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PROJECT
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DRAFT FEASIBILITY STUDY

RIVER ROAD LANDFILL
HERMITAGE, PENNSYLVANIA

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EXECUTIVE SUMMARY

This document is the Draft Feasibility Study for the River Road Landfill in Hermitage, Pennsylvania. The RI was conducted between November 1991 and March 1993 and the findings are reported in the Final Remedial Investigation Report (Montgomery Watson, 1995). The RI demonstrated that sufficient data was generated for the site to develop an assessment of the risks posed to human health and the environment in the vicinity of the site. The risks were quantified in the report entitled Baseline Risk Assessment, River Road Landfill (RUST Environmental, 1995). Data was also collected to evaluate the effectiveness of several remedial response actions WMPA has taken at the site over the past 15 years to minimize the risks to human health and the environment. WMPA constructed the final cap for the landfill in accordance with the permit, installed a groundwater/leachate collection system encircling the landfill, constructed a groundwater dam on the downgradient side of the landfill, built a surface water and erosion control system, and constructed a security fence.

The 102-acre River Road Landfill site is located in the City of Hermitage and South Pymatuning Township, Mercer County, Pennsylvania. Approximately 37.5 acres was used for refuse disposal. In the late 1950s, the property was operated as a sand and gravel mine. During the period from 1962 to 1980, the site accepted municipal, residential, and industrial waste from area communities, businesses and industries. The Pennsylvania Department of Environmental Resources (PADER) granted technical approval for operations on January 25, 1978, allowing continuance of operations until PADER issued a final Solid Waste Permit. Erie Disposal Company, a subsidiary of WMX Technologies Incorporated (WMX), purchased the site on August 15, 1980. PADER issued the final solid waste disposal permit on November 30, 1984. The landfill received the last shipment of waste in 1986. Post-closure plans were approved by PADER in November 1988.

The River Road Landfill is located between River Road (Route 846) on the northwest and the Shenango River on the southeast. The natural topography slopes from the road at an elevation of 920 feet mean sea level (MSL) to the River at an elevation of approximately 860 feet MSL. The landfill is 1,000 feet wide by 2,100 feet long, along a nearly east-west axis, and the top of the landfill is at an approximate elevation 955 feet MSL. The top slopes at about 1.5 to 6 percent to the top of the side slopes. The side slopes of 12 to 20 percent are broken every 10 to 20 feet in elevation by gently sloping terraces, which collect and convey surface water runoff to two sedimentation basins. Perimeter drainage channels also collect and convey runoff to the two sedimentation basins. Each of the sedimentation basins has an overflow for discharging water to the Shenango River.

The geology of the River Road site consists of alluvial and glacial deposits overlying shale and sandstone bedrock. The Berea Sandstone is generally the uppermost bedrock unit at the site. However, in some locations the sandstone is overlain by the Orangeville Shale. The unconsolidated units beneath the site consist of two till units and an overlying alluvial and lacustrine deposit. The lower-most till unit (coarse-grained till), composed of fine to coarse sand, overlies bedrock beneath all but the north-central portion of the site. The fine-grained till (fine to medium sandy silt) is present overlying the coarse-grained till beneath most of the site, but is absent in the far southeast corner. A veneer of variable sands and silts overlies the till at the site. This variable unit (alluvium) probably consists of a mixture of alluvium, lacustrine, and ice contact deposits. In general, the unconsolidated deposits are thickest in the uplands in the northern portion of the site, and thin in a southerly direction, reflecting the ground surface topography.

A groundwater flow system occurs through four stratigraphic units: bedrock, coarse-grained till, fine-grained till, and alluvium. Hydraulic conductivity is variable among these four units, but overall contrasts are not significant. The horizontal and vertical gradients are of approximately equivalent magnitude. The magnitude of vertical gradients is locally variable. Groundwater flow paths may be locally influenced by stratigraphic differentiation, but the groundwater flow is generally southerly and upward, to discharge at the Shenango River. A groundwater/leachate collection system was installed around the entire landfill. Collected leachate drains by gravity to the south side of the landfill where it actively extracted and discharged, via an on-site interceptor line, to the local POTW. The presence of the leachate collection system causes the formation of a localized flow system, superimposed on the regional system. Diversion of shallow groundwater flow into the groundwater/leachate collection system occurs both upgradient and downgradient of the landfill.

