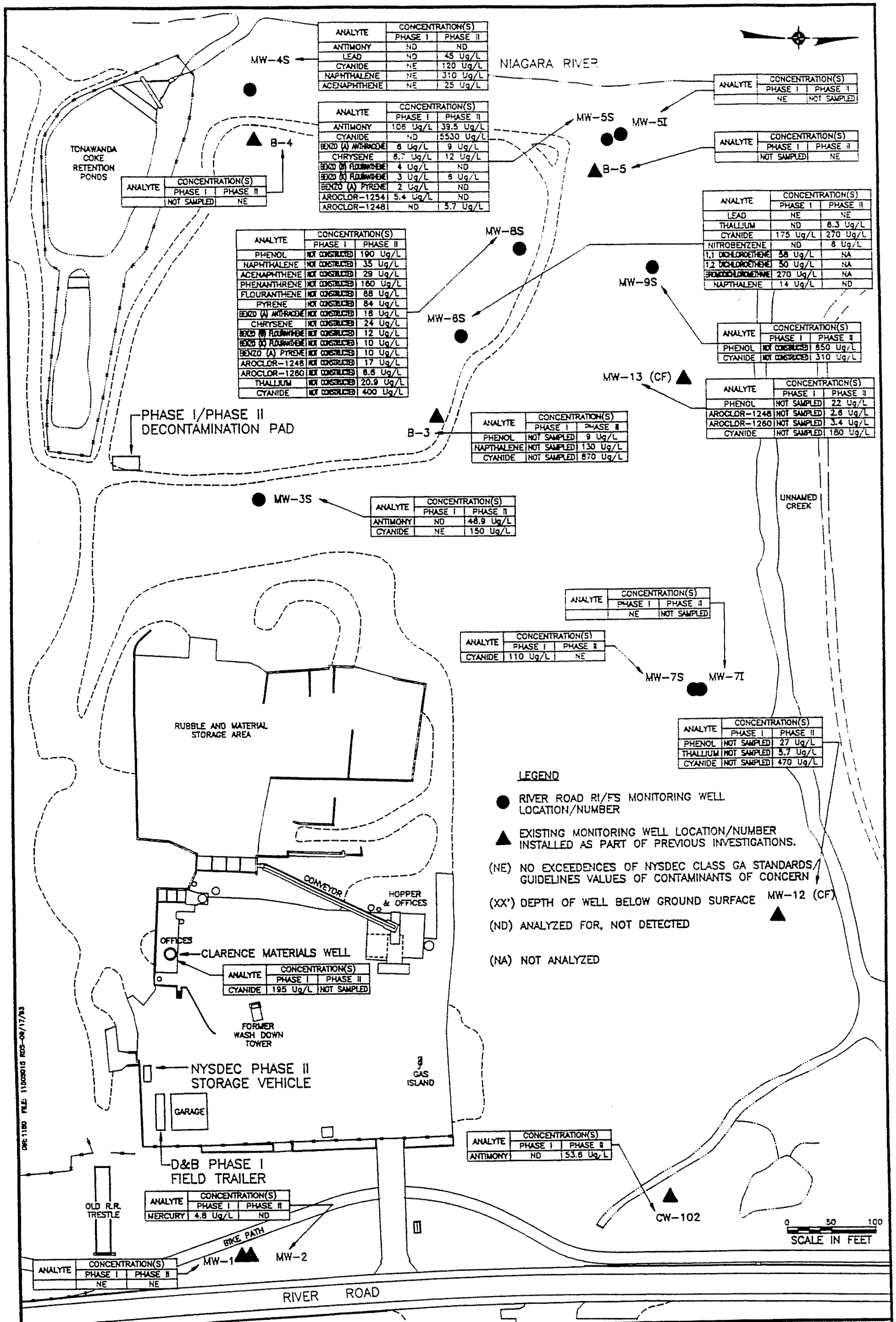
CONTAMINANT	Number of detections/ number of samples collected	Concentration Min - Max	Location of Maximum (Sample ID)
METALS (mg/kg)			
Aluminum	14/14	3130-33900	RRTT11
Antimony	12/14	12.1-144	RRTT11
Arsenic	14/14	4.4-44.7	RRTT11
Barium	14/14	23.2-734	RRTT11
Beryllium	11/14	0.72-2.7	RRTT06
Cadmium	4/14	5.5-180	RRTT09
Calcium	14/14	3580-66300	RRTT03
Chromium	14/14	31.3-1650	RRTT11
Cobalt	14/14	4.7-50.4	RRTT11
Copper	14/14	25.4-2110	RRTT11
Iron	14/14	20300-290000	RRTT11
Lead	14/14	13.1-7740	RRTT09
Magnesium	14/14	505-9130	RRTT03
Manganese	14/14	423-19400	RRTT09
Mercury	8/14	0.12-1.6	RRTT09
Nickel	14/14	12.4-213	RRTT14
Potassium	12/14	414-6500	RRTT09
Selenium	1/14	6.5-6.5	RRTT09
Silver	1/14	28.5-28.5	RRTT09
Sodium	13/14	113-1300	RRTT09
Thallium	2/14	1.2-2.3	RRTT09
Vanadium	12/14	5.5-123	RRTT03
Zinc	14/14	36.7-23900	RRTT09
Cyanide	7/14	0.54-1.5	RRTT05 & RRTT12
RECRA CHARACTERISTICS			
pH	7/7	6.52-8.9	RRTT06
TCLP CONSTITUENTS (ug/l)			
Arsenic	3/6	134-673	RRTT08
Barium	3/6	1290-2100	RRTT11
Chromium	3/6	4.4-423	RRTT11
Lead	2/6	90-112	RRTT11

1.3.3 Groundwater

Groundwater samples from the upper zone and intermediate zones, when compared to NYSDEC Class GA groundwater standards and guidelines, showed elevated levels for VOC contaminants in only one monitoring well, MW-6S, located in the northwestern area of the site. See Figure 1-6 for Phase I/II groundwater monitoring well locations and results, and Table 1-4 for contaminant detection frequencies and concentration ranges for groundwater samples collected during the Phase I and Phase II field investigations. Semivolatile/PAH exceedances were detected in wells near the Niagara River, and two Cherry Farm wells located on the River Road site, MW-12CF and MW-13CF, in the vicinity of the creek, as well as in well B-3, also in the northwestern portion of the site. The groundwater samples from monitoring wells near the river also exceeded the standard for PCBs. In addition, wells MW-5S, MW-6S and MW-8S contained a LNAPL which was also found in the northwest quadrant of the site during previous investigations. The LNAPL analytical results indicated very high levels of SVOCs most of which are PAHs, including carcinogenic PAHs, and elevated levels of PCBs. See Figure 1-7 for locations and results and Table 1-5 for contaminant detection frequencies and concentration ranges for the LNAPL.

Groundwater data for metals show widespread elevated levels for iron, sodium, manganese and magnesium. However, elevated levels in excess of Class GA standards for heavy metals of concern were predominantly encountered at wells located along the river in the western portion of the site. Cyanide was found essentially in all shallow wells throughout the site, in particular at well MW-5S. It should be noted that mercury levels in groundwater on-site were below Class GA standards; however, the upgradient sample collected from monitoring well MW-2, nearest River Road, exceeded the standard for this metal suggesting an off-site source of contamination.

Based upon the results of this investigation, groundwater contamination appears to be primarily confined to the upper/fill zone above the alluvial deposits at the site. The primary concern from groundwater contamination at the site would appear to be migration to the Niagara River, especially since the majority of exceedances of standards for semivolatiles, PCBs, metals of concern and cyanide occurred in wells closest to this area, in particular, in the northwest portion of the site.



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PHASE I/II MONITORING LOCATIONS AND EXCEEDENCE OF NYSDEC CLASS GA GROUNDWATER STANDARDS/GUIDELINES

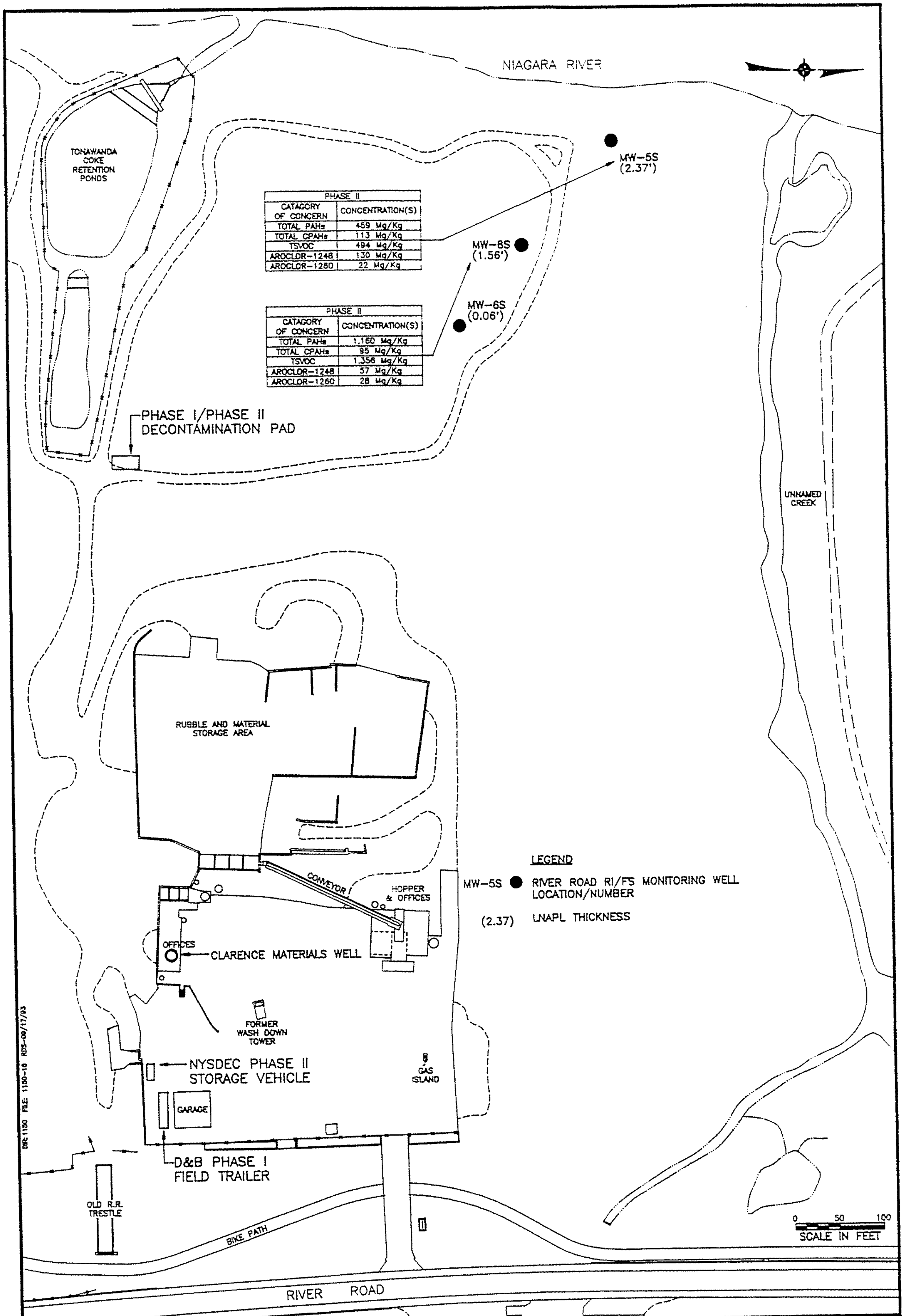
FIGURE I - 6

TABLE 1-4
RIVER ROAD SITE
PHASE III FEASIBILITY STUDY
CONTAMINANT DETECTION FREQUENCY AND CONCENTRATION RANGE FOR GROUNDWATER

CONTAMINANT	Number of detections/ number of samples collected	Concentration Min - Max	Location of Maximum (Sample ID)
VOLATILE ORGANICS (ug/l)			
Methylene Chloride	4/11	2-7	RRMWCM
Acetone	1/11	10-10	RRMW1
1,1-Dichloroethene	1/11	58-58	RRMW6S
1,1-Dichloroethane	1/11	3-3	RRMW7S
1,2-Dichloroethene (total)	3/11	1-50	RRMW6S
2-Butanone	1/11	4-4	RRMW5S
Bromodichloromethane	3/11	1-270	RRMW6S
Dibromochloromethane	3/11	1-14	RRMW6S
Benzene	1/11	3-3	RRMW3S
Bromoform	1/11	4-4	RRMW6S
Tetrachloroethene	2/11	2-3	RRMW6S
1,1,2,2-Tetrachloroethane	1/11	1-1	RRMW6S
Chlorobenzene	1/11	4-4	RRMW5S
Ethylbenzene	1/11	1-1	RRMW5S
SEMIVOLATILE ORGANICS (ug/l)			
Phenol	9/26	1-650	RRMW9S
2-Methylphenol	6/26	2-530	RRMW9S
4-Methylphenol	11/26	1-1900	RRMW9S
Nitrobenzene	4/16	2-6	RRMW6S
2,4-Dimethylphenol	13/26	1-880	RRMW9S
Naphthalene	10/26	1-310	RRMW4S
2-Methylnaphthalene	6/26	1-14	RRMW8S
2,4,6-Trichlorophenol	3/26	1-5	RRMW8S
2,4,5-Trichlorophenol	5/26	2-8	RRMW7S
2-Chloronaphthalene	2/26	1-4	RRMW8S
Dimethylphthalate	2/26	4-9	RRMW8S
Acenaphthylene	6/26	1-3	RRMW8S
2,6-Dinitrotoluene	1/26	13-13	RRMW5S
Acenaphthene	13/26	1-29	RRMW8S
Dibenzofuran	6/26	2-22	RRMW8S
Diethylphthalate	6/26	1-2	RRMW5S & RRMW13CF
Fluorene	12/26	1-38	RRMW8S
4-Nitroaniline	1/26	21-21	RRMW13CF
N-Nitrosodiphenylamine	9/26	1-28	RRMW5S
Pentachlorophenol	2/26	1-2	RRMW6S
Phenanathrene	11/26	1-160	RRMW8S
Anthracene	9/26	1-27	RRMW8S
Carbazole	9/26	1-38	RRMW4S
Di-n-butylphthalate	7/26	1-1	RRMW1 & 5S & 7S & CW102 & 13CF
Fluoranthene	8/26	1-88	RRMW8S
Pyrene	8/26	1-84	RRMW8S
Benzo(a)anthracene	3/26	6-18	RRMW8S
Chyrsene	3/26	7-24	RRMW8S
bis(2ethylhexyl)phthalate	15/26	1-36	RRMW8S
Di-n-octylphthalate	2/26	1-2	RRMW5S
Benzo(b)fluoranthene	2/26	3-12	RRMW8S
Benzo(k)fluoranthene	3/26	3-10	RRMW8S
Benzo(a)pyrene	2/26	2-10	RRMW8S

