Ramapo Landfill (Site No. 3-44-004)
Feasibility Study Report
Project Review - August 22, 1991

Site Description and History

- 60-acre former municipal landfill
- Located in Torne Valley, south of Harriman State Park in Rockland County
- Ramapo River approaches southwest corner of site at distance of 300 feet
- Wellfield is 1500 feet from site (Spring Valley Water Company)
- Gravel quarry in 1960's and previous; evidence of limited waste disposal
- Landfill operated from 1971 to 1983 by contractors to Town; later the Town itself. C&D debris accepted until 1989.
- Wastes disposed: municipal solid waste, construction and demolition debris, industrial and sewage sludge, asbestos, and paint sludge (hazardous by EP Toxicity)
- Fill is 90 feet deep in northern lobe; 70 feet in southern lobe.
- Accepted to NPL in 1983
- Leachate collection system installed in 1984 in accordance with a 1980 DEC consent order
    - groundwater and surface runoff collected
    - treatment by aeration; discharge to Ramapo River
    - met SPDES permit except for chronic exceedances for ammonia
    - as of November 1, 1990, aeration discontinued and outfall to river sealed. Leachate force main to Suffern POTW (treatment cost to Town is $250,000/year - flat rate)
- 1988 EQBA consent order for remedial program; state technical and enforcement lead, overseen by EPA Region II
- RI/FS performed by URS Consultants (Buffalo)

Major Conclusions of the Remedial Investigation

- Report under revision
- Paint sludge deposits (by no means all of them) removed by DEC as an IRM, though sludge tested by URS not found to be hazardous; taken to Clarkstown Landfill
- Risk conclusions:
    - **Current Land Use Scenario** (actual groundwater users, town employees, trespassers)
        - Carcinogenic: risk is within NCP acceptable range for all receptors
        - Non-carcinogenic health impacts: workers (HI = 7) chiefly from inhalation of landfill gas
    - **Future Land Use Scenario** (residence on landfill, on-site well for drinking water)
        - Carcinogenic: adult risk exceeds 10^{-4} from groundwater ingestion
        - Non-carcinogenic health effects: high hazard indices for all receptor groups, chiefly from inhalation of landfill gas.
- Evaluation of leachate collection system effectiveness:
    - water table below deep collector in localized areas; allows leachate to bypass collection system
    - groundwater from landfill can flow to Candle Brook at northern end; contaminants appear in well clusters MW-4 and MW-6

- Minor impact on surface water quality in Torne Brook; no contamination noted in Ramapo River following closure of outfall.
- Sediment concentrations do not exceed DEC sediment criteria

Remedial Action Objectives

1. Eliminate exposure to surface soils
2. Eliminate exposure to landfill gas
3. Ensure no future exposure to groundwater

Post Screening Technology Evaluations

-Groundwater model
-Landfill gas quality assessment

Technologies Selected

- Institutional Controls:
    - Fencing
    - Deed restrictions
    - Curtail use of site
- Alternate water supply: extend nearby existing line to residences now using PW-1 and PW-2
- Leachate collection system improvements:
    - Re-excavating and lowering the deep collector in select areas
    - Construct collector along access road to baler facility
    - bedrock grouting (questionable effectiveness)
- Soil cap:
    - HDPE on flat top surfaces of lobes
    - 18 inches soil (incl. topsoil and vegetation) over entire site
    - retaining walls along Torne Valley Road and relocation of road
    - gas collection layer (passive)
- Part 360 cap
    - regrading to permissible slopes
    - HDPE on flat surfaces
    - clay on steep side slopes
    - minimum 30 inch barrier protection layer over clay
    - retaining walls along Torne Valley Road and relocation of road
    - gas collection layer (passive)

Alternatives Proposed

	Score	Total Cost	Capital Cost
1. No Action	51.5	$0	$0
2. Institutional Action	54.5	$1.0 million	$580,000
3. Part 360 Cap and Improved Leachate Collector	57.0	$44.6 million	$40.8 million
4. Soil Cap and Alternate Water Supply			