During the RI, the potential source media were characterized, the potential migration pathways were identified, and potentially affected media were evaluated. Leachate, groundwater, and sediment were identified as media of concern. Leachate and sediment present potential sources of contamination. Groundwater presents a potential migration pathway for contaminants leaking from the landfill.

Leachate is a media of concern because it is the probable source or catalyst for low level groundwater contamination found in monitoring wells MW113S and MW117S. A variety of VOCs, SVOCs, and inorganic compounds were detected in the leachate samples. The volume of leachate produced by the landfill was estimated to be approximately 22,600 gallons per day. Leachate is being collected by the groundwater/leachate collection system which encircles the landfill. The collected leachate is discharge to an on-site interceptor line which leads to the local POTW.

Sediment is a media of concern due to a potential ecological risk at three distinct locations. Aroclor 1248 was detected in samples of sediment from sedimentation Basin B. Chromium was found in the discharge channel from Basin B. Arsenic was detected in samples of sediment from Basins A and B. Approximately 2,000 cubic yards of sediment has accumulated in these three area.

Trace levels of vinyl chloride (2 ug/L) and 1,2-Dibromo-3-chloropropane (0.5ug/L) were detected in samples from monitoring wells MW113S and MW117S. Groundwater is a media of concern because it has the potential to act as a migration pathway for contaminants in a future risk scenario. There has been no formation of a contaminant plume. Groundwater flow at the site is toward the Shenango River. However, any discharge of organic constituents contained in the groundwater to the river would result in dilution of those constituents to non-detectable levels.

Several anomalies were identified in the RI.

- PCBs were detected in one soil sample from the area near the site entrance. However, confirmatory sampling did not yield further indication of PCB contamination.

- Arsenic concentrations were found in several sediment samples that were above the mean values for soils in the Eastern United States. However, these concentrations were within the documented range for soils in the Eastern United States.

- Surface water samples indicate that water quality criteria may be exceeded in the discharge from the sedimentation basins. However, the surface outflowing water quality is consistent with the water discharging from springs in the natural soil upgradient of the landfill. Therefore, it is likely that the exceedances of water quality criteria are natural for the area, and not related to the landfill.

- Elevated concentrations of aluminum and manganese were detected in groundwater samples during the RI. The elevated aluminum concentrations were correlated to likely sample contamination during round 2 sampling. The manganese anaomaly was detected in samples both up and down gradient of the landfill. The manganese is a naturally occurring mineral in the site soils, which is mobilized in the groundwater by reducing conditions. Reducing conditions are caused by groundwater fluctuating across the vadose zone, and may also be caused by leachate. It is not possible to differentiate between the two potential causes of elevated manganese.

To transition from the Remedial Investigation to the Feasibility Study, remedial action objectives were developed for each media of concern. The remedial objectives for groundwater are preventing off-site migration and preventing ingestion of groundwater containing leachate constituents at concentrations that present an unacceptable health risk. The remedial action objective for leachate is to minimize the release of leachate constituents to the groundwater that may present an unacceptable health risk. The remedial objective for sediment is to prevent exposure to sediment containing unacceptable levels of arsenic, Aroclor 1248, and chromium.

A broad range of possible remedial approaches were compiled to address the remedial action objectives for each of the media of concern. These were screened first for applicability, and then for effectiveness, implementability, and relative cost. The screening yielded several general response actions that have potential to effectively meet the remedial action objectives. The general response actions for groundwater, retained through the rigorous screening process include: groundwater use restrictions, monitoring, gradient controls, and off-site treatment. The general response actions retained for leachate include: leachate use restrictions, monitoring, containment, vertical barriers, and treatment off-site. The general response actions retained for sediment include: access restriction, monitoring, removal and off-site disposal.

The response actions and process options retained through the screening process were then assembled into remedial action components by combining several similar and complementary process options into components. These were further combined to develop a list of five Remedial Alternatives, for detailed analysis:

Alternative 1- No Action

Alternative 2- No Further Action. (Fence, PADER Solid Waste Cap, Groundwater Dam, Groundwater/Leachate Collection System, and Monitoring.)

Alternative 3- Fence, PADER Solid Waste Cap, Groundwater Dam, Groundwater/Leachate Collection System, Monitoring, Institutional Controls, Off-Site Disposal of Sediment, and Habitat Enhancement.