TABLE 1-4 (continued)
RIVER ROAD SITE
PHASE III FEASIBILITY STUDY
CONTAMINANT DETECTION FREQUENCY AND CONCENTRATION RANGE FOR GROUNDWATER

CONTAMINANT	Number of detections/ number of samples collected	Concentration Min - Max	Location of Maximum (Sample ID)
PESTICIDE/PCBs (ug/l)			
alpha-Chlordane	1/26	0.65-0.65	RRMW5S
Aroclor-1248	3/26	2.6-17	RRMW8S
Aroclor-1254	1/26	5.4-5.4	RRMW5S
Aroclor-1260	2/26	3.4-6.6	RRMW8S
METALS (ug/l)			
Aluminum	25/26	36.3-2580	RRMW6S
Antimony	5/26	38.8-102	RRMW5S
Arsenic	7/26	5.6-12.3	RRCW102DM
Barium	26/26	16.4-307	RRB3TA
Calcium	26/26	14700-508000	RRMW5S
Cobalt	1/26	8-8	RRMW5S
Copper	7/26	4.3-7.4	RRMWCM
Iron	26/26	37.1-42600	RRMW5S
Lead	15/26	2.6-160	RRMW4S
Magnesium	22/26	618-95800	RRMW5I
Manganese	25/26	5.1-4170	RRMW5S
Mercury	10/26	0.21-4.8	RRMW2
Nickel	2/26	20.7-26.3	RRMW9S
Potassium	25/26	810-102000	RRMW12CF
Selenium	3/26	5.4-6.8	RRMW9S
Sodium	26/26	15800-140000	RRMW2
Thallium	3/26	5.7-20.9	RRMW8S
Vanadium	6/26	5.4-132	RRMW12CF
Zinc	14/26	5.7-389	RRMW4S
Cyanide	19/26	10-870	RRB3TA
Hexavalent Chromium	1/11	90-90	RRMW5S



PHASE II	
CATAGORY OF CONCERN	CONCENTRATION(S)
TOTAL PAHs	459 Mg/Kg
TOTAL CPAHs	113 Mg/Kg
TSVOC	494 Mg/Kg
AROCLOR-1248	130 Mg/Kg
AROCLOR-1260	22 Mg/Kg

PHASE II	
CATAGORY OF CONCERN	CONCENTRATION(S)
TOTAL PAHs	1,160 Mg/Kg
TOTAL CPAHs	95 Mg/Kg
TSVOC	1,356 Mg/Kg
AROCLOR-1248	57 Mg/Kg
AROCLOR-1260	28 Mg/Kg

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RIVER ROAD SITE
PHASE III FEASIBILITY STUDY
TONAWANDA, NEW YORK

PHASE II RESULTS OF LIGHT NONAQUEOUS PHASE LIQUID ANALYSIS

FIGURE 1-7

TABLE 1-5
RIVER ROAD SITE
PHASE III FEASIBILITY STUDY
CONTAMINANT DETECTION FREQUENCY AND CONCENTRATION RANGE FOR LIGHT NON-AQUEOUS PHASE LIQUIDS

CONTAMINANT	Number of detections/ number of samples collected	Concentration Min - Max	Location of Maximum (Sample ID)
SEMIVOLATILE ORGANICS (ug/kg)			
Naphthalene	1/2	100000-100000	RRMW8SO
2-Methylnaphthalene	1/2	54000-54000	RRMW8SO
Dimethylphthalate	1/2	6600-6600	RRMW5SO
Acenaphthylene	2/2	6400-12000	RRMW8SO
Acenaphthene	2/2	21000-65000	RRMW8SO
Dibenzofuran	2/2	22000-43000	RRMW8SO
Fluorene	2/2	38000-97000	RRMW8SO
Phenanathrene	2/2	22000-360000	RRMW8SO
Anthracene	2/2	35000-49000	RRMW8SO
Carbazole	1/2	7800-7800	RRMW5SO
Di-n-butylphthalate	2/2	2800-6800	RRMW8SO
Fluoranthene	2/2	130000-220000	RRMW8SO
Pyrene	2/2	100000-190000	RRMW8SO
Benzo(a)anthracene	2/2	33000-49000	RRMW8SO
Chyrsene	2/2	43000-60000	RRMW8SO
bis(2ethylhexyl)phthalate	2/2	76000-110000	RRMW8SO
Di-n-octylphthalate	2/2	2500-4300	RRMW8SO
Benzo(b)fluoranthene	2/2	20000-31000	RRMW8SO
Benzo(k)fluoranthene	1/2	17000-17000	RRMW5SO
Benzo(a)pyrene	1/2	14000-14000	RRMW5SO
PESTICIDE/PCBs (ug/kg)			
Aroclor-1248	2/2	57000-130000	RRMW5SO
Aroclor-1260	2/2	22000-28000	RRMW8SO
TOTAL PETROLEUM HYDROCARBONS			
GC Fingerprint	0/1		

1.3.4 Sediments

As indicated previously, surface water sediment in the creek bordering the Cherry Farm site which exceeded remediation guidelines has not been evaluated as part of this feasibility study. NYSDEC has indicated that these sediments will be addressed as part of the Cherry Farm site remediation.

1.4 Identification of Alternatives to be Analyzed

The Preliminary FS considered a broad range of general remedial technologies and identified a limited number of technologies most applicable to the operable units described previously for the River Road site. These technologies include institutional actions (fencing, deed restrictions and monitoring), containment (capping through the use of a permeable or impermeable cover material, groundwater removal through an extraction system (wells or trenches) with groundwater treatment (on-site and/or off-site), on-site waste consolidation, and excavation and off-site disposal). This Phase III FS will evaluate the remaining technologies in combination as remedial alternatives.

Remediation activities fall into two distinct categories: remediation of site soils which includes both surface (0 to 2 feet deep) and subsurface (greater than 2 feet deep); and remediation of the LNAPL and resulting dissolved fractions in the groundwater, as well as groundwater contamination that may be resulting separately from impacts attributable to contaminated site subsurface soils. Evaluation of remedial technologies through the Preliminary FS, consideration of remedial alternatives regarding similar and adjacent sites, and discussion with NYSDEC has identified five specific remedial alternatives for the River Road site requiring Phase III analysis as provided below:

Alternative 1 - No Action

In this alternative, the River Road site would remain in its present condition. No remedial activities would be performed; however, periodic monitoring of groundwater and LNAPL would be initiated and continued for 30 years. The contaminated groundwater, and surface and subsurface soil would not be removed and/or treated. Initially, monitoring would be performed quarterly for Target Compound List (TCL) +30 constituents in all groundwater monitoring wells and be reduced over time as site specific indicator chemicals and concentrations, and their fate are better defined.

Alternative 2 - Institutional Actions, LNAPL/Groundwater Extraction and Treatment, Placement of Permeable Cover Over Majority of Site and Low Permeability Cover Over LNAPL Area, and Excavation of Soil and Placement of Erosion Resistant Material Along River Bank

This alternative includes taking actions needed to obtain deed restrictions to prevent activities that would intrude into the wastes or otherwise diminish the effectiveness of the alternative. Site control would be provided by utilizing partial perimeter fencing to reduce site access. This alternative includes limited extraction and treatment (separation for off-site incineration) of LNAPL (2 years), and longer term extraction and on-site treatment of groundwater (additional 13 years) in the northwestern area of the site to be discharged to the Town of Tonawanda sewer system. The intent of groundwater extraction is to reverse groundwater gradients at site and prevent contamination from migrating off-site and affecting potable water supplys/Niagara River.

Waste piles (approximately 6,000 cubic yards [cy]) in the western portion of the site would be placed in the area in which a low permeability cover over the LNAPL will be constructed. A permeable cover would be placed over the remaining portions of the site. This permeable cover would include the installation of a biotic barrier to prevent intrusion into contaminated soil by wildlife. The cover placed in the area of the LNAPL would consist of replacing the biolic barrier with low permeability clay. Also included is the excavation of soil within 50 feet of the Niagara River, where feasible, and replacement with clean backfill, and placement of an erosion resistant material along the bank of the river. The material removed from along the river would be placed in the area of the low permeability cover. Access roads would be constructed for inspection and maintenance activities.

Operation and maintenance, and monitoring are also included under this alternative. These activities would include repair and replacement of groundwater treatment equipment, effluent monitoring and inspection and repair of the low permeability and permeable covers. Groundwater and effluent discharge monitoring would be performed initially to determine the effectiveness of the extraction and treatment system, and subsequently to determine the long term effects on groundwater quality. The vegetative soil layer and vegetation would also be maintained, and security fencing inspected and repaired as necessary.

Alternative 3 - Institutional Actions, LNAPL/Groundwater Extraction and Treatment, Extensive Consolidation of Site Soils, Placement of Low Permeability Cover Over Portion of Site and Excavation of Soil and Placement of Erosion Resistant Material Along River

This alternative includes taking actions needed to obtain deed restrictions, LNAPL/groundwater extraction and treatment, excavation of soil and placement of an erosion resistant material along the Niagara River, provision for access roads, operation and maintenance, and effluent and groundwater monitoring as discussed in Alternative 2. The waste piles would be graded in the western portion of the site. An extensive consolidation of site soils would be performed resulting in the removal of approximately 70,000 cy from the eastern area of the site for placement in the western area of the site. The excavated area would be backfilled with clean soil and the entire western portion of the site would be capped with a low permeability synthetic cover.

Alternative 4 - Institutional Actions, LNAPL/Groundwater Extraction and Treatment, Placement of Low Permeability Cover Over Entire Site, and Excavation of Soil and Placement of Erosion Resistant Material Along River Bank

This alternative also includes taking actions needed to obtain deed restrictions, LNAPL/groundwater extraction and treatment, excavation of soil and placement of an erosion resistant material along the river, provision for access roads, O&M and monitoring as discussed in Alternative 2. The waste piles in the western portion of the site would be regraded and the entire site would be capped with a low permeability synthetic cover.

Alternative 5 - LNAPL/Groundwater Extraction and Treatment, Extensive Excavation and Off-Site Disposal of Site Soils and Construction of a Slurry Wall Along River Bank

Similar to Alternatives 2 through 4, it is also assumed under this alternative that 2 years will be necessary to recover the LNAPL at the site and that an additional of 13 years will be required to treat the dissolved fraction of the LNAPL and contribution of contaminants from site subsurface soils to the groundwater. O&M and the groundwater extraction and treatment system will also be required, together with groundwater and effluent monitoring. Site soils exceeding criteria established for protection of groundwater will be excavated to the depth of slag material at the site, which is approximately 7 feet, and disposed/treated off-site. The estimated quantity of this material is 150,000 cy. Clean soil will be backfilled to replace excavated materials. A slurry wall will be constructed along the Niagara River to prevent intrusion of river water and additional groundwater from being contaminated during groundwater remediation. An erosion resistant material will also be placed along the Niagara River as was included in all previous alternatives, except no action. Continued groundwater monitoring may be required under this alternative, however, after completion of groundwater remediation at the site, it is anticipated that active operation and maintenance activities could be terminated.

Section 2

2.0 DETAILED DESCRIPTION OF REMEDIAL ALTERNATIVES

In this section, the alternatives for remediation of the operable units at the River Road site, consisting of contaminated LNAPL and groundwater, and surface and subsurface soils are further defined. Because of the dissimilarities of the properties of the LNAPL/groundwater and soil mediums, technologies utilized for remediation of these mediums are different. However, the two mediums are related due to the LNAPL/groundwater's capability to contaminate soil by adsorbing onto soil particles and into soil pore spaces as it migrates through the subsurface environment, and the soils' capability to contaminate groundwater by the recharge of precipitation through contaminated soil and release of contaminants from soil particles and soil pore spaces.

In consideration of the differences in medium properties and remediation technologies, the interrelation between the mediums and constructability, remediation of the River Road site in sequence of construction, will first address the contaminated surface and subsurface soil followed by remediation of LNAPL/groundwater.

2.1 Alternative 1 - No Action

In this alternative, the contaminated LNAPL/groundwater would not be remediated and would be free to migrate to the Niagara River, potentially impacting public water supply. Contaminated soil on-site would remain in its present condition and no remedial activities would be performed for either soil or groundwater. The only activity planned to be implemented under this alternative is groundwater monitoring of a total of five wells consisting of one shallow upgradient well (MW-2), and three shallow downgradient wells (MW-4S, MW-5S and MW-9S) and one intermediate downgradient well (MW-5I). Groundwater monitoring to be performed at the site would initially consist of Target Compound List (TCL) +30 and conventional parameters on a quarterly basis for the first 3 years. Groundwater monitoring would then be performed twice a year for 2 years. Annual groundwater monitoring would be performed for the same TCL +30 and conventional parameters years 6 through 10. After year 10, groundwater monitoring would be performed every 2 years for the remainder of a 30-year period. No contamination at the site would be removed or treated, and natural attenuation mechanisms would be allowed to take place. Due to the concentrated nature of the wastes on-site and the slow migration of groundwater through the site, it is not believed that natural attenuation would be significantly effective in reducing health and environmental risks associated with the site.