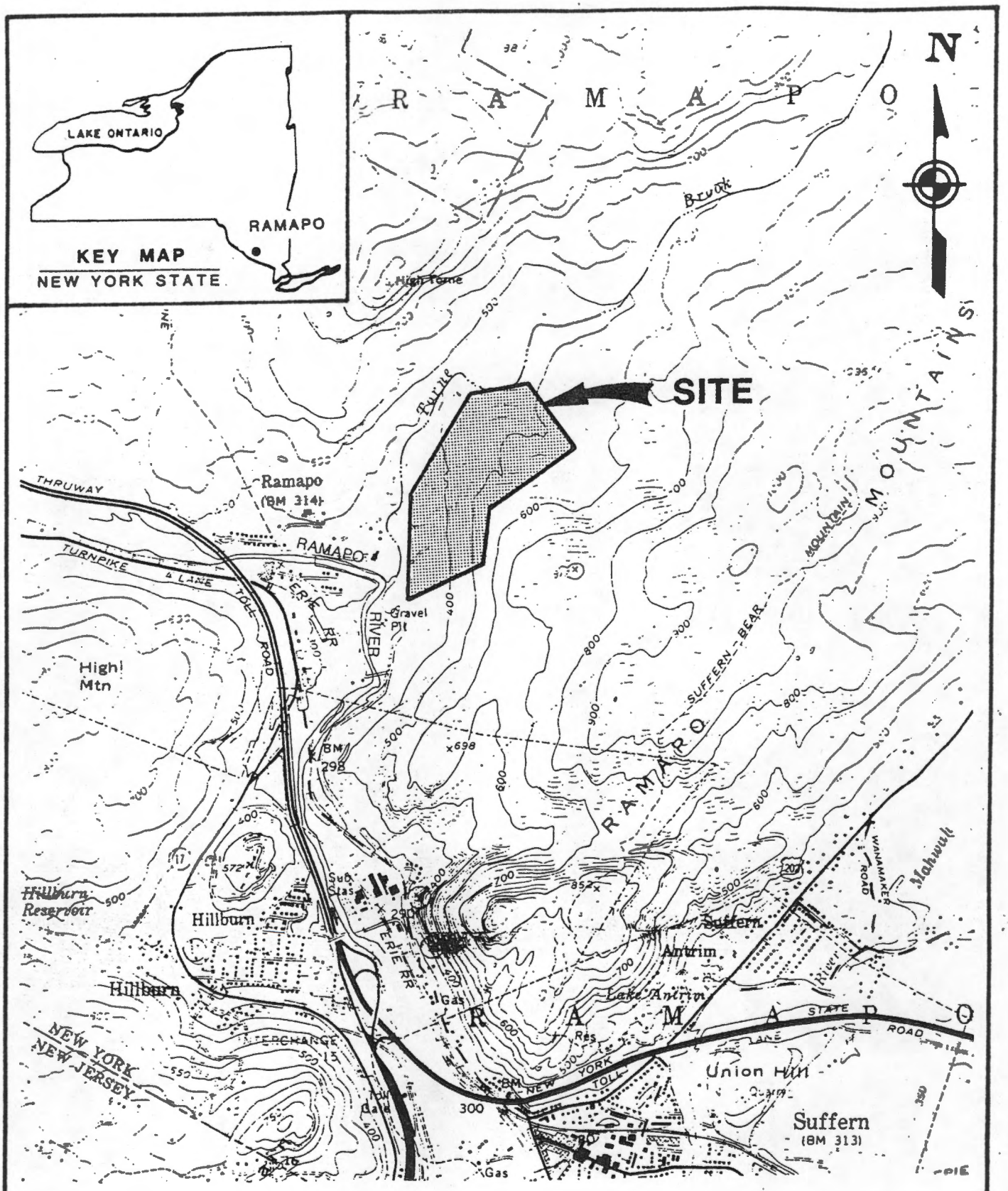
	58.0	$24.8 million	$21.0 million
5. Soil Cap and Improved Leachate Collector			
	59.0	$29.4 million	$25.6 million
6. Part 360 Cap, Improved Leachate Collector, and Alternate Water Supply			
	55.0	$46.6 million	$42.4 million

Issues

- Technologies improperly screened out
  - extraction wells
  - vertical barriers
  - active gas collection
  - RCRA cap
  - FML as low permeability layer in full Part 360 cap
  - regrading
- Cost figures overinflated by excessive estimates for markups and contingencies.

DEC's Current Recommended Alternative

- Part 360 cap with HDPE and a 1-foot barrier protection layer	$17 million
- cantilever wall	5 million
- retaining wall	.26 million
- road relocation	.33 million
- surface water diversion	1.28 million
- improve leachate collector	.60 million
TOTAL	$24.47 million



URS CONSULTANTS, INC.