Alternative 4- Fence, PADER Solid Waste Cap, Groundwater Dam, Groundwater/Leachate Collection System, Monitoring, Institutional Controls, Off-Site Disposal of Sediment, Groundwater/Leachate Collection System Enhancement, and Habitat Enhancement.

Alternative 5- Fence, PADER Solid Waste Cap, Groundwater Dam, Groundwater/Leachate Collection System, Monitoring, Institutional Controls, Off-Site Disposal of Sediment, Groundwater/Leachate Collection System Enhancement, RCRA Subtitle D Cap, and Habitat Enhancement.

The five alternatives were analyzed based on nine evaluation criteria to address CERCLA requirements and address additional technical and policy considerations that have proven important for the selection of remedial alternatives. The nine evaluation criteria are:

- Overall Protection of Human Health and the Environment
- Compliance with ARARs
- Long-Term Effectiveness and Permanence
- Reduction of Toxicity, Mobility, or Volume
- Short-Term Effectiveness
- Implementability
- Cost
- State Acceptance
- Community Acceptance

The first seven criteria are considered in the FS. The last two are considered later in the selection process. Each of the five alternatives was subjected to detailed evaluation and comparative analysis to evaluate the relative performance of each alternative in relation to each of the seven criteria. The purpose of the comparative analysis is to identify the advantages and disadvantages of each alternative relative to one another, so the relative strengths (to be evaluated by the U.S. EPA) can be identified. These strengths, combined with risk management decisions made by the Agency, will serve as the rationale for selecting a preferred alternative and provide a transition between the Feasibility Study and Record of Decision. The conclusions of the Draft Feasibility Study are:

- Alternatives 3 through 5 would adequately protect human health and the environment by 1) eliminating unacceptable risk to human health, 2) eliminating unacceptable risk to the environment, and 3) meeting the remedial action objectives.

- ARARs will not play a significant role in the selection of a final remedial alternative since each alternative complies with the identified ARARs to the same degree.

- The long-term effectiveness criterion would be satisfied by Alternatives 4 and 5. These alternatives 1) mitigate residual risk, 2) eliminate the remaining sources of residual risk with the exception of refuse, which would remain at the site, 3) conduct a five year review, and 4) adequately and reliably control site risk.

- Alternatives 3 through 5 would result in significant reduction of toxicity, mobility, and volume through treatment.

- All five alteratives would satisfy the short term effectiveness criterion. In general, short term effectiveness would decrease with increasing alternative numbers, due to the increasing construction aspects of each subsequent alternative.

- All alternatives are implementable; they are 1) technically feasible, 2) administratively feasible, and 3) services and materials are available to implement the alternatives.

- The present net worth costs increase with alternative number ranging from a low of $3,202,000 to a high of $10,593,000

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1

INTRODUCTION

This Feasibility Study (FS) has been prepared on behalf of Waste Management of Pennsylvania (WMPA) for the River Road Landfill site located in Hermitage, PA. WMPA entered into an Administrative Order by Consent (AOC) Agreement in March 1990, with the United States Environmental Protection Agency (U.S. EPA), to conduct a Remedial Investigation/Feasibility Study (RI/FS) at the site. The RI/FS is being conducted pursuant to the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), with the requirements of the National Oil and Hazardous Substances Contingency Plan (NCP) and in accordance with guidance from the U.S. EPA.

The final RI Report was submitted to the U.S. EPA on March 31, 1995. Based on the identified alternatives, WMPA formally requests the U.S. EPA to identify the final list of applicable or relevant and appropriate requirements (ARARs) for the site.

This FS presents the process to evaluate a comprehensive list of general response actions to identify the best approach currently available to meet the remedial action objectives for the River Road Landfill. Through the screening process, general response actions which are comprised of remedial technology subsets and further broken down into process options, were assembled into five remedial action alternatives for the site. The range of alternatives was limited to viable options that would mitigate site specific risks to human health and the environment, as identified in the Baseline Risk Assessment (RUST Environmental, 1995).

A habitat enhancement component was also introduced. This component of Alternative 3 through 5 is of particular importance to WMPA. As discussed with U.S. EPA and the Biological Technical Assistance Group (BTAG), the results of the RI have demonstrated that the River Road Landfill Site, in its current state, poses a minimal risk to human health and the environment. It is the intent of WMPA to take steps above and beyond the remedial actions necessitated by site risks, and to establish a beneficial use for the property that is of value to the surrounding community.