2.2 Alternative 2 - Institutional Actions, LNAPL/Groundwater Extraction and Treatment, Placement of Permeable Cover Over Majority of Site and Low Permeability Cover Over LNAPL Area, and Excavation of Soil and Placement of Erosion Resistant Material Along River Bank

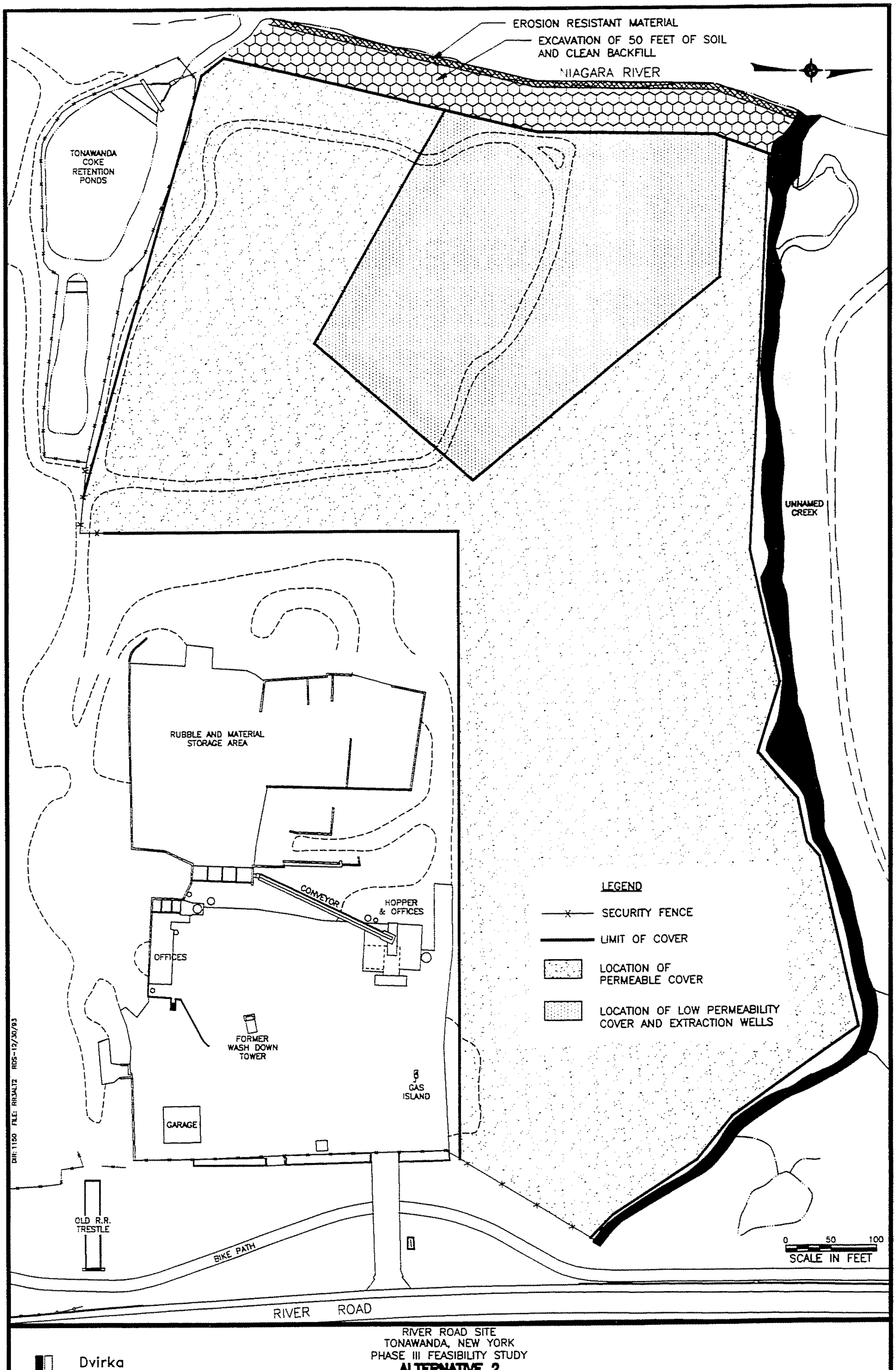
This alternative, as well as the subsequent alternatives, will be divided into individual components for evaluation. Since a number of components are common to subsequent alternatives, reference to previous discussion will reduce repetitive evaluation of components. Figure 2-1 illustrates the physical components of this alternative.

2.2.1 Institutional Actions

Institutional actions included in this and other alternatives consist of partial security fencing to limit uncontrolled site access along the south and east property lines not already fenced by Clarence Materials Corporation and the Tonawanda Coke Retention Ponds. Site access restrictions intend to reduce unauthorized entry to the site and therefore potential exposure to site contaminants. Maintenance activities would be required to ensure continued integrity of site fencing. Actions would also be taken to obtain deed restrictions to prevent activities that would intrude into waste and contaminated soil or otherwise diminish the effectiveness of the alternative. Deed restrictions are intended to prohibit site activities such as construction of foundations or regrading of the property which could jeopardize the integrity of remediation controls and allow potential exposure to site contaminants.

2.2.2 LNAPL/Groundwater Extraction and Treatment

Included under Alternative 2 and subsequent alternatives is the recovery and treatment/disposal of Light Nonaqueous Phase Liquid (LNAPL) identified at the site. Although the extent of the LNAPL plume has not been defined, it is assumed under this alternative that 2 years would be required to recover this concentrated material. Based upon an evaluation of site conditions, it is believed that the utilization of five LNAPL recovery wells at a depth of 25 feet in the affected areas could recover the LNAPL while minimizing the movement of the LNAPL plume both horizontally and vertically into subsurface soils not currently affected by the undissolved portion of the plume. This short-term LNAPL recovery will be supplemented by the implementation of a longer term groundwater recovery and treatment system. Groundwater recovery would be implemented only after cessation of LNAPL recovery to prevent additional soil from being affected by the LNAPL plume as a result of drawdown of the water table by the groundwater recovery wells. Based upon review and monitoring, the need for extended LNAPL recovery will be evaluated.



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ALTERNATIVE 2

INSTITUTIONAL ACTIONS, LNAPL/GROUNDWATER RECOVERY AND TREATEMENT, PLACEMENT OF PERMEABLE COVER OVER MAJORITY OF SITE AND LOW PERMEABILITY COVER OVER LNAPL AREA, AND EXCAVATION OF SOIL WITHIN 50 FEET OF NIAGARA RIVER AND PLACEMENT OF EROSION RESISTANT MATERIAL ALONG RIVER BANK

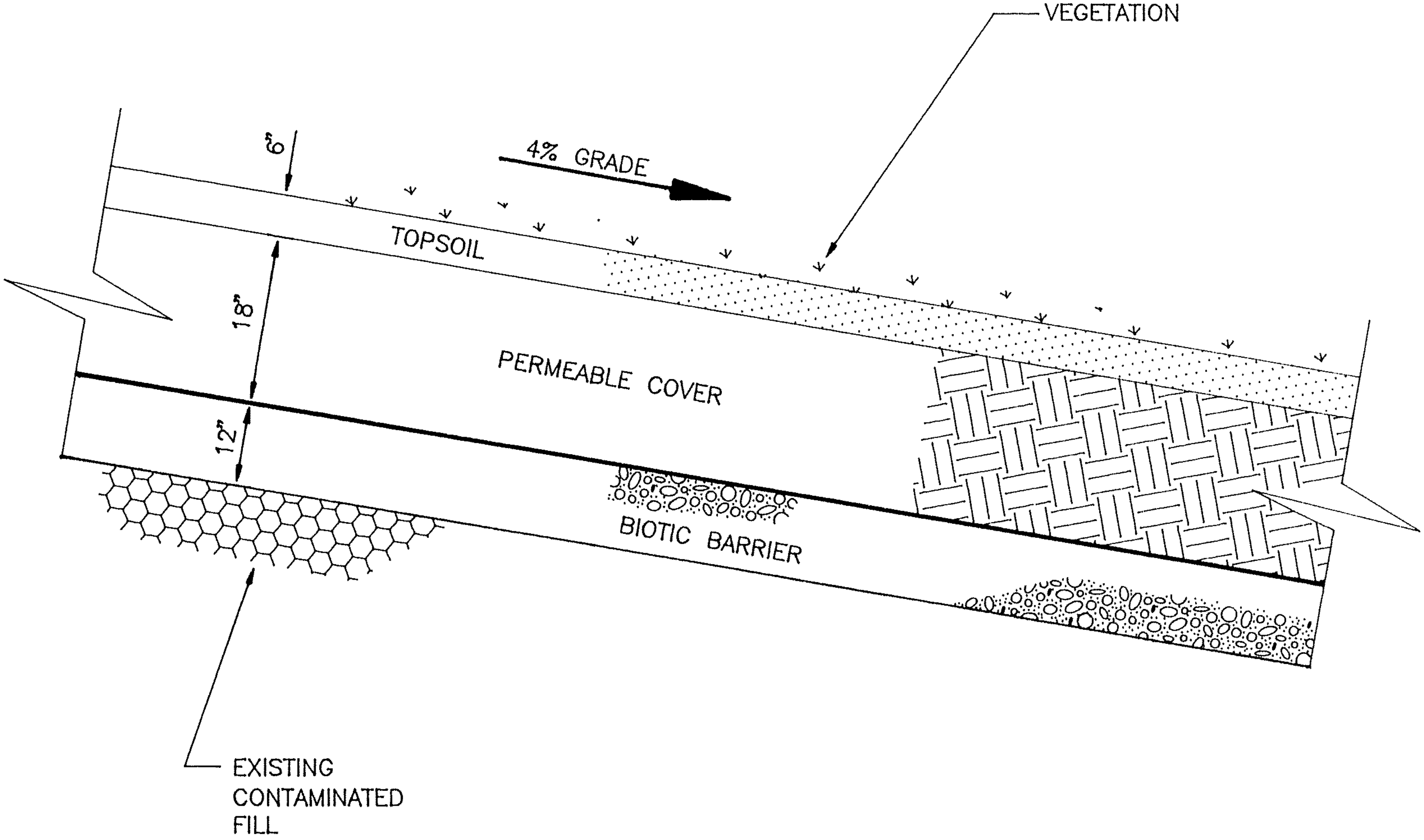
FIGURE 2–1

Under this alternative, it is planned to recover and treat the dissolved portion of the contaminants in the significantly contaminated groundwater identified at the site for a period of 13 years after completion of LNAPL recovery. It is believed that this duration of groundwater recovery and treatment should reduce the concentration of contaminants in groundwater to the levels at which contaminants are desorbed from soil contamination in very limited concentrations. The extraction system will be designed to reverse groundwater gradients at the site and prevent contaminated groundwater at the site from reaching the Niagara River. However, it should be noted that the actual time period for remediation of groundwater will be determined by the results of monitoring the effectiveness of remediation and will be evaluated at 5 year intervals to determine if continued system operation would be effective at remediating groundwater contamination at the site.

The treatment system for the LNAPL would consist of an oil-water separator to remove the LNAPL for off-site disposal/treatment followed by an on-site conventional metals removal process, such as pH adjustment/chemical precipitation, followed by air stripping and/or activated carbon treatment for the remaining groundwater . These processes would be modified as necessary based upon predesign treatability studies recommended to be performed at the site. Discharge from the on-site treatment process would be to the Town of Tonawanda sewer located on the western side of River Road adjacent to eastern area of the site. Final treatment would be performed at the Town of Tonawanda Wastewater Treatment Plant located at Two Mile Creek Road. It is anticipated that the selected on-site treatment processes would be capable of achieving pretreatment standards. In discussions with the Town of Tonawanda, both the sewer line in the vicinity of the site along River Road and the wastewater treatment plant (WWTP) have the capacity to accommodate the flow from the site. (Based upon the results of the Cherry Farm pump test, it is estimated that the flow from the groundwater extraction and treatment system at the River Road site will be about 25 gpm. This will need to be confirmed by a pump test on the site.) Effluent monitoring would be performed to ensure that the discharge from the treatment system complies with pretreatment requirements of the sewer system.

2.2.3 Placement of a Permeable Cover

A 3-foot thick, permeable cover comprising a 1 foot biotic barrier consisting of cobbles, 1.5 feet of gravel covered by 6 inches of top soil will be placed over the entire site except in the area of the LNAPL plume. A permeable cover section is illustrated in Figure 2-2. It is estimated that this permeable cover will be placed over an area of approximately 50,000 sy. Access roads would be constructed at the site to provide the ability for inspection and maintenance of the cover. Placement of this cover would likely require some regrading of the site.



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RIVER ROAD SITE
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PHASE III FEASIBILITY STUDY

PERMEABLE COVER SECTION

FIGURE 2-2

2.2.4 Placement of a Low Permeability Cover

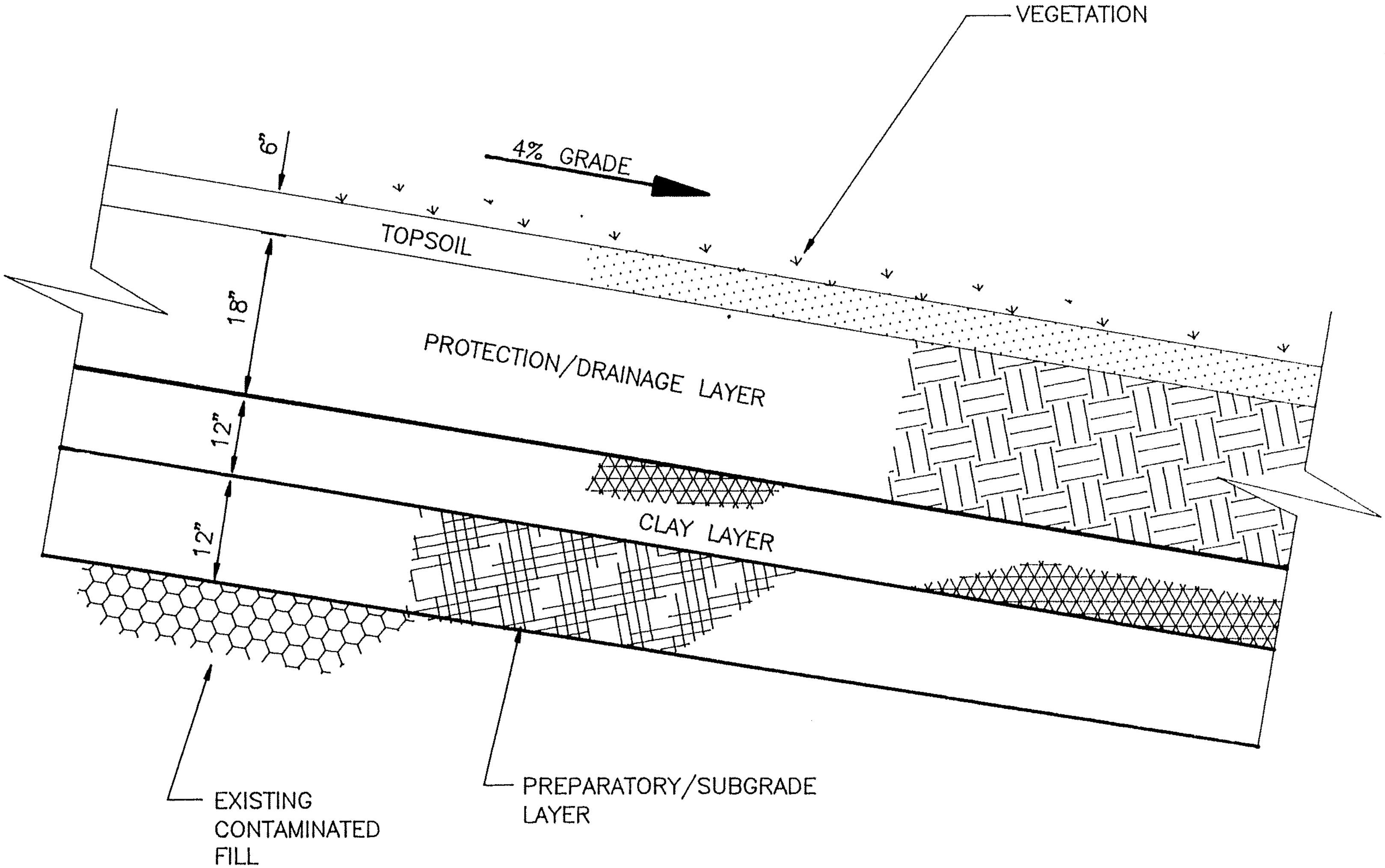
A 3-foot thick, low permeability cover comprising 1 foot of clay with a permeability of less than $1x10^{-7}$ cm/sec placed on a preparatory/subgrade layer and covered by 1.5 foot protective drainage layer and 6 inches of top soil would be placed over the area of the LNAPL plume. A low permeability cover section is illustrated in Figure 2-3. This area would be graded with 4% minimum slopes to promote proper runoff and would require periodic inspection, maintenance and construction of an access roadway around the perimeter of the site. Runoff would ultimately be discharged to the Niagara River. It is estimated that the low permeability over will be placed over the area of approximately 15,000 sy. The waste piles (6,000 cy) in the western portion of the site would be placed in the area of the low permeability cover and graded prior to construction of the cover.