SITE LOCATION

FIGURE 1-1

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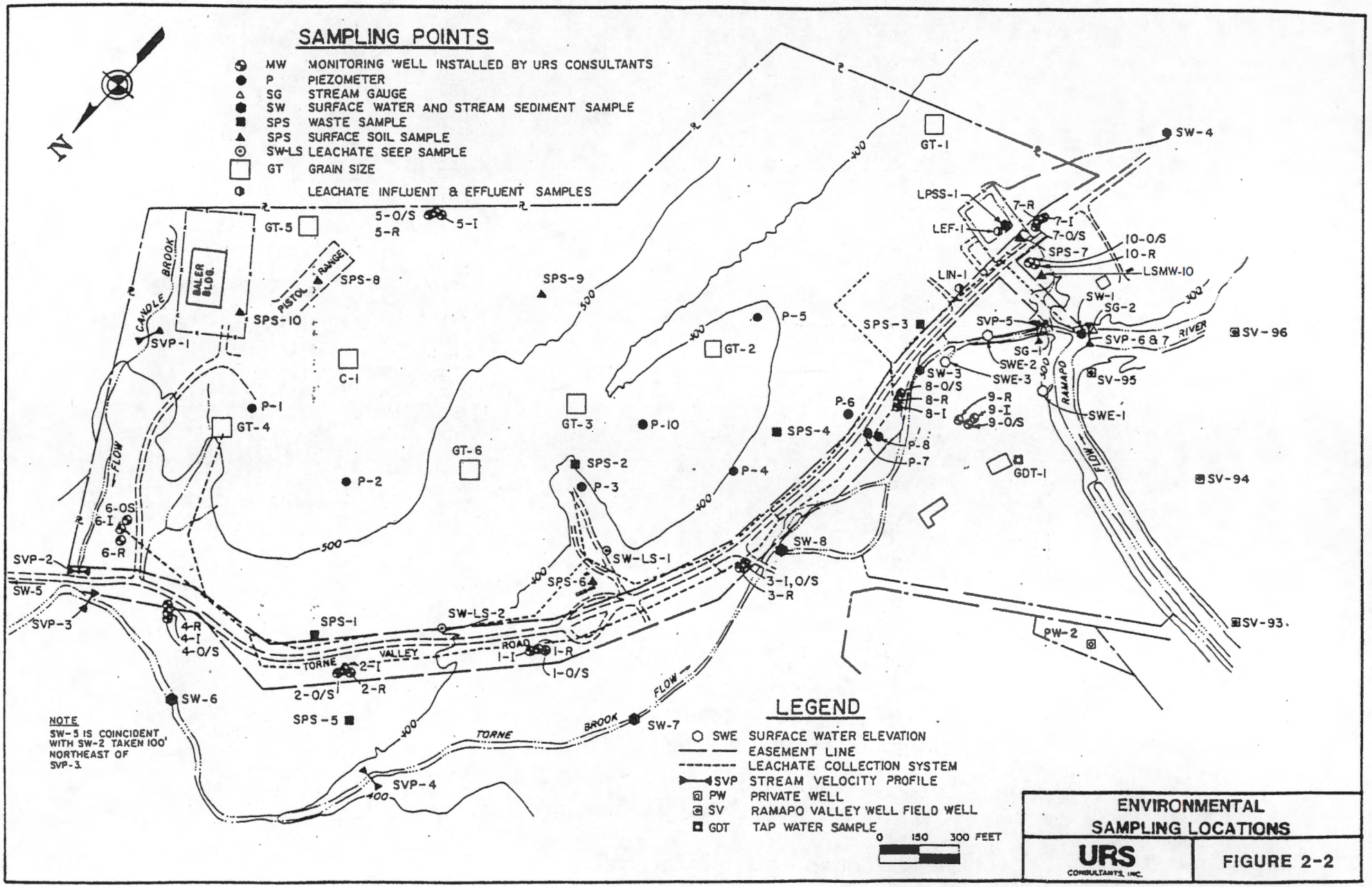
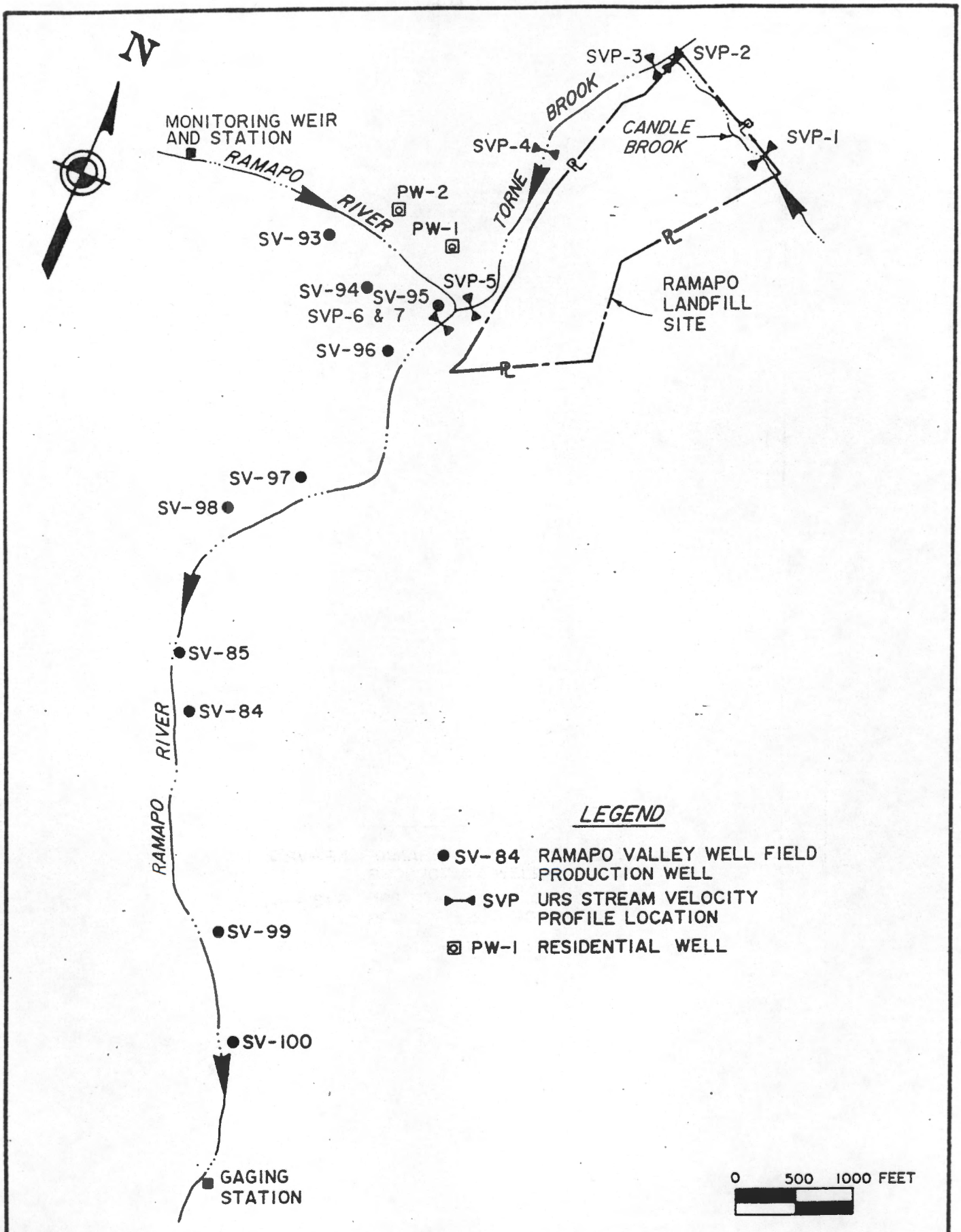