2.2.5 Excavation of Soil Within 50 Feet of the Niagara River and Placement of an Erosion Resistant Material Along the River Bank

This action will remove soil/waste from the area within 50 feet of the Niagara River, where practical, to prevent direct exposure of contamination to river water. This excavation represents approximately 8,000 cy of material. The excavated area would be backfilled with clean soil and the excavated material would be placed under the low permeability cover. In addition, an erosion resistant material, such as rip rap, would be placed along the river bank to prevent soil erosion from occurring eliminating the direct release of soil/waste to the river as well as additional exposure of contaminated materials on-site. Inspection and maintenance will be required for this erosion barrier.

2.3 Alternative 3 - Institutional Actions, Short-term LNAPL/Groundwater Extraction and Treatment, Extensive Consolidation of Site Soils, Placement of Low Permeability Cover Over Portion of Site, and Excavation of Soil and Placement of Erosion Resistant Material Along River Bank

This alternative includes the institutional actions described in Section 2.2.1. The following subsections describe the differences in the other components to be implemented with this remedial alternative. Figure 2-4 illustrates the physical components of this alternative.



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FILE NAME: LNAPLCAP
DATE: RDS–01/06/94

RIVER ROAD SITE
TONAWANDA, NEW YORK
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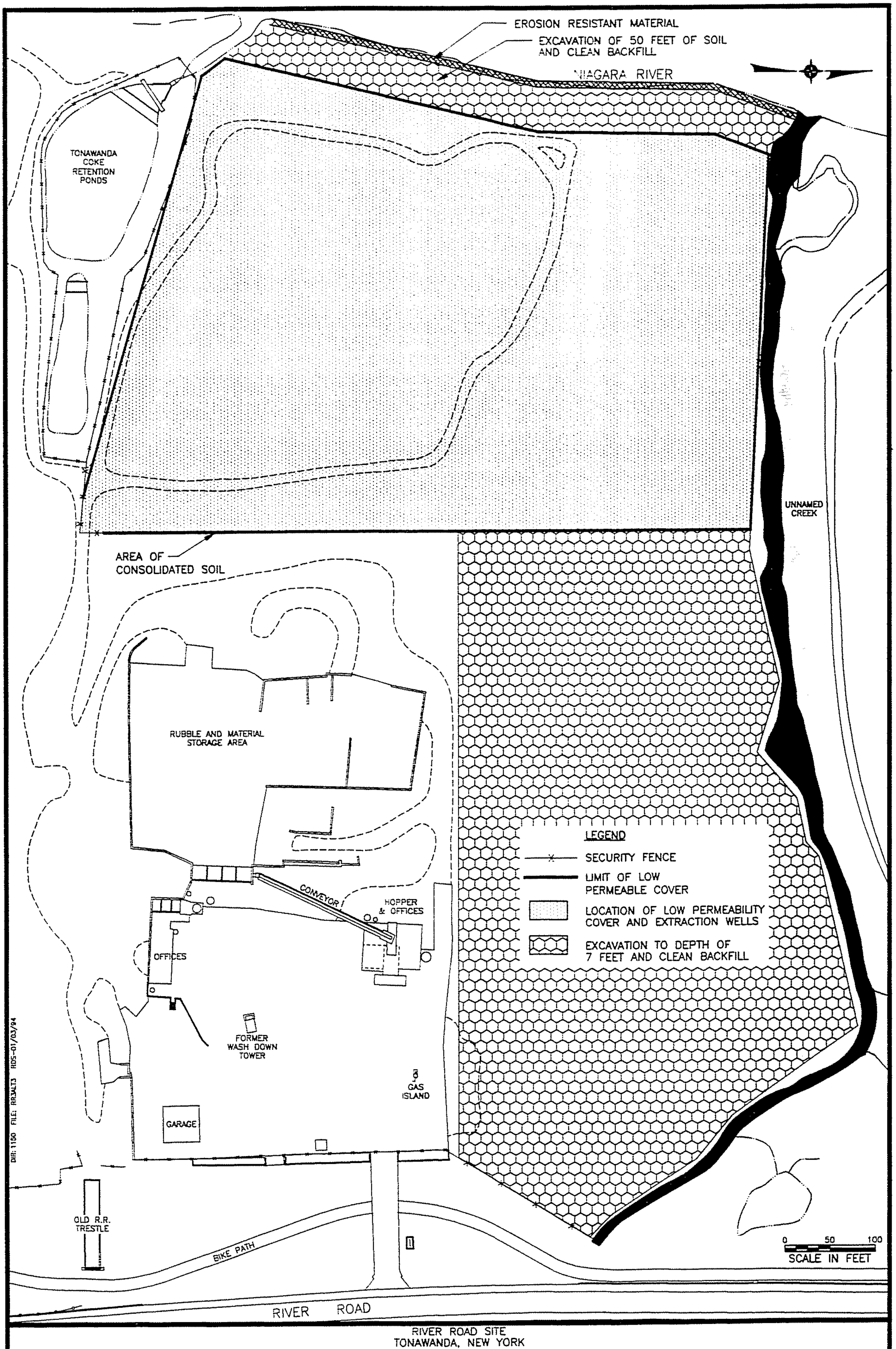
LOW PERMEABILITY CLAY COVER SECTION

FIGURE 2–3



RIVER ROAD SITE
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ALTERNATIVE 3

INSTITUTIONAL ACTIONS, LNAPL/GROUNDWATER RECOVERY AND TREATMENT, EXTENSIVE CONSOLIDATION OF SOIL ON-SITE, PLACEMENT OF LOW PERMEABILITY COVER OVER WESTERN PORTION OF SITE, AND EXCAVATION OF SOIL WITHIN 50 FEET OF NIAGARA RIVER AND PLACEMENT OF EROSION RESISTANT MATERIAL ALONG RIVER BANK

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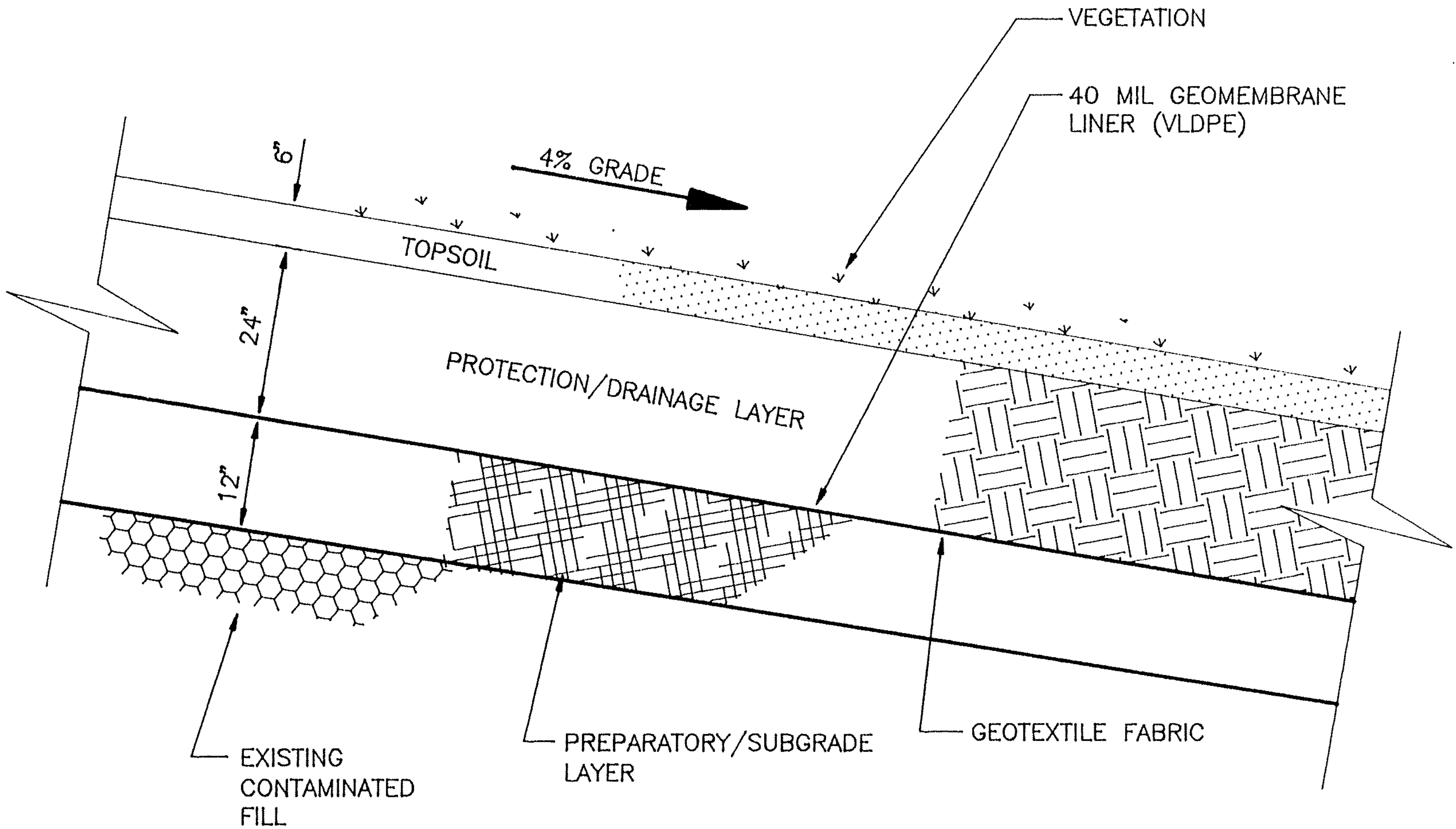
FIGURE 2-4

2.3.1 Extensive Consolidation of Site Soils

This component includes the excavation of approximately 70,000 cy of surface and subsurface soils from the eastern area of the site and placement in the western area and graded with the waste piles. This quantity of material represents the excavation of soil to a depth of approximately 7 feet. A 7-foot depth was selected based upon the depth to which test trenches could be generally excavated during the remedial investigation before hitting a slag material which generally could not be penetrated with the excavator bucket. The intent of this extensive consolidation is to prevent direct contract with materials exceeding the RI recommended surficial soil remediation guidelines in the eastern portion of the site, as well as those exceeding the subsurface remediation guidelines which can be readily excavated. Excavation and consolidation of the entire eastern area, including limited areas which did not exceed soil remediation was considered prudent due to the heterogenious nature of the contamination and limited number of sample locations to designate contaminated areas. The relocated soil and waste piles were graded to provide a 4% slope for drainage as described below.

2.3.2 Placement of a Low Permeability Cover Over a Portion of the Site

A low permeability cover would be placed over the relocated eastern surface and subsurface soils, regraded waste piles and western surface and subsurface soils. It is estimated that the low permeability cover would be placed over an area of approximately 35,000 sy. Since approximately 70,000 cy of material will be placed to this area prior to capping, the material would cause the elevation of the entire area to be capped to increase by an average of approximately 6 feet. The low permeability cover would then increase the elevation of the area an additional 3 feet utilizing a synthetic membrane such as Very Low Density Polyethylene (VLDPE). A cover section based upon utilization of a synthetic membrane is illustrated in Figure 2-5. Since it is believed that a cover consisting of a synthetic liner, protective layer and top soil will provide adequate performance relative to a RCRA cover at a significantly lower cost, this cover will be utilized for purposes of detailed evaluation. The low permeability cover will significantly reduce the amount of infiltration and contact with contaminated waste and soil. The cover would be constructed on a minimum 4% slope to promote proper drainage. The cover would mitigate surface runoff of contaminants from the site, but would increase surface water runoff. Access roads around the perimeter of the site would be provided to allow inspection and maintenance activities at the site.



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FILE NAME: SYNMEMCS
DATE: RDS-01/06/94

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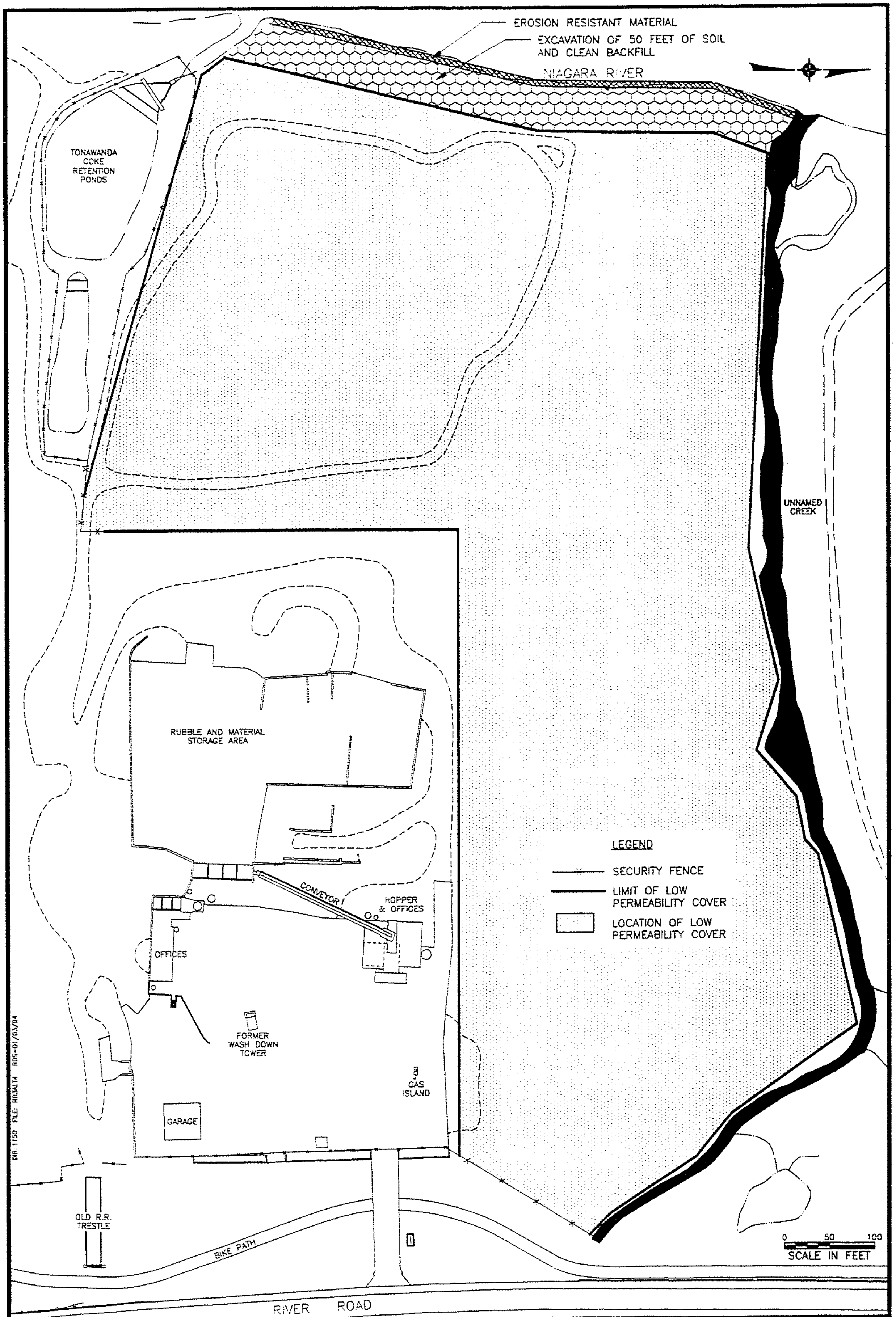
LOW PERMEABILITY SYNTHETIC COVER SECTION

FIGURE 2-5



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ALTERNATIVE 4

INSTITUTIONAL ACTIONS, LNAPL/GROUNDWATER EXTRACTION AND TREATMENT, PLACEMENT OF LOW PERMEABILITY COVER OVER ENTIRE SITE, EXCAVATION OF SOIL WITHIN 50 FEET OF NIAGARA RIVER AND PLACEMENT OF EROSION RESISTANT MATERIAL ALONG RIVER BANK

FIGURE 2-6

2.4 Alternative 4 - Institutional Actions, LNAPL/Groundwater Extraction and Treatment, Placement of a Low Permeability Cover Over Entire Site, and Excavation of Soil Within 50 Feet of Niagara River and Placement of an Erosion Resistant Material Along River Bank

This alternative includes the institutional actions described in Section 2.2.1, groundwater/LNAPL extraction and treatment discussed in Section 2.2.2, and excavation of soil within 50 feet of Niagara River and placement of an erosion resistant material along the river bank as discussed in Section 2.2.5. Figure 2-6 illustrates the components of this alternative. The low permeability cover would be placed over the entire site as discussed below.