SAMPLING POINTS
MW MONITORING WELL INSTALLED BY URS CONSULTANTS
P PIEZOMETER
SG STREAM GAUGE
SW SURFACE WATER AND STREAM SEDIMENT SAMPLE
SPS WASTE SAMPLE
SPS SURFACE SOIL SAMPLE
SW-LS LEACHATE SEEP SAMPLE
GT GRAIN SIZE
LEACHATE INFLUENT & EFFLUENT SAMPLES
N
BALER BLDG.
CANDLE BROOK
PISTOL RANGE
FLOW
TORNE VALLEY ROAD
TORNE BROOK
RAMAPO RIVER
NOTE
SW-5 IS COINCIDENT WITH SW-2 TAKEN 100' NORTHEAST OF SVP-3.
LEGEND
SWE SURFACE WATER ELEVATION
EASEMENT LINE
LEACHATE COLLECTION SYSTEM
SVP STREAM VELOCITY PROFILE
PW PRIVATE WELL
SV RAMAPO VALLEY WELL FIELD WELL
GDT TAP WATER SAMPLE
0 150 300 FEET
ENVIRONMENTAL SAMPLING LOCATIONS
URS CONSULTANTS, INC.
FIGURE 2-2



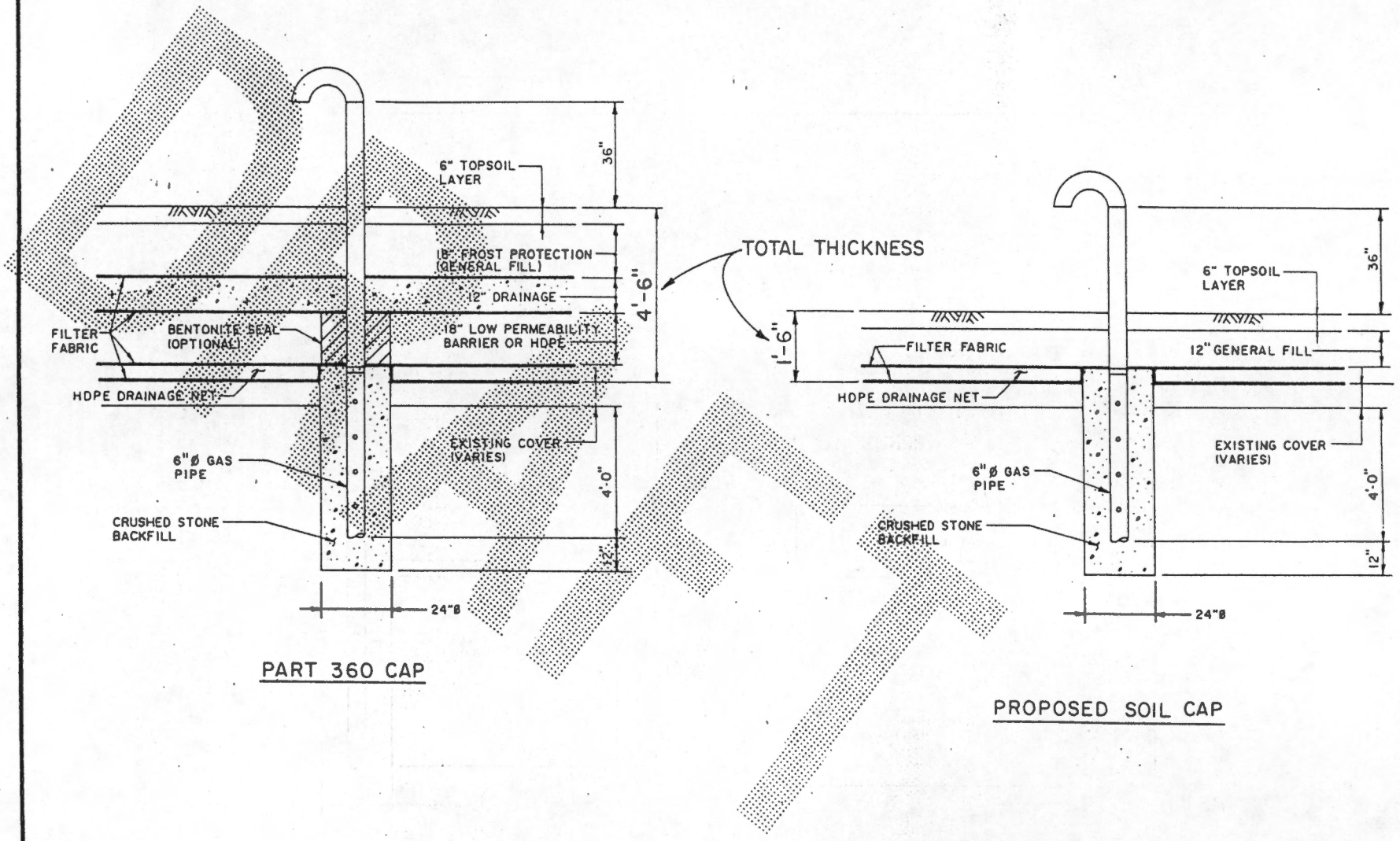
URS CONSULTANTS, INC.

MAP OF SURFACE WATER FEATURES

FIGURE 3-3

A-3191

A-3910



URS CONSULTANTS, INC.