2.4.1 Placement of a Low Permeability Cover Over Entire Site

A low permeability cover will be constructed over the entire site. It is estimated that this cap would be placed over an area of approximately 65,000 cy. The cap would consist of 12" of a preparatory/subgrade layer, a 40 mil geomembrane liner (VLDPE), a 24" protective/drainage layer and 6 inches of topsoil as illustrated in Figure 2-5. The site would require extensive regrading in order to ensure that proper runoff occurs. Access roads would also be required to allow the performance of inspection and maintenance activities.

2.5 Alternative 5 - LNAPL/Groundwater Extraction and Treatment, Extensive Excavation and Off-site Disposal of Site Soils, Construction of a Slurry Wall, and Excavation of Soil Within 50 Feet of the Niagara River and Placement of an Erosion Resistant Material Along River Bank

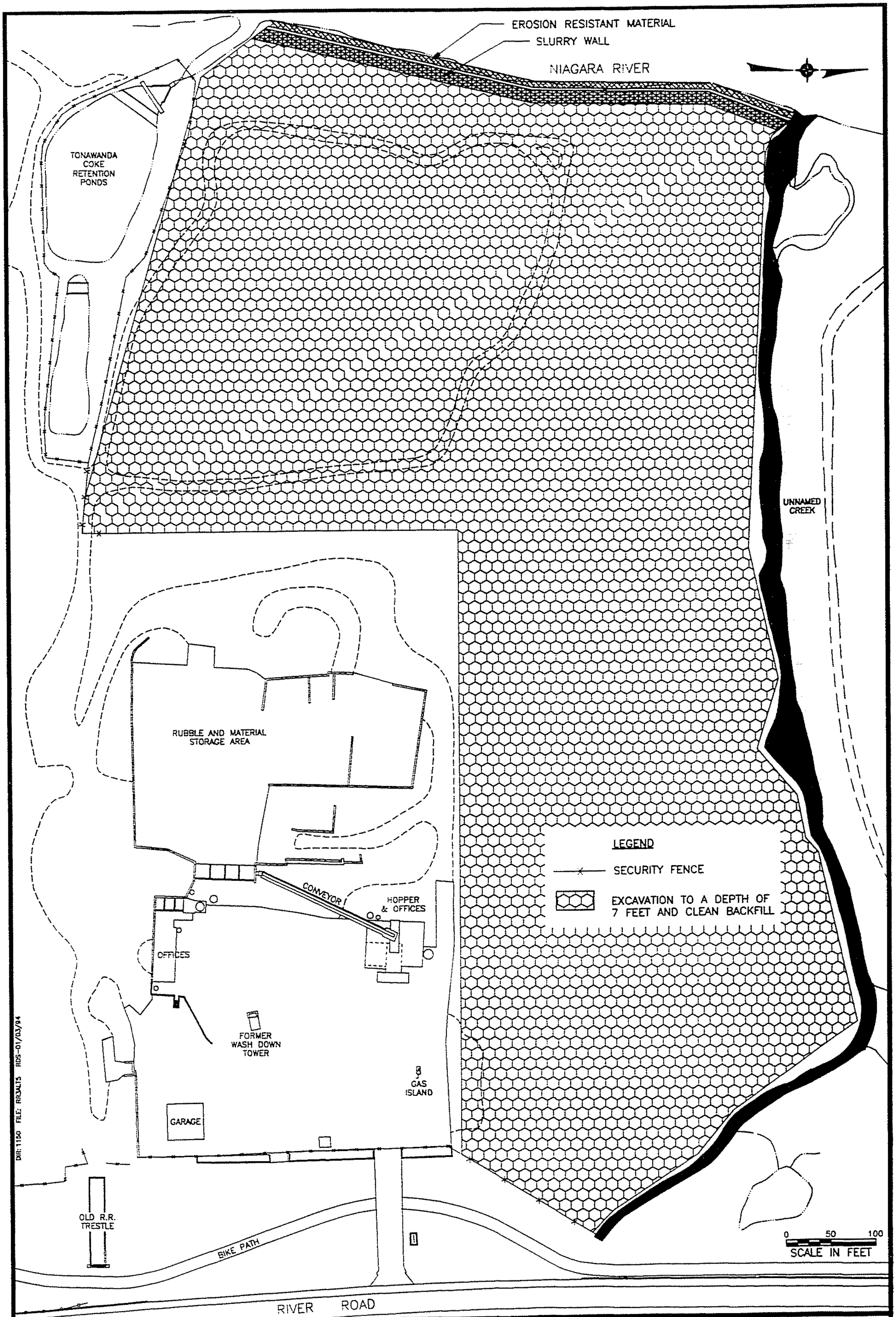
Included in this alternative is the LNAPL/groundwater extraction and treatment as discussed in Section 2.2.2 and placement of an erosion resistant material along the Niagara River Bank as discussed in Section 2.2.5. All site soils and waste would be excavated to the depth of slag and removed from the site, and the excavated area backfilled with clean soil. A slurry wall would be constructed as discussed in Section 2.5.2. Figure 2-7 illustrates the physical components of this alternative.

2.5.1 Extensive Excavation of Site Soils

This activity includes the excavation of all waste piles, surface and subsurface soils to the depth of slag which is approximately 7 feet below grade at the site. The quantity of material estimated to be excavated is approximately 150,000 cy and the quantity to be removed, including the waste piles, is about 156,000 cy. This material would be transported off-site to an approved facility meeting appropriate federal and state requirements for treatment/disposal. The excavated areas would be backfilled with clean fill with placement of 6 inches of top soil and revegetated.

2.5.2 Slurry Wall Construction

This component is intended to prevent the intrusion of Niagara River water into the contaminated soils and waste at the River Road site during extraction and treatment of the LNAPL and contaminated groundwater. The slurry wall would be constructed after completion of soil excavation and backfill with clean soil. The slurry wall would be constructed to a depth of 25 feet which is below the limit of the fill material and into the alluvial sediments at the site adjacent to the river. The slurry wall would remain in place subsequent to the LNAPL/groundwater recovery and treatment.



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RIVER ROAD SITE
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PHASE III FEASIBILITY STUDY

ALTERNATIVE 5

LNAPL/GROUNDWATER RECOVERY AND TREATMENT, EXCAVATION OF SOIL FOR OFF-SITE DISPOSAL, CONSTRUCTION OF A SLURRY WALL ALONG NIAGARA RIVER AND PLACEMENT OF EROSION RESISTANT MATERIAL ALONG RIVER BANK

FIGURE 2–7

Section 3

3.0 DETAILED EVALUATION OF ALTERNATIVES

The detailed evaluation of alternatives provides the basis for remedial alternative selection. A comparative analysis comprised of an assessment of the alternatives against seven evaluation criteria, as defined in the New York State Department of Environmental Conservation (NYSDEC) Technical Assistance Guidance Memorandum (TAGM) for the Selection of Remedial Actions at Inactive Hazardous Waste Sites (HWR-90-4030), is performed below. This process identifies the overall feasibility and acceptability of remedial alternatives, and determines the relative performance of the alternatives and limitations between the alternatives. The Remedial Action Objectives for the River Road site are presented in Table 3-1. SCGs and Preliminary Remediation ARARs for the River Road site are presented in Table 3-2.

3.1 Compliance With New York State Standards, Criteria and Guidelines

Both chemical and action specific standards, criteria and guidelines (SCGs) have been identified for the River Road site. Compliance of each of the remedial alternatives with the SCGs is discussed below.

3.1.1 Chemical-specific SCGs

Chemical specific SCGs are typically health or risk based criteria or methodologies which, when applied to site specific conditions, result in the establishment of numerical values. These values establish the acceptable amount or concentration of a chemical that may remain in or be discharged to the environment. There are different sets of criteria utilized to establish SCGs at a site. For the River Road site, and as presented in the Phase I/II Remedial Investigation report, these criteria are based on NYSDEC proposed cleanup guidelines and recommendations by NYSDOH which have resulted in the following guidance values to be used to determine the need for remediation of surface and subsurface soil contamination:

Total VOCs	-	1 mg/kg
Total PAHs	-	100 mg/kg
Total Carcinogenic PAHs	-	10 mg/kg
Total PCBs	-	1 mg/kg (surface soil)
	-	10 mg/kg (subsurface soil)
Total Lead	-	500 mg/kg
Total Mercury	-	10 mg/kg

TABLE 3 - 1

Remedial Action Objectives

Exposure Pathways	*Environmental Media*	*Remedial Action Objectives*
1. Ingestion of contaminated soil	Soil	Reduce exposure or contaminant concentrations to acceptable levels as defined by NYSDEC/ NYSDOH.
2. Dermal exposure to contaminated soil	Soil	Reduce exposure or contaminant concentrations to acceptable levels as defined by NYSDEC/ NYSDOH.
3. Ingestion of contaminated surface water	Surface Water	Eliminate/reduce discharges to the creek/ Niagara River.
4. Dermal exposure to contaminated surface water and surface water sediment	Surface Water and Sediment	Eliminate/reduce discharges to the creek.
5. Ingestion of contaminated fish	Water	Control consumption of biota from creek area. Eliminate/reduce contaminant concentrations to New York State Class A Surface Water Quality Standards and groundwater levels to NYS Class GA Groundwater Standards. Reduce sediment contaminant concentrations or exposure to below acute/chronic toxicity limits.
6. Inhalation of fugitive dust from contaminated soil	Air	Reduce exposure or contaminant concentrations to levels that comply with NYSDEC ambient guideline concentrations.
7. Ingestion of contaminated groundwater/ LNAPL	Groundwater/ LNAPL	Eliminate/reduce levels encountered.
8. Dermal exposure to contaminated groundwater/ LNAPL	Groundwater/ LNAPL	Eliminate/reduce levels encountered.

TABLE 3 - 2

SCGs and Preliminary Remediation ARARs for the River Road Site

Statue, Regulation or Program	*Applicability*	*Category*
Water Quality Standards for Surface and Groundwater (6 NYCRR Parts 700 - 705)	Applicable to all sources of surface and groundwater	Action-specific; Contamination-specific; Location-specific
NYSDOH Requirements for General Organic Chemicals in Drinking Water (PHL; Sections 201 and 205)	Applicable to sources of potable water supply.	Contaminant-specific;
NYSDEC Air Guide-1 (New York State Air Guidelines for 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
NYSDEC Hazardous Waste Treatment Storage and Disposal Facility Permitting Requirements (6 NYCRR Part 373)	Applicable groundwater protection standards and to potential treatment, storage and disposal of hazardous wastes.	Action-specific; Contaminant-specific
Safe Drinking Water Act/USEPA Health Advisories 40 C.F.R. Parts 141, 142 and 143)	Applicable Maximum Contaminant Levels to sources of groundwater and potable water supply where more stringent or where specific NYSDEC standards or guidelines do not exist.	Contaminant-specific
Resource Conservation and Recovery Act-Groundwater Protection Standards (40 CFR Part 264, 90-264,109)	Applicable standards to sources of groundwater and potable water supply where more stringent or where specific NYSDEC standards or guidelines do not exist.	Contaminant-specific
Resource Conservation and Recovery Act-Subtitle C/Hazardous and Solid Waste Ammendments/New York State Hazardous Waste Management Regulations.	Applicable to the treatment, storage, transportation and disposal of hazardous wastes and wastes listed under 6 NYCRR Part 371.	Action-specific
Clean Water Act - Ambient Water Quality Criteria (EPA 44/5-86-001)	Applicable to alternatives involving treatment with point-source discharges to surface water.	Action-specific; Contaminant-specific; Location-specific

TABLE 3-2 (CONT'D)

Statute, Regulation or Program	*Applicability*	*Category*
Occupational Safety and Health Administration (OSHA) Regulations (29 CFR 1900–1999)	Applicable to workers and work place throughout implementation of investigation activities and remedial actions.	Action-specific; Contaminant-specific; Location-specific
Hazardous Materials Transportation	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
State Pollutant Discharge Elimination System Permit Program	Applicable to projects which discharge treated effluent to surface waters or groundwaters of New York State.	Action-specific; Contaminant-specific; Location-specific

Based upon this remediation criteria, it is estimated that approximately 40,000 cy of surface and subsurface soil exceed the criteria in the eastern area of the site. However, since contamination in the eastern area is heterogenious, it has been assumed that the entire eastern area will be excavated to a depth of 7 feet representing a volume of 70,000 cy. In addition, there are also proposed SCGs which are based upon the partitioning theory in which soil contamination may result in groundwater contamination. As compared to the soil remediation guidance values above, which are primarily for the protection of human health, the partitioning theory results in extremely low values for individual compounds utilized for soil criteria for the protection of groundwater. Based on the assumption that a slag layer at a depth of 7 ft is the limit of excavation and perhaps containment of leachable soil at the site, it is estimated that a volume of 150,000 cy of surface and subsurface soils at the site may exceed the groundwater based criteria. The remedial action alternatives selected for the River Road site would comply with the two types of chemical specific SCGs to varying degrees.

Alternative 1 - No Action would not meet any of the chemical specific SCGs for soil or groundwater at the site as the wastes, contaminated surface and subsurface soils, and groundwater exceeding remediation guidelines would remain in place.