SECTIONS THROUGH PART 360 AND SOIL CAP

FIGURE 11-1

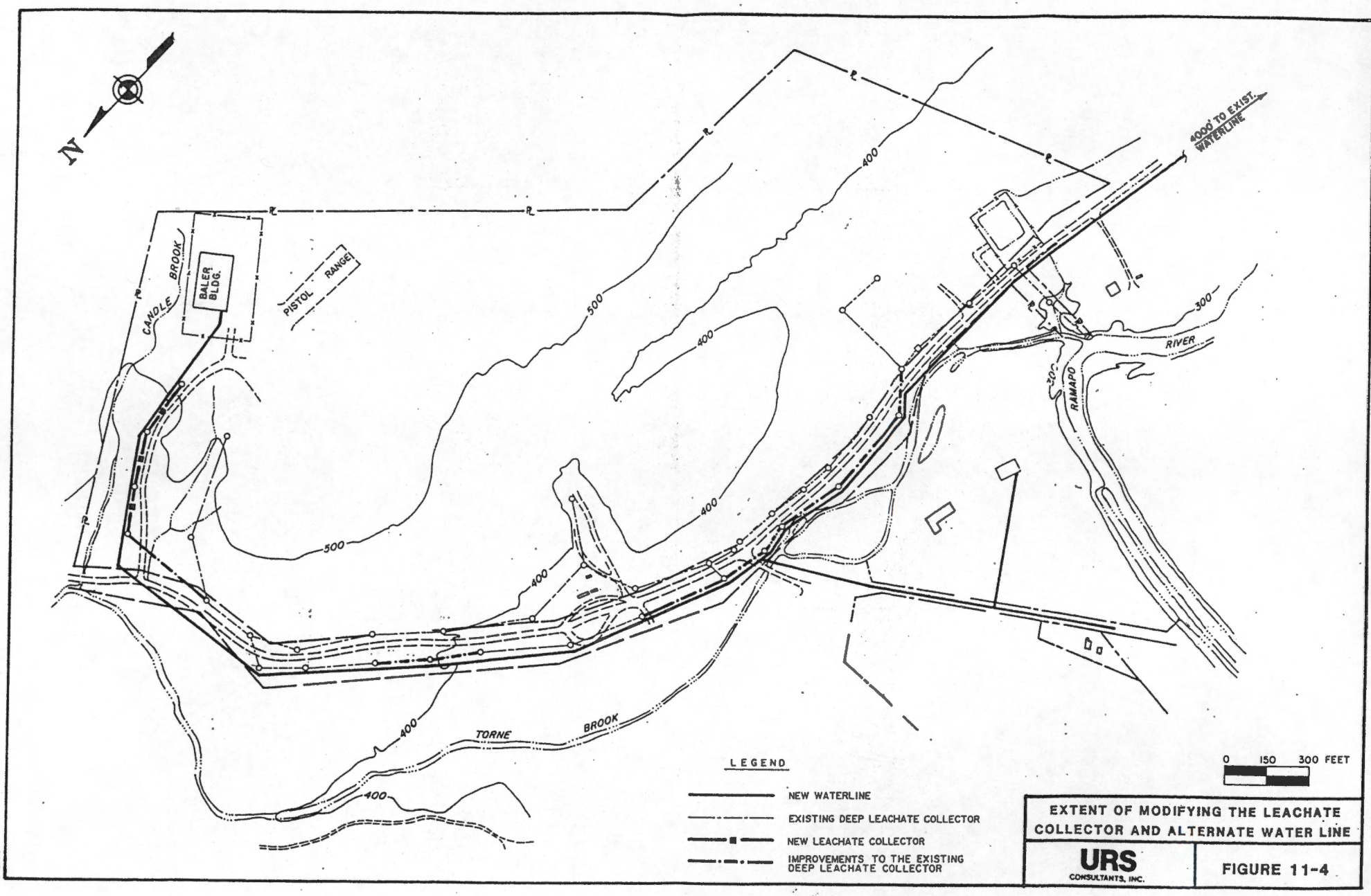

N
CANDLE BROOK
BALER BLDG.
PISTOL RANGE
400' TO EXIST. WATERLINE
RAMAPO RIVER
TORNE BROOK
500
400
300
LEGEND
NEW WATERLINE
EXISTING DEEP LEACHATE COLLECTOR
NEW LEACHATE COLLECTOR
IMPROVEMENTS TO THE EXISTING DEEP LEACHATE COLLECTOR
0 150 300 FEET
EXTENT OF MODIFYING THE LEACHATE COLLECTOR AND ALTERNATE WATER LINE
URS CONSULTANTS, INC.
FIGURE 11-4
C-2144

TABLE 8-1 Continued

Environmental Medium	Remedial Action Objectives	General Response Actions	Remedial Technologies	Process Options
Groundwater		No Action	Maintain existing leachate collection system with discharge to the POTW	
	Human Health Prevent future use of onsite groundwater	Institutional Action	Deed restrictions	- Limiting future use of groundwater
				Alternate Water Supply
	Environmental Prevent the potential for offsite migration of contaminated groundwater			- Extend Village of Hillburn water line - Extend Pothat Water Co. water line
		Collection	Modify the existing leachate collection system	- Improve the deep collector
			Localized groundwater withdrawal	- Withdrawal wells - Well point system
		Physical controls	Vertical Barriers	- Slurry wall - Grout curtain - Bedrock grouting

TABLE 8-1
REMEDIAL ACTION OBJECTIVES, GENERAL RESPONSE ACTIONS,
REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS

Environmental Medium	Remedial Action Objectives	General Response Actions	Remedial Technologies	Process Options
Soil		No Action	Continue with current level of maintenance and onsite activities	
	Human Health Prevent inhalation of vapors from landfill surface	Institutional Action	Access restrictions Deed restrictions	- Posting - Fencing - Modify use of site - Restrict future use of site
	Environmental Prevent erosion of contaminated surficial soil runoff	Containment	Capping	- RCRA cap - Part 360 cap - Soil cap
		Excavation	Excavation/Off-site Disposal	- RCRA facility
			Excavation/Onsite Treatment	- Above-Ground Treatment
			In-situ Treatment	- Biological - Chemical - Physical/Thermal