With respect to groundwater, Alternatives 2 through 5, which all include short-term LNAPL extraction and treatment, and long-term groundwater extraction and treatment, are assumed will achieve groundwater SCGs. Since these alternatives all contain the same degree of groundwater treatment, they are assumed to provide the same ability to achieve chemical specific SCGs. Groundwater quality would be evaluated at a maximum of 5 year intervals and near the end of the planned extraction and treatment to determine if continued groundwater remediation is appropriate.

Surface and subsurface (unsaturated) soil SCGs for the protection of health and groundwater would only be potentially achieved under Alternative 5 in which extensive excavation and off-site treatment/disposal of 150,000 cy of surface and subsurface soils/waste is proposed. Since this excavation does not include fill material below the slag layer, end point sampling would be necessary to determine if SCGs for soil were achieved. If not, groundwater remediation would be relied upon to achieve the SCGs.

In Alternative 2, the cover to be placed would be a low permeability membrane in the area containing LNAPL and a permeable cover over all other areas of the site. This would eliminate surface contact and protect health, but would not meet soil SCGs and would rely on 2/15 years (or greater) of LNAPL/groundwater recovery, respectively, to remediate groundwater contamination to SCGs. Alternative 4 includes the placement of a low permeability cover over the entire site which would minimize infiltration of precipitation through contaminated soil/waste preventing additional groundwater from becoming contaminated and would protect health, but would not meet SCGs for soil.

Alternative 3 includes on-site consolidation of 70,000 cy of contaminated site surface and subsurface soils. These soils would be transferred from the eastern portion to the western area of the site and covered with a low permeability membrane. This action would achieve SCGs for site soils in the eastern area and would protect health, but would not meet soil SCGs in the western portion of the site. Surface and subsurface soil exceeding SCGs for protection of groundwater would only be partially remediated under this alternative. Similar to Alternative 5, this determination assumes that material below the slag layer would meet SCGs. If not, groundwater remediation would be relied upon to achieve SCGs.

In addition to groundwater and soil SCGs at the site, there are also chemical specific SCGs regarding air emissions. These SCGs are intended to ensure that no remedial alternative results in an unacceptable degradation of air quality. All the alternatives, with the exception of the no action alternative, include excavation and handling of contaminated soil. These activities can result in the release of vapors and dust in sufficient quantities to require engineering controls to prevent exceedance of air quality SCGs. These controls could include a hooded structure with a gas collection and treatment system or other means such as use of dust suppressants. A determination prior to the implementation of any alternatives requiring soil disturbance would be made to identify the potential for site soils and waste to generate dust and vapors, and the degree of control required during remediation.

In summary, Alternatives 2 through 5 are likely to achieve SCGs for groundwater at the site. Alternative 5 may achieve soil SCGs at the site. All other alternatives, except no action, involve extensive consolidation of site soils and/or cover, which does not achieve soil contaminant specific SCGs; however, Alternative 3 partially achieves SCGs. Although Alternatives 2 through 4 do not achieve soil SCGs, they do protect health and Alternative 4 achieves a greater potential in reducing leaching of contaminants to groundwater. It is believed that engineering controls can be used to prevent contravention of air SCGs.

3.1.2 Action-specific SCGs

All of the remedial alternatives, would be designed and implemented to comply with action specific SCGs at the site. Alternative 5, which requires transportation of the excavated contaminated material off-site, would comply with the SCGs of 6NYCRR Part 372 and the U.S. Department of Transportation regulations regarding shipment of hazardous waste and hazardous materials. All alternatives, except no action, require excavation and/or regrading of the site. This activity may release toxic vapors and dust. Air emissions during these activities would be regulated under the NYSDEC's Air Guide - 1 (NYSDEC, 1991), Ambient Guideline Concentrations (AGCs) and National Emission Standards for Hazardous Air Pollutants (NESHAPS). New York State or local nuisance odor or noise regulations may also be applicable during the remedial action.

Covering of contaminated materials over of the site, as included in Alternatives 2, 3 and 4, would be regulated under 6NYCRR Part 373, and a minimum of 30 years of postclosure groundwater monitoring and maintenance (except for Alternative 5) would be required for all of the alternatives. Since groundwater at and in the vicinity of the site is not used as a potable water supply, maximum contaminant levels (MCLs) promulgated under the Federal Safe Drinking Water Act (42 U.S.C. 300f) and New York State Public Health Law Section 225 would not be applicable.

In summary, it is believed that all alternatives, including no action, would achieve action specific SCGs.

3.2 Overall Protection of Human Health and the Environment

Remediation of the River Road site by implementing the selected alternatives, except for no action, would provide for protection of human health and the environment resulting from ingestion of and dermal contact with the groundwater or soil/waste, and inhalation of soil/waste to varying degrees. Alternatives 2 through 5 assume that a total of 15 years recovery and treatment of groundwater would achieve standards/guidelines. Groundwater quality would be reevaluated at a maximum of 5 year intervals and prior to the end of the planned remediation period to determine if continued groundwater treatment is necessary.

Alternatives 2 and 4 provide protection to human health and the environment by covering the site and preventing contact with these soils. Alternative 3 involves an extensive consolidation of soils from the eastern portion of the site and placement under a low permeability cover. This should also effectively eliminate exposure pathways based upon exposure to site surface and subsurface soils. Alternative 4 would be more protective than Alternative 2, since this alternative includes a low permeability cap over all site soils and would be more effective in mitigating leaching of soil contaminants to groundwater. Alternative 5 includes the excavation and removal of contaminated soil/waste at the site. The intent of this excavation is to remove all soil/waste at the site that exceed recommended remediation guidelines for protection of human health and the environment, including those for protection of groundwater.

In summary, Alternative 5 is anticipated to be the most protective of human health and the environment due to all significantly contaminated soil and groundwater being removed off-site and treated, respectively, assuming that the material below the slag layer does not exceed remediation criteria for protection of human health and groundwater. Of the remaining alternatives, Alternative 3 would be most protective of human health and the environment since a portion (approximately 50%) of site soils would be removed and covered with a low permeability membrane and LNAPL/Groundwater treatment would be performed. Alternatives 2 and 4 would eliminate surface soil exposure routes, however, Alternative 4 would provide an impermeable cover over the entire site and Alternative 2 would only provide a low permeability cap in the area of LNAPL contamination. LNAPL/groundwater treatment would be performed under all alternatives except no-action. In the long run, exclusive of Alternative 5, Alternative 2 may provide the greatest reduction of risk associated with soil and groundwater as a result of flushing the contaminated site soils utilizing a permeable cover over a portion of the site thereby decreasing soil toxicity. Alternative 1 would not provide any protection of human health or the environment for groundwater or contaminated soils at the site.

3.3 Short-term Impacts and Effectiveness

During construction activities associated with Alternatives 2, 3, 4 and 5, access to the site would be restricted to eliminate potential for exposure to contaminants. Site remediation workers would be protected through use of appropriate respiratory and dermal contact protection as required by the Occupational Safety and Health Administration (OSHA), and the site specific health and safety plan to be developed prior to remediation. The environment would be protected through measures to prevent fugitive emissions, such as dust suppression and temporary cover, and runoff of contaminated excavated material, such as erosion controls.

During construction activities associated with Alternatives 2 and 4, a limited volume of waste piles (6,000 cy), contaminated soil and waste along the Niagara River (8,000 cy) would be excavated, consolidated and regraded. These activities would occur over a short period likely to be less than a few months. Placement of the permeable and low permeability cover would utilize clean material and therefore impacts would be more of a nuisance than health or environmental based; however, regrading of the site and disturbance of contaminated material would be required. It it anticipated that significantly more regrading would be required with regard to Alternative 4 as compared to Alternative 2.

Alternative 3 involves the excavation, consolidation and regrading of 70,000 cy of material and would take about 1 year. This activity would take considerably longer than Alternatives 2 and 4 (about 6 to 9 months), and therefore the adverse short-term impacts would be greater. Alternative 5 includes the excavation and off-site transportation of 150,000 cy of fill material and the backfill of an equal quantity of clean fill. It is likely that this construction period would require approximately 1.5 to 2 years to accomplish. Alternative 5 also includes the construction of a slurry wall along the Niagara River. This containment barrier could be constructed in a manner in which little or no impacts would result from this activity.

The construction of the LNAPL/groundwater recovery system required for all alternatives, except no action, might take 3 to 6 months to construct. Installation would be conducted after the site regrading, excavation, backfilling and cover construction activities.

All alternatives would be protective of the community, environment and on-site workers with appropriate controls/mitigation measures, but the shorter the construction period, the less the risk of short-term adverse impacts. In summary, Alternatives 2 and 4, respectively, provide the least disturbance of site soils and therefore the least short-term impacts followed by Alternatives 3 and 5, respectively. Since Alternative 1 will require no activity, there will be no short-term impacts due to construction.

Essentially, until remediation is complete for soils and groundwater, none of the alternatives will be effective in the short term.

3.4 Long-term Effectiveness and Permanence

3.4.1 Permanence

According to NYSDEC TAGM 4030, destruction technologies and separation/treatment technologies are considered permanent remedies for contaminants. On-site containment and off-site disposal are not considered permanent remedies because the physical containment structures used have a limited lifetime. These structures would require maintenance, repair and/or replacement.

Treatment proposed for LNAPL/groundwater at the site would be a permanent remedy for the contaminants in the water. Oil/water separation, additional on-site pretreatment and treatment by the Town of Tonawanda WWTP would remove organic and inorganic contaminants from the groundwater to acceptable levels prior to discharge to the Niagara River. The groundwater discharge to the WWTP would meet the facility's pretreatment requirements. The duration of groundwater recovery and treatment at the site will determine whether complete remediation of site groundwater will occur. Any portion of contaminated soils remaining in place as part of Alternatives 1 through 4 will provide potential for additional groundwater to become contaminated. However, additional groundwater contamination is less likely with Alternatives 3 and 4 which provide a low permeability cover over contaminated material at the site, with Alternative 3 being more effective because a portion of the site contamination will be removed. Alternative 2 provides low permeability cover only over a portion of the site and therefore provides less degree of protection from additional groundwater contamination.

3.4.2 Waste Remaining at the Site

Alternative 5 is the alternative in which the least amount of contaminated soil/waste will remain at the site. Excavation conducted as part of this alternative will continue until the slag layer is encountered. It is not believed the slag material represents a human or environmental risk and is not likely to leach contaminants to the groundwater. Alternative 2, involves on-site containment/low permeability cover over a portion (25%) of the site. In Alternative 2, the area of the cap is limited to the portion of the site where LNAPL has been identified. In Alternative 3, extensive soil consolidation is performed and included in the western portion of the site which is to be contained with a low permeability cover. Alternative 4 provides a low permeability cover over the entire site. None of these alternatives treat any of the contaminated soils/wastes, except for Alternative 5 which may require some degree of treatment. Alternatives 2, 3 and 4, provide increasing degrees of prevention of leaching of contaminants to groundwater. These alternatives also provide for LNAPL/groundwater recovery which would limit lateral contaminant migration and, as a result, the mobility of the contaminants at the site would decrease. Alternative 5 also includes LNAPL/groundwater treatment which limits contaminant mobility.

3.4.3 Environmental Controls

Remedial alternatives requiring postclosure maintenance include all alternatives exclusive of 5. Alternatives 2, 3 and 4 would require maintenance of the permeable and low permeability covers, and these alternatives would require monitoring. Alternatives 2 through 5 would require maintenance of the groundwater extraction and treatment system. Alternatives 1 through 5 would require groundwater monitoring during, and subsequent to, remediation of the groundwater. With each of the alternatives, a minimum of 30 years monitoring and maintenance (exclusive of Alternative 5) would be conducted. Groundwater monitoring wells have been selected to detect any migration of contaminants from the site. If contaminants are detected in monitoring wells or in the discharge of the pretreatment facility at unacceptable levels, corrective actions will be taken. The covers at the site would be inspected regularly and maintained as needed.

In summary, Alternative 5 is judged to be the most effective in the long term for the River Road site, requiring limited long-term monitoring/maintenance, but is not considered permanent because contaminants will remain in the soil/waste at the off-site landfill if not treated. On-site containment/low permeability cover (Alternatives 3 and 4) and a permeable cover with containment over LNAPL area (Alternative 2) are not considered permanent. Contaminated soil would remain at the site without treatment, requiring a minimum of 30 years of groundwater monitoring and maintenance. Alternatives 3 and 4, respectively, are likely to be more effective than Alternative 2 with regard to leaching contaminants to groundwater, however, Alternative 2 may be better in the long term due to the flushing of contaminants from site soils. Alternative 3 would be more effective than Alternative 4 because a portion of site contaminated soil/waste would be removed and contained. The no action alternative (Alternative 1) would not be long-term effective.

3.5 Reduction of Toxicity, Mobility and Volume

3.5.1 Reduction of Toxicity

On-site containment (Alternatives 2 through 4), off-site disposal (Alternative 5) and no action (Alternative 1) would not reduce the toxicity of the wastes and contaminated soils unless for Alternative 5 there is some treatment. Groundwater recovery and treatment (Alternatives 2 through 5) would reduce the toxicity of the groundwater and is likely to have at least a minor beneficial impact on site soils due to the flushing action of the groundwater. Alternative 2, with a partial permeable cover, will allow the flushing of contaminated site soils.

3.5.2 Reduction of Mobility and Volume

On-site containment with a low permeability cover (Alternatives 3 and 4) and off-site land disposal (Alternative 5) would reduce the mobility of the contaminants in soil through isolation with physical structures and removal, respectively. The volume of the contaminants would remain unchanged. Alternative 2 would reduce the mobility of contaminants in the soil in the area of the low permeability cover and through prevention of dust emissions by isolation with a permeable cover. With Alternative 2, additional groundwater has the potential for becoming contaminated due to the infiltration of precipitation through contaminated soil in the area of the permeable cover; however, this would tend to reduce the toxicity and volume of contaminated site soils over time. No action (Alternative 1) would not affect the mobility or volume of the contaminants. All alternatives involving groundwater extraction and treatment (Alternatives 2 through 5) would reduce the mobility and volume of the contaminated groundwater. The extent of the reduction would be dependent upon the duration of operation of the extraction and treatment system, as well as how effectively soil/waste contamination at the site has been contained (Alternatives 3 and 4) or partially flushed (Alternative 2). Since Alternatives 2 through 5 involve groundwater extraction and treatment, these alternatives would be similarly effective in reducing the mobility and volume of contaminants in groundwater.

3.5.3 Reversibility

Since none of the alternatives destroy soil/waste contamination at the site, all of the alternatives evaluated for the River Road site pertaining to soil and waste are considered reversible. Even those alternatives involving a reduction in mobility provided by containment are reversible, because the physical containment structures have a limited lifetime and would require repair or a replacement.