TABLE 8-1 Continued

Environmental Medium	Remedial Action Objectives	General Response Actions	Remedial Technologies	Process Options
Air		No Action	Continue with current level of activities	
	Human Health Prevent inhalation of vapors from landfill surface	Institutional Action	Deed restrictions	- Limiting present or future use of site - Posting - Fencing
		Gas Collection	Gas Collection	- Passive venting - Treatment Open-Air flaring or Methane recovery

TABLE 8 - 2
SUMMARY OF SELECTED REMEDIAL TECHNOLOGIES
AND PROCESS OPTIONS

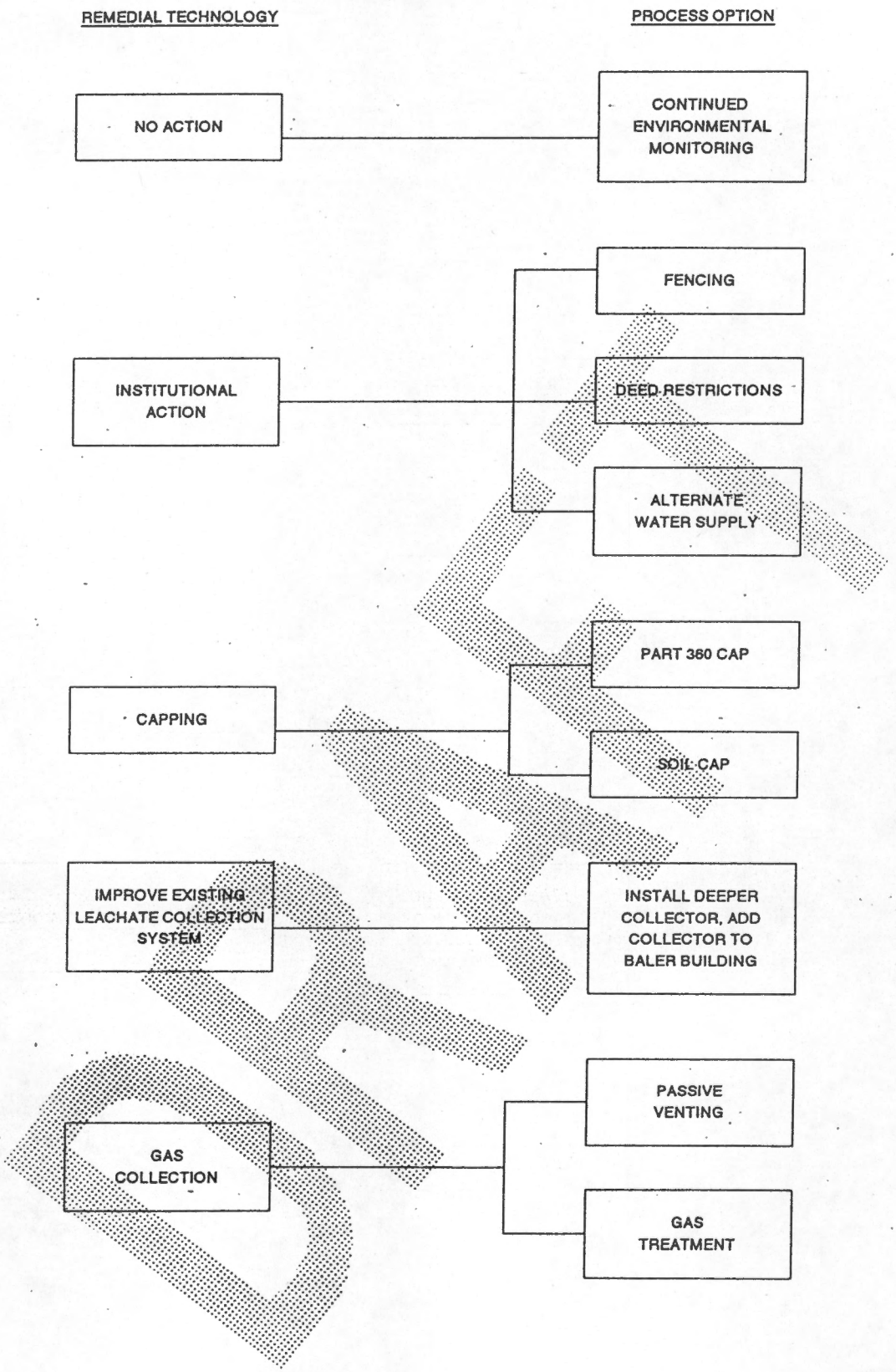


TABLE 10-1
RAMAPO LANDFILL
COMPONENTS OF ALTERNATIVES

Alternative	1	2	3	4	5	6
	No Action	Institutional Action	Meets ARARs	Does Not Meet ARARs		Exceeds ARARs
Process Options						
No Action	X					
Deed Restrictions		X	X	X	X	X
Alternate Water		X		X		X
Improve Leachate Collector			X		X	X
Part 360 Cap			X			X
Soil Cap				X	X	
Gas Treatment						X

TABLE 11-1 (PAGE 1 of 6)

SCORING SYSTEM FOR REMEDIAL ALTERNATIVES

SHORT-TERM IMPACTS AND EFFECTIVENESS (Relative Weight = 10)