Recovery and treatment of contaminated LNAPL/groundwater at the site will be irreversible. The contaminants will be removed and pretreated on-site and further treated at the Town of Tonawanda WWTP. The duration of groundwater treatment will be based upon a maximum of a 5 year review and evaluation interval to determine if continued groundwater treatment is appropriate. Future remedial action for groundwater would only be necessary if the contaminated soil/waste at the site was not adequately remediated (removed or contained) and continued to leach contaminants to the groundwater.

In summary, Alternatives 2 through 5, have the same planned of LNAPL/groundwater extraction and treatment, and therefore equally beneficial reduction of toxicity, mobility and volume of contaminated groundwater at the site. Alternative 2 may also have an added benefit of likely decreasing the toxicity and volume of contaminated site soils over time, not including the area of the low permeability cover.

3.6 Implementability

3.6.1 Ease of Implementation

At the River Road site, there are two general implementation difficulties regarding remediation: air emissions and a subsurface slag material.

The remedial alternatives requiring excavation and/or consolidation, and regrading of contaminated material at the site may have some difficulty during remediation because of the vapors, and dust that may be released during these activities. Control systems for air emissions, such as temporary covers, dust suppressants, etc., may be required. Workers excavating the site may be required to wear higher levels of personal protective equipment than Level D.

The slag material could represent a difficulty during excavation as it will not likely be able to be removed with a typical excavator and may require additional measures such as the use of pneumatic hammers to remove the material. Due to the properties of the slag material, which would limit leaching of contaminants, the alternatives as planned leave the material in place.

The on-site groundwater extraction and treatment system should be easily constructed and operated at the site. Adequate space exists in areas of the site which will be remediated for location of the on-site treatment system.

Difficulties may arise during the construction of the slurry wall (Alternative 5) and excavation of the material within 50 feet of the Niagara River due to the slag material which may be encountered. Construction activities for the slurry wall should be conducted in areas which have not been exposed to significant contamination at the site (in clean fill, where possible), to maximize the effectiveness of the slurry wall.

Table 3-3

ALTERNATIVES COST SUMMARY

Alternative	Estimated Capital Cost	Estimated Contingency and Engineering Fees	Present Worth of Annual Operating and Maintenance Costs	Total Estimated Costs
1	0	0	$ 154,000	$ 154,000
2	$ 2,169,000	$ 976,000	$2,301,000	$ 5,446,000
3	$ 3,749,000	$1,687,000	$2,393,000	$ 7,829,000
4	$ 2,622,000	$1,180,000	$2,593,000	$ 6,395,000
5	$40,803,000	$ 4,488,000	$2,193,000	$47,484,000

3.6.2 Delays in Implementation

No delays in implementation of the technologies under consideration for the River Road site are anticipated. Each of the technologies are proven and have been utilized at numerous number of sites. Although equipment such as that utilized for LNAPL/groundwater recovery and treatment do experience breakdowns, it is not anticipated that significant delays would occur in the replacement of this equipment.

3.6.3 Coordination of the Remedial Alternatives

Interaction with the Army Corps of Engineers may be required for construction activities along the creek and Niagara River. Therefore, all of the remedial alternatives, except no action, may require coordination with offices of agencies outside the NYSDEC. The LNAPL/groundwater recovery, pretreatment and discharge to the Town of Tonawanda WWTP (Alternatives 2 through 5) will require coordination with the Town. The discharge will need to comply with the WWTP's pretreatment requirements.

3.6.4 Availability of Technologies

Each of the remedial technologies being considered for the River Road site is readily available. The availability of any specific technology is not likely to effect the implementability of any of the alternatives. Based on discussions with a disposal facility (Model City Landfill), capacity for disposal of 150,000 cy of contaminated soil is available in the Buffalo area.

In summary, Alternative 2 most likely represents the most readily implementable alternative other than no action due to the limited consolidation of wastes and the relatively easy constructability of a permeable cover. Alternative 2 also presents the easiest sequence of remedial actions with one action not likely to interfere with the implementation of a subsequent action. Alternative 4 would likely be the next easiest alternative to be implemented since a low permeable cap would be placed over the site which would likely require fairly significant regrading and site preparation activities. Based on volumes of material to be excavated, Alternatives 3 and 5, respectively, would be more difficult to implement.

3.7 Cost

The capital, and operation and maintenance (O&M) costs of each of the remedial alternatives considered for the River Road site are summarized below. A detailed breakdown of each estimate is provided in Appendix A. A summary table comparing total capital and annual O&M costs, together with the implementation period and net present worth (30 years at 5% interest) for each alternative is presented in Table 3-1. Costs for activities such as LNAPL/groundwater extraction and treatment have been based upon their planned operational period.

The following assumptions were utilized in the preparation of the cost estimates:

- Excavation activities could release vapors, dusts and odors. However, since the material encountered during excavation associated with the test trench program during the remedial investigation did not release detectable quantities of dusts or odors and elevated vapor readings were detected only in extremely close proximity to the excavated fill, no costs for enclosures or vapor phase treatment have been included in the cost estimates. It is assumed that all emissions generated during excavation activities can be controlled through conventional means such as dust suppressants or use of cover material.
- Costs are rounded to the nearest thousand dollars.
- Groundwater treatment system costs are based upon information provided by vendors of package type treatment systems.
- All site work costs (e.g., excavation, backfill, etc.) were estimated using Means Site Work Cost Data for 1993, experience in construction, and adjusted for hazardous site work based upon information provided by contractors specializing in hazardous waste site remediation.
- Off-site land disposal costs were estimated based upon information provided by Chemical Waste Management, Inc. (CWM). Costs for transportation and disposal of contaminated soil and sludge are based upon utilization of the Model City facility which has the capacity to accept the soil and a TSCA cell for the sludge. Cost for incineration of the LNAPL are based upon utilization of CWM's Port Arthur, Texas facility.
- Treatment costs are based upon a 7 day/week and 24 hour/day operation.

Section 4

4.0 PREFERRED ALTERNATIVE

In this Phase III Feasibility Study, five remedial alternatives developed for the River Road site are evaluated in conformance with the criteria specified in NYSDEC TAGM 4030 (Selecting Remedial Alternatives at Inactive Hazardous Waste Sites). With the exception of no action, each alternative includes LNAPL/groundwater extraction with on-site treatment and discharge to the Town of Tonawanda WWTP, combined with regrading and/or consolidation of site soils and waste and placement of a permeable or low permeability cover, or excavation of site soils and waste with off-site disposal.

The qualitative risk assessment conducted as part of the remedial investigation indicated that exposed contaminated soil/waste at the site poses an unacceptable risk to human health and the environment due to direct contact. In addition, the potential exists for light nonaqueous phase liquid and groundwater in excess of standards and guidelines to adversely affect water quality in the Niagara River which is used as a source of potable water.

Table 4-1 presents a summary of the comparative analysis of alternatives for each of the evaluation criteria discussed in detail in Section 3.0 and a ranking of alternatives for each criteria based upon the comparative analysis. Table 4-2 presents a summary of the ranking of the alternatives for each evaluation criteria and an overall ranking of the alternatives.

Alternative 1, which is no action, will not be considered for the River Road site because, in addition to being the lowest ranking alternative, it is not protective of human health and the environment, and therefore does not attain the remedial action objectives selected for the site.

Although Alternative 5, which comprises long-term groundwater remediation and extensive removal of contaminated material from the site, based on the evaluation criteria exclusive of cost, is the highest ranking alternative, it is substantially greater in cost compared to the other alternatives. (The estimated cost for Alternative 5 is $47,484,000, while the next highest cost is $7,829,000 [Alternative 3].) In addition, there is the possibility, as indicated by a few of the remedial investigation results, that residual contamination may remain in the slag and under lying material after excavation of the soil and waste above the slag layer, which would not result in unrestricted use of the site as intended with this alternative.

Table 4-1

ALTERNATIVE COMPARATIVE ANALYSIS SUMMARY

Chemical Specific SCGs

Alternative	Soil	Groundwater	Rank
1	No	No	5
2	No, but reduces the area for leaching contaminants (15,000 sy).	Yes	4
3	No, but reduces the area of contaminated soil (30,000 sy)* and reduces the area of the remainder of the site for leaching contaminants (35,000 sy).	Yes	2
4	No, but reduces the area for leaching contaminants (65,000 sy).	Yes	3
5	Yes*	Yes	1

*Assumes that the slag layer and material below the slag layer will meet SCGs.

Action Specific SCGs

Yes for all alternatives

Overall Protection of Human Health and the Environment

Alternative	Soil	Groundwater	Rank
1	No		5
2	Yes, but does not prevent leaching of contaminants to groundwater for a portion (75%) of the site.		4
3	Yes, reduces contaminated soil from a portion (50%) of the site and prevents leaching of contaminants.		2
4	Yes, and prevents leaching of contaminants.		3
5	Yes		1

Table 4-1 (continued)

ALTERNATIVE COMPARATIVE ANALYSIS SUMMARY

Short-Term Impacts and Effectiveness

Alternative	Construction/Soil Disturbance	Rank
1	None	1
2	Relatively minor excavation (14,000 cy) and regrading (20,000 cy).	2
3	Significant excavation (70,000 cy).	4
4	Relatively minor excavation of 14,000 cy, but significant regrading (40,000 cy).	3
5	Extensive excavation and off-site transportation (150,000 cy) and construction of a slurry wall.	5

Long-Term Effectiveness and Permanence

Alternative	Soil	Groundwater	Rank
1	No	No	5
2	No, but provides a low permeability cover for a portion of the site.	Yes	4
3	No, but partially effective on-site.	Yes	2
4	No, but provides a low permeability cover for the entire site.	Yes	3
5	No, but effective and permanent on-site and could receive some treatment off-site.	Yes	1

Table 4-1 (continued)

ALTERNATIVE COMPARATIVE ANALYSIS SUMMARY

Reduction of Toxicity, Mobility and Volume

Alternative	Soil	Groundwater	Rank
1	No	No	5
2	No, but mobility reduced over a portion of the site.	Yes	4
3	No, but mobility reduced over the entire site with consolidation.	Yes	2
4	No, but mobility reduced over the entire site.	Yes	3
5	No, but toxicity could be reduced as a result of off-site treatment.	Yes	1

Implementability

Alternative	Soil	Groundwater	Rank
1	Simple	Yes	1
2	Fairly simple, construction of a low permeability cover (15,000 sy).	Yes	2
3	Some difficulty, significant excavation (70,000 cy) and construction of a low permeability cover (35,000 sy).	Yes	4
4	Some difficulty, construction of a low permeability cover (65,000 sy).	Yes	3
5	Some difficulty, extensive excavation (150,000 cy).	Yes	5

Cost

Alternative	Cost	Rank
1	$154,000	1
2	$5,446,000	2
3	$7,829,000	4
4	$6,395,000	3
5	$47,484,000	5

Table 4-2

SUMMARY OF ALTERNATIVE RANKING
BASED ON EVALUATION CRITERIA

Alternative	Compliance with SCGs	Protection of Health and Environment	Short-Term Impacts and Effectiveness	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility and Volume	Implementability	Overall Ranking Exclusive of Cost	Cost
1	5	5	1	5	5	1	5	$154,000
2	4	4	2	4	4	2	4	$5,446,000
3	2	2	4	2	2	4	2	$7,829,000
4	3	3	3	3	3	3	3	$6,395,000
5	1	1	5	1	1	5	1	$47,484,000

This alternative would also have significant short-term impacts because of the large quantities of contaminated soil and waste which would be excavated and transported off-site, and the large amount of clean backfill which would need to be brought to the site. In addition, because of the slag material on-site, excavation and construction of the slurry wall may be difficult.

As a result of these factors, Alternative 5 is not recommended for implementation at the River Road site.

Alternative 3, which comprises long-term groundwater remediation and extensive excavation and consolidation of contaminated material on-site and cover with an impermeable membrane, based on the evaluation criteria is the next highest ranking alternative; however, similar to Alternative 5 may result in residual contamination remaining in the eastern area after excavation of fill material to the slag layer, which would not result in unrestricted use of this portion of the site. In addition, it would result in a significant disturbance of contaminated material at the site and result in an average increase in elevation of nearly 10 feet, including the low permeability cover, in the western portion of the site. In order to attain the planned 4% slopes for site drainage, the maximum elevation would be greater. This alternative will also result in significant short term impacts due extensive excavation and grading of contaminated material, and placement and grading of clean soil to backfill the excavated area.

Based on these considerations, Alternative 4 is not recommended for implementation at the site.

Of the remaining alternatives (Alternative 2, which comprises long-term groundwater remedial and placement of a low permeability cover over the LNAPL area and a permeable cover over the remaining site, and Alternative 4, which also comprises long-term groundwater remediation and placement of an impermeable cover over the entire site), both would be protective of human health and the environment resulting from direct contact with contaminated soil and waste at the site and rank closely.

Alternative 4 would mitigate the leaching of contaminants from the soil over the entire site, while Alternative 2 would allow the flushing of contaminants from the soil outside of the limits of the LNAPL area which would have a low permeability cover. Based on existing data, it does not appear that leaching of contaminants from other than the LNAPL area is significantly impacting groundwater quality, and it is expected that this situation will continue in the future and likely result in less groundwater contamination with time. In addition, the planned groundwater extraction and treatment system will partially control the migration of contaminated groundwater resulting from areas covered by a permeable protection barrier. Also, Alternative 2 would allow more options for construction (without concern for comprising the integrity of an impermeable membrane, except in the LNAPL area), and therefore would allow less restrictive use of the site.

Based on the above comparison between Alternatives 2 and 4, and consideration of the cost of Alternative 2 being nearly $1 million less than Alternative 4, Alternative 2 is recommended as the remedial action for the River Road site. As a condition to selection of this alternative, it is recommended that a contingency element be added which would provide for additional groundwater extraction wells and treatment if groundwater became significantly contaminated in the area of the permeable cover as determined by the results of the long term groundwater monitoring program. In addition, implementation of Alternative 2 will require predesign investigation, including a pump test to determine the extraction rate, and final number and location of extraction wells to reverse groundwater flow direction on-site, and a treatability study to determine the most appropriate groundwater treatment process to achieve sewer use discharge limitations.