FACTOR	BASIS FOR EVALUATION	WEIGHT	ALTERNATIVE NUMBER					
			1	2	3	4	5	6
1. Protection of community during remedial actions	- Are there significant short-term risks to the community that must be addressed? (if no, go to factor 2)	Yes - 0 No - 4	4	0	0	0	0	0
	- Can the risk be easily controlled?	Yes - 1 No - 0	0	1	1	1	1	1
	- Does the mitigative effort to control risk impact the community life-style?	Yes - 0 No - 2	0	2	2	2	2	2
2. Environmental Impacts	- Are there significant short-term risks to the environment that must be addressed? (if no, go to factor 3)	Yes - 0 No - 4	4	4	0	0	0	0
	- Are the available mitigative measures reliable to minimize potential impacts?	Yes - 3 No - 0	0	0	3	3	3	3
3. Time to implement the remedy	- What is the required time to implement the remedy?	<2 yr - 1 >2 yr - 0	1	1	0	0	0	0
	- Required duration of the mitigative effort to control short-term risk.	<2 yr - 1 >2 yr - 0	1	1	0	0	0	0
SUBTOTAL (MAXIMUM = 10)			10	9	6	6	6	6

SCORING SYSTEM FOR REMEDIAL ALTERNATIVES

LONG-TERM EFFECTIVENESS AND PERMANENCE (Relative Weight = 15)

FACTOR	BASIS FOR EVALUATION	WEIGHT	ALTERNATIVE NUMBER					
			1	2	3	4	5	6
1. Permanence of the remedial alternative	- Will the remedy be classified as permanent in accordance with Section 2.1(a),(b) or (c) of the NYSDEC TAGM for the "Selection of Remedial Actions at Inactive Hazardous Waste Sites", Sept. 13, 1989? (if yes, go to factor 3)	Yes - 5 No - 0	0	0	0	0	0	0
2. Lifetime of remedial actions	- Expected lifetime or duration of effectiveness of the remedy	25-30 yr - 4 20-25 yr - 3 15-20 yr - 2 <15 yr - 0	0	4	4	4	4	4
3. Quantity and nature of waste or residual left at the site after remediation	i. Quantity of untreated hazardous waste left at the site	None - 3 <25% - 2 25-50% - 1 >50% - 0	0	0	0	0	0	0
	ii. Is there any treated residual left at the site? (if no, go to factor 4)	Yes - 0 No - 2	2	2	2	2	2	2
	iii. Is the treated residual toxic?	Yes - 0 No - 1						
	iv. Is the treated residual mobile?	Yes - 0 No - 1						
4. Adequacy and reliability of controls	i. Operation and maintenance required for a period of:	<5 yr - 1 >5 yr - 0	0	0	0	0	0	0
	ii. Are environmental controls required as a part of the remedy to handle potential problems? (if no, go to "iv")	Yes - 0 No - 2	2	2	2	2	2	2
	iii. Degree of confidence that controls can adequately handle potential problems	Moderate to very confident - 1 Somewhat to not confident - 0						
	iv. Relative degree of long-term monitoring required (compare with other alternatives)	Minimum - 2 Moderate - 1 Extensive - 0	2	0	1	1	1	2
SUBTOTAL (MAXIMUM = 15)			6	8	9	9	9	10

SCORING SYSTEM FOR REMEDIAL ALTERNATIVES

REDUCTION IN TOXICITY, MOBILITY AND VOLUME OF HAZARDOUS WASTE (Relative Weight = 15)

FACTOR	BASIS FOR EVALUATION	WEIGHT	ALTERNATIVE NUMBER					
			1	2	3	4	5	6
1. Volume of hazardous waste reduced (reduction in volume or toxicity)	i. Quantity of hazardous waste destroyed or treated	100% - 10 80-99% - 8 60-80% - 6 40-60% - 4 20-40% - 2 <20% - 0	0	0	0	0	0	0
	ii. Are there any concentrated hazardous wastes produced as a result of (i)? (if no, go to factor 2)	Yes - 0 No - 2	2	2	2	2	2	2
	iii. How is the concentrated hazardous waste stream disposed?	On-site land disposal - 0 Off-site secure land disposal - 1 On-site or off-site destruction or treatment - 2						
2. Reduction in mobility of hazardous waste	i. Method of Reduction - Reduced mobility by containment - Reduced mobility by alternative treatment technology	1 3	0	0	1	1	1	1
	ii. Quantity of wastes immobilized	<100% - 2 >60% - 1 <60% - 0	0	0	1	0	0	1
3. Irreversibility of the destruction or treatment of hazardous waste	- Completely irreversible - Irreversible for most of the hazardous waste constituents - Irreversible for only some of the hazardous waste constituents - Reversible for most of the hazardous waste constituents	3 2 1 0	0	0	0	0	0	0
SUBTOTAL (MAXIMUM = 15)			2	2	4	3	3	4

TABLE 11-1 (PAGE 4 of 6)

SCORING SYSTEM FOR REMEDIAL ALTERNATIVES

IMPLEMENTABILITY (Relative Weight = 15)

FACTOR	BASIS FOR EVALUATION	WEIGHT	ALTERNATIVE NUMBER					
			1	2	3	4	5	6
1. Technical Feasibility								
a. Ability to construct technology	i. Not difficult to construct. No uncertainties in construction	3	3	3	1	2	1	1
	ii. Somewhat difficult to construct. No uncertainties in construction	2						
	iii. Very difficult to construct and/or significant uncertainties in construction	1						
b. Reliability of technology	i. Very reliable in meeting the specified process efficiencies or performance goals	3	0	3	3	3	3	3
	ii. Somewhat reliable in meeting the specified process efficiencies or performance goals	2						
c. Schedule of delays due to technical problems	i. Unlikely	2	2	2	1	1	1	1
	ii. Somewhat likely	1						
d. Need of undertaking additional remedial action, if necessary	i. No future remedial action may be anticipated	2	1	1	2	2	2	2
	ii. Some future remedial actions may be necessary	1						
2. Administrative Feasibility								
a. Coordination with other agencies	i. Minimal coordination is required	2	2	2	1	1	1	0
	ii. Required coordination is normal	1						
	iii. Extensive coordination is required	0						
3. Availability of Services and Materials								
a. Availability of prospective technologies	i. Are technologies under consideration generally commercially available for the site-specific application?	Yes - 1 No - 0	1	1	1	1	1	1
	ii. Will more than one vendor be available to provide a competitive bid?	Yes - 1 No - 0	1	1	1	1	1	1
b. Availability of necessary equipment and specialists	i. Additional equipment and specialists may be available without significant delay	Yes - 1 No - 0	1	1	1	1	1	0
SUBTOTAL (MAXIMUM = 15)			11	14	11	12	11	9