Appendix A

APPENDIX A

DETAILED COST ANALYSIS

TABLE A-1
RIVER ROAD SITE
COST ESTIMATE – ALTERNATIVE 1
NO ACTION ALTERNATIVE

Monitoring Costs Per Event

Item	Quantity	Units	Unit Cost	Total Cost
Groundwater sampling	2	mandays	$600	$1,200
Sample analysis	5	samples	$1,200	$6,000
	Estimated Per Event Monitoring Costs			$7,200
	Present Worth of Annual Groundwater Monitoring Cost for 30 yrs (i=5%)*			$154,000
	Remedial Alternative 1 Total Estimated Costs			$154,000

*Sampling Frequency

Years	Number of Sampling Events/Year
1–3	4
4–5	2
5–10	1
10–30	bi–annual

TABLE A-2
RIVER ROAD SITE
COST ESTIMATE – ALTERNATIVE 2

Direct Capital Costs

Item	Quantity	Units	Unit Cost	Total Cost
Site Preparation				
Clearing and grubbing	13	Acres	$3,000	$39,000
Regrading fill (including waste piles) to attain 4% slope for drainage	20000	CY	$5	$100,000
Permeable Cover Materials and Installation				
Buy/haul/place 1' Cobbles	16000	CY	$12	$192,000
Buy/haul/place 1.5' bank run	24000	CY	$12	$288,000
Buy/haul/place 6" topsoil	8000	CY	$18	$144,000
Seed, fertilizer and mulch	50000	SY	$1	$50,000
Low Permeability Cover Material and Installation				
Buy/haul/place 1' sand and compact	5000	CY	$15	$75,000
Buy/haul/place/compact 1' clay (10-7 cm/sec)	5000	CY	$21	$105,000
Buy/haul/place 18" protective layer	7500	CY	$15	$113,000
Buy/haul/place 6" topsoil	2500	CY	$18	$45,000
Seed, fertilizer and mulch	15000	SY	$1	$15,000
LNAPL/Groundwater Recovery and Treatment and Installation				
Extraction wells (10@25)	250	LF	$100	$25,000
Submersible pumps and piping	10	Each	$1,500	$15,000
Package treatment plant	-	Lump Sum	$400,000	$400,000
Misc.(controllers,discharge piping)	-	Lump Sum	$80,000	$80,000
Pipes to treatment plant and sewer	1200	LF	$17	$20,000
Manholes	12	Each	$1,800	$22,000
Other Costs				
Safety program	-	Lump Sum	$50,000	$50,000
Dust control	-	Lump Sum	$20,000	$20,000
Runoff control	-	Lump Sum	$20,000	$20,000
Equipment decontamination	-	Lump Sum	$15,000	$15,000
Mobilization/demobilization	-	Lump Sum	$80,000	$80,000
Site fencing	400	LF	$10	$4,000
Erosion Control				
Excavation of river bank	8000	CY	$12	$96,000
Buy/haul/place bank run	8000	CY	$12	$96,000
Rip-rap (1' deep)	1500	SY	$40	$60,000
	Estimated Capital Cost			**$2,169,000**
Contingency and Engineering Fees				
Contingency allowance(25%)				$542,000
Engineering fees (20%)				$434,000
	Estimated Contingency and Engineering Fees			**$976,000**
	TOTAL ESTIMATED CAPITAL COST			**$3,145,000**

TABLE A-2(Cont'd)
RIVER ROAD SITE
COST ESTIMATE – ALTERNATIVE 2

Annual Operating and Maintenance Costs

Item	Quantity	Units	Unit Cost	Total Cost
Site mowing	15	Mandays	$300	$4,500
Site inspection	10	Mandays	$600	$6,000
Miscellaneous site work	20	Mandays	$300	$6,000
Site work materials	–	Lump Sum	$4,000	$4,000
		Estimated Annual Operating and Maintenance Costs		$20,500
	Present Worth of Annual Operating & Maintenance Cost for 30 Yrs (i=5%)			$323,000
	Present Worth of Annual Groundwater and Effluent Monitoring (30 yrs, i=5%)*			$154,000
LNAPL disposal (2 years)	10000	Gallons	$3	$30,000
Transportation (Port Arthur, Texas)	2	Trips	$6,500	$13,000
Sludge disposal (15 years)	2000	CF	$30	$60,000
Groundwater treatment system (15 years)	–	Annual Cost	$80,000	$80,000
Sewer discharge (15 years)	13	MG/year	$1,250	$16,000
Effluent monitoring (15 years)	–	Annual Cost	$12,000	$12,000
	Present Worth Based Upon Years shown in Parenthesis			$1,824,000
		REMEDIAL ALTERNATIVE 2 TOTAL ESTIMATED COST		$5,446,000

*Assumes same monitoring level of effort as no action alternative

TABLE A-3
RIVER ROAD SITE
COST ESTIMATE - ALTERNATIVE 3

Direct Capital Costs

Item	Quantity	Units	Unit Cost	Total Cost
Site Preparation				
Clearing and grubbing	13	Acres	$3,000	$39,000
Excavate/haul/place contaminated material	70000	CY	$12	$840,000
Regrading fill (including waste piles) to attain 4% slope for drainage	25000	CY	$5	$125,000
Low Permeability Cover Material and Installation				
Buy/place geotextile filter fabric (2 layers)	70000	SY	$1.50	$105,000
Buy/place synthetic low permeability liner	35000	SY	$5	$175,000
Buy/haul/place 6" drainage layer	6000	CY	$18	$108,000
Buy/haul/place 1.5' bank run	18000	CY	$12	$216,000
Buy/haul/place 6" topsoil	6000	CY	$18	$108,000
Seed, fertilizer and mulch	35000	SY	$1	$35,000
Backfill excavated area	70000	CY	$12	$840,000
Buy/haul/place 6" top soil over excavated area	5000	CY	$18	$90,000
Seed, fertilizer and mulch	65000	CY	$1	$65,000
LNAPL/Groundwater Recovery and Treatment and Installation				
Extraction wells (10@25)	250	LF	$100	$25,000
Submersible pumps and piping	10	Each	$1,500	$15,000
Package treatment plant	-	Lump Sum	$400,000	$400,000
Misc.(controllers,discharge piping)	-	Lump Sum	$80,000	$80,000
Pipes to treatment plant and sewer	1200	LF	$17	$20,400
Manholes	12	Each	$1,800	$21,600
Other Costs				
Safety program	-	Lump Sum	$50,000	$50,000
Dust control	-	Lump Sum	$20,000	$20,000
Runoff control	-	Lump Sum	$20,000	$20,000
Equipment decontamination	-	Lump Sum	$15,000	$15,000
Mobilization/demobilization	-	Lump Sum	$80,000	$80,000
Site fencing	400	LF	$10	$4,000
Erosion Control				
Excavation of river bank	8000	CY	$12	$96,000
Buy/haul/place bank run	8000	CY	$12	$96,000
Rip-rap (1' deep)	1500	SY	$40	$60,000
	Estimated Capital Cost			**$3,749,000**
Contingency and Engineering Fees				
Contingency allowance(25%)				$937,000
Engineering fees (20%)				$750,000
	Estimated Contingency and Engineering Fees			**$1,687,000**
	TOTAL ESTIMATED CAPITAL COST			**$5,436,000**

TABLE A-3(Cont'd)
RIVER ROAD SITE
COST ESTIMATE - ALTERNATIVE 3

Annual Operating and Maintenance Costs

Item	Quantity	Units	Unit Cost	Total Cost
Site mowing	20	Mandays	$300	$6,000
Site inspection	10	Mandays	$600	$6,000
Miscellaneous site work	30	Mandays	$300	$9,000
Site work materials	-	Lump Sum	$6,000	$6,000
		Estimated Annual Operating and Maintenance Costs		$27,000
	Present Worth of Annual Operating & Maintenance Cost for 30 Yrs (i=5%)			$415,000
	Present Worth of Annual Groundwater and Effluent Monitoring (30 yrs, i=5%)*			$154,000
LNAPL disposal (2 years)	10000	Gallons	$3	$30,000
Transportation (Port Arthor, Texas)	2	Trips	$6,500	$13,000
Sludge disposal (15 years)	2000	CF	$30	$60,000
Groundwater treatment system (15 years)	-	Annual Cost	$80,000	$80,000
Sewer discharge (15 years)	13	MG/year	$1,250	$16,000
Effluent monitoring (15 years)	-	Annual Cost	$12,000	$12,000
	Present Worth Based Upon Years shown in Parenthesis			$1,824,000
		REMEDIAL ALTERNATIVE 3 TOTAL ESTIMATED COST		**$7,829,000**

*Assumes same level of effort as no action alternative

TABLE A–4
RIVER ROAD SITE
COST ESTIMATE – ALTERNATIVE 4

Direct Capital Costs

Item	Quantity	Units	Unit Cost	Total Cost
Site Preparation				
Clearing and grubbing	13	Acres	$3,000	$39,000
Regrading fill (including waste piles) to attain 4% slope for drainage	40000	CY	$5	$200,000
Low Permeability Cover Material and Installation				
Buy/place geotextile filter fabric (2 layers)	130000	SY	$1.50	$195,000
Buy/place synthetic low permeability liner	65000	SY	$5	$325,000
Buy/haul/place 6″ drainage layer	10000	CY	$18	$180,000
Buy/haul/place 1.5' bankrun	30000	CY	$12	$360,000
Buy/haul/place 6″ topsoil	10000	CY	$18	$180,000
Seed, fertilizer and mulch	65000	SY	$1	$65,000
LNAPL/Groundwater Recovery and Treatment and Installation				
Extraction wells (10@25)	250	LF	$100	$25,000
Submersible pumps and piping	10	Each	$1,500	$15,000
Package treatment plant	–	Lump Sum	$400,000	$400,000
Special construction of foundation over liner	–	Lump Sum	$50,000	$50,000
Misc.(controllers,discharge piping)	–	Lump Sum	$80,000	$80,000
Pipes to treatment plant and sewer	1200	LF	$17	$20,000
Special construction of piping over/under liner	–	Lump Sum	$25,000	$25,000
Manholes	12	Each	$1,800	$22,000
Other Costs				
Safety program	–	Lump Sum	$50,000	$50,000
Dust control	–	Lump Sum	$20,000	$20,000
Runoff control	–	Lump Sum	$20,000	$20,000
Equipment decontamination	–	Lump Sum	$15,000	$15,000
Mobilization/demobilization	–	Lump Sum	$80,000	$80,000
Site fencing	400	LF	$10	$4,000
Erosion Control				
Excavation of river bank	8000	CY	$12	$96,000
Buy/haul/place 6″ bank run	8000	CY	$12	$96,000
Rip–rap (1' inch deep)	1500	SY	$40	$60,000
	Estimated Capital Cost			$2,622,000
Contingency and Engineering Fees				
Contingency allowance(25%)				$655,500
Engineering fees (20%)				$524,000
	Estimated Contingency and Engineering Fees			$1,179,500
	TOTAL ESTIMATED CAPITAL COST			$3,801,500

TABLE A-4(Cont'd)
RIVER ROAD SITE
COST ESTIMATE – ALTERNATIVE 4

Annual Operating and Maintenance Costs

Item	Quantity	Units	Unit Cost	Total Cost
Site mowing	30	Mandays	$300	$9,000
Site inspection	10	Mandays	$600	$6,000
Miscellaneous site work	40	Mandays	$300	$12,000
Site work materials	-	Lump Sum	$8,000	$8,000
Specialized liner penetration/support	-	Lump Sum	$5,000	$5,000
		Estimated Annual Operating and Maintenance Costs		$40,000
	Present Worth of Annual Operating & Maintenance Cost for 30 Yrs (i=5%)			$615,000
	Present Worth of Annual Groundwater and Effluent Monitoring (30 yrs, i=5%)*			$154,000
LNAPL disposal (2 years)	10000	Gallons	$3	$30,000
Transportation (Port Arthur,Texas)	2	Trips	$6,500	$13,000
Sludge disposal (15 years)	2000	CY	$30	$60,000
Groundwater treatment system (15 years)	-	Annual Cost	$80,000	$80,000
Sewer discharge (15 years)	13	MG/year	$1,250	$16,000
Effluent monitoring (15 years)	-	Annual Cost	$12,000	$12,000
	Present Worth Based Upon Years shown in Parenthesis			$1,824,000
		REMEDIAL ALTERNATIVE 4 TOTAL ESTIMATED COST		$6,395,000

*Assumes same level of effort as no action alternative

TABLE A-5
RIVER ROAD SITE
COST ESTIMATE – ALTERNATIVE 5

Direct Capital Costs

Item	Quantity	Units	Unit Cost	Total Cost
Site Preparation				
Clearing and grubbing	13	acres	$3,000	$39,000
Excavate contaminated material	156000	CY	$14	$2,184,000
Transport to Chemical Waste Management disposal facility in Model City	156000	CY	$22	$3,432,000
Disposal at off-site facility(assume 10% hazardous, 90% non-hazardous)	156000	CY	$195	$30,420,000
Buy/haul/place backfill material	156000	CY	$12	$1,872,000
Cover Material and Installation				
Buy/haul/place 6″ topsoil	10000	CY	$18	$180,000
Seed, fertilizer and mulch	65000	SY	$1	$65,000
Slurry Wall Construction and Installation				
Slurry trenching/excavation/mixing/backfilling	60000	CF	$30	$1,800,000
LNAPL/Groundwater Recovery and Treatment and Installation				
Extraction wells (10@25)	250	LF	$100	$25,000
Submersible pumps and piping	10	Each	$1,500	$15,000
Package treatment plant	–	Lump Sum	$400,000	$400,000
Misc.(controllers,discharge piping)	–	Lump Sum	$80,000	$80,000
Pipes to treatment plant and sewer	1200	LF	$17	$20,400
Manholes	12	Each	$1,800	$21,600
Other Costs				
Safety program	–	Lump Sum	$50,000	$50,000
Dust control	–	Lump Sum	$20,000	$20,000
Runoff control	–	Lump Sum	$20,000	$20,000
Equipment decontamination	–	Lump Sum	$15,000	$15,000
Mobilization/demobilization	–	Lump Sum	$80,000	$80,000
Site fencing	400	LF	$10	$4,000
Erosion Control				
Rip-rap (1' inch deep)	1500	SY	$40	$60,000
	Estimated Capital Cost			$40,803,000

Contingency and Engineering Fees

Contingency allowance(10%)	$4,080,000
Engineering fees (1%)	$408,000
Estimated Contingency and Engineering Fees	$4,488,000
TOTAL ESTIMATED CAPITAL COST	$45,291,000

TABLE A-5(Cont'd)
RIVER ROAD SITE
COST ESTIMATE – ALTERNATIVE 5

Annual Operating and Maintenance Costs

Item	Quantity	Units	Unit Cost	Total Cost
Site inspection	10	Mandays	$600	$6,000
Miscellaneous site work	20	Mandays	$300	$6,000
Site work materials	–	Lump Sum	$2,000	$2,000
		Estimated Annual Operating and Maintenance Costs		$14,000
	Present Worth of Annual Operating & Maintenance Cost for 30 Yrs (i=5%)			$215,000
	Present Worth of Annual Groundwater and Effluent Monitoring (30 yrs, i=5%)*			$154,000
LNAPL disposal (2 years)	10000	gallons	$3	$30,000
Transportation(Port Arthur, Texas)	2	Trips	$6,500	$13,000
Sludge disposal (15 years)	2000	CF	$30	$60,000
Groundwater treatment system (15 years)	–	Annual Cost	$80,000	$80,000
Sewer discharge (15 years)	13	MG/year	$1,250	$16,000
Effluent monitoring (15 years)	–	Annual Cost	$12,000	$12,000
	Present Worth Based Upon Years shown in Parenthesis			$1,824,000
		REMEDIAL ALTERNATIVE 5 TOTAL ESTIMATED COST		$47,484,000

*Assumes same level of effort as no action alternative