TABLE 11-1 (PAGE 5 of 6)

SCORING SYSTEM FOR REMEDIAL ALTERNATIVES

COMPLIANCE WITH STANDARDS, CRITERIA, AND GUIDANCE NYS (SCGs) (Relative Weight = 10)

FACTOR	BASIS FOR EVALUATION	WEIGHT	ALTERNATIVE NUMBER					
			1	2	3	4	5	6
1. Chemical-specific	Meets chemical-specific SCGs	Yes - 2.5 No - 0	1.5	1.5	2.5	1.5	2.5	2.5
2. Action-specific	Meets action-specific SCGs	Yes - 2.5 No - 0	1.0	1.0	2.5	1.5	1.5	2.5
3. Location-specific	Meets location-specific SCGs	Yes - 2.5 No - 0	0.0	0.0	0.0	0.0	0.0	0.0
4. Compliance with appropriate criteria, advisories and guidelines	The alternative meets all relevant and appropriate Federal and State guidelines that are not promulgated	Yes - 2.5 No - 0	1.0	1.0	1.0	1.0	1.0	1.0
SUBTOTAL (MAXIMUM = 10)			3.5	3.5	6.0	4.0	5.0	6.0

OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT (Relative Weight = 20)

FACTOR	BASIS FOR EVALUATION	WEIGHT	ALTERNATIVE NUMBER					
			1	2	3	4	5	6
1. Use of site after remediation	Unrestricted use of the land and water (if yes, go to end of table)	Yes - 20 No - 0	0	0	0	0	0	0
2. Human health and the environment exposure after the remediation	i. Is the exposure to contaminants via air route acceptable?	Yes - 3 No - 0	0	0	3	3	3	3
	ii. Is the exposure to contaminants via groundwater/surface water acceptable?	Yes - 4 No - 0	4	4	4	4	4	4
	iii. Is the exposure to contaminants via sediments/ soil acceptable?	Yes - 3 No - 0	0	0	3	3	3	3
3. Magnitude of residual public health risks after the remediation	i. Health risk ii. Health risk	<1 in 1,000,000 - 5 <1 in 100,000 - 2	0	0	5	5	5	5
4. Magnitude of residual environmental risks after the remediation	i. Less than acceptable ii. Slightly greater than acceptable iii. Significant risk still exists	5 3 0	0	0	5	3	5	5
SUBTOTAL (MAXIMUM = 20)			4	4	20	18	20	20

SCORING SYSTEM FOR REMEDIAL ALTERNATIVES

COST (Relative Weight = 15)

	BASIS FOR EVALUATION	WEIGHT	ALTERNATIVE NUMBER					
			1	2	3	4	5	6
" An alternative with the lowest present worth shall be assigned the highest score of 15. Other alternatives shall be assigned the cost score inversely proportional to their present worth. "			15	14	1	6	5	0
SUBTOTAL (MAXIMUM = 15)			15	14	1	6	5	0
TOTAL SCORE (MAXIMUM = 100)			51.5	54.5	57.0	58.0	59.0	55.0

NOTES:
Alt 1 - No Action
Alt 2 - Institutional Action
Alt 3 -
Alt 4 -
Alt 5 -
Alt 6 -

TABLE 11-15

RAMAPO LANDFILL
COST SUMMARY TABLE FOR ALTERNATIVES

Alternative	1	2	3	4	5	6
	No Action	Institutional Action	Meets ARARs	Less Than ARARs	Less Than ARARs	Exceeds ARARs
Capital Cost						
Alternate Water Supply		$580,000		$580,000		$580,000
Improve Collector			$5,170,000		$5,170,000	$5,170,000
Part 360 Cap :						
Cap			$28,030,000			$28,030,000
Cantilever			$4,980,000			$4,980,000
Retaining Wall			$1,050,000			$1,050,000
Soil Cap :						
Cap				$13,980,000	$13,980,000	
Cantilever				$4,620,000	$4,620,000	
Retaining Wall				$260,000	$260,000	
Road Relocation			$330,000	$330,000	$330,000	$330,000
Surface Water Diversion			$1,280,000	$1,280,000	$1,280,000	$1,280,000
Gas Treatment						$970,000
Total Capital Cost	$0	$580,000	$40,840,000	$21,050,000	$25,640,000	$42,390,000
O & M Costs						
Monitoring		$45,200	$45,200	$45,200	$45,200	$45,200
Cap			$347,500	$347,500	$347,500	$347,500
Retaining Walls			$2,700	$2,700	$2,700	$2,700
Flaring System						$48,800
Total Annual O & M	$0	$45,200	$395,400	$395,400	$395,400	$444,200
Present Worth of O & M	$0	$430,000	$3,730,000	$3,730,000	$3,730,000	$4,200,000
Total Present Worth	$0	$1,010,000	$44,570,000	$24,780,000	$29,370,000	$46,590,000