1.1 REPORT ORGANIZATION

This FS has been prepared in accordance with the U.S. EPA, 1988, *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA, Interim Final.* Based on the format presented in the above document, this FS has been organized in the following manner:

- Section 1 presents an introduction to the FS, and presents the document's organizational structure.
- Section 2 summarizes the site information developed in the RI, including location, history, and physical setting.
- Section 3 discusses the nature and extent of contaminants identified at the site including a summary of the results of the Baseline Risk Assessment.
- Section 4 begins the FS element of the CERCLA process. The remedial action objectives are stated, and the subsequent general response actions with associated remedial technologies and process options are introduced. The remedial technologies and process options are then evaluated, screened, and selected for the development of alternatives in Section 5.
- Section 5 presents the development of alternatives by assembling the limited number of viable process options identified through the screening process.
- Section 6 provides a detailed analysis of the five remedial action alternatives, addressing each of the nine criteria set forth in the NCP. The nine criteria include: overall protection of human health and the environment; compliance with ARARs; long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short term effectiveness; implementability; cost; state acceptance; and community acceptance.
- Section 7 provides the comparative analysis of the five alternatives.
- Section 8 lists cited and other relevant references.

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BACKGROUND

2.1 SITE LOCATION

The River Road Landfill (site) is located in the City of Hermitage and South Pymatuning Township, Mercer County, Pennsylvania. The site is located approximately two miles northeast of the City of Sharon, PA. As shown in Figure 2-1, the site location is bounded by River Road (Route 846) to the northwest and by the Shenango River to the south. The landfill occupies approximately 37.5 acres of the 102-acre site. Site features are illustrated in Figure 2-2.

2.2 SITE SETTING

2.2.1 Surrounding Land Use

Land use in the area is primarily low density residential, with the greatest concentration of residences to the north and northeast. Wooded and agricultural lands are located across River Road to the west and north of the site. Wooded and residential property is located southeast of the site. Industrial use predominates across the river to the south.

2.2.2 Topography and Surface Features

The topography of the landfill and surrounding area is illustrated in Figure 2-2. River Road (Route 846) is present along the western crest of an upland area extending along the northern and western boundaries of the site. The maximum elevation of this upland area is about 920 feet mean sea level (MSL) along River Road. The upland area slopes toward McCullough Run on the west (approximate elevation 870 feet MSL) and toward the Shenango River (approximate elevation 860 feet MSL) on the south and east.

The River Road Landfill is located on the northern bank of the Shenango River, south and east of the upland area. Prior to landfilling, the northern portion of the site was relatively flat. The southern portion of the site, where the landfill is located, was a gentle south to southeasterly slope. The topography of the area was extensively modified by the landfilling operations. The maximum elevation of the landfill is 955.2 feet MSL. At the base of the landfill, ground surface elevations range from approximately 900 feet MSL on the north to 870 feet MSL on the south.

Other portions of the site were modified during landfill operation and closure activities. Cover material was borrowed from the site property north of the landfill, causing more variable topography than was originally present. A flat, grassy area is now present between the southern toe of the landfill and the Shenango River. The topography has been further modified through the construction of surface water drainage features and sedimentation basins.

2.2.3 Surrounding Water Supply

The surrounding water supply is a mix of both private well use and municipal water supply. The residents of South Pymatuning and Hermitage, within a 0.5 mile radius of the site, obtain their water from private wells. Residents of the Borough of Sharpsville, located within a 0.5 mile radius of the site on the south side of the Shenango River, obtain water from the City of Sharpsville Municipal Water Plant. This water treatment plant draws water from the Shenango River. The intake is located approximately one mile upstream of the site.

2.2.4 Wetlands

On-site wetlands near the landfill are associated with and limited to the ditches and basins of the surface storm water management system. They are palustrine emergent and scrub/shrub ecosystems. Other wetlands, also palustrine emergent, are located on the southern half of the grassy area between the southern landfill toe and the Shenango River. These wetlands are located in and near swales and depressions in the gently undulating topography. Two small wooded areas, which are also wet, occur in this southern area. Additionally, palustrine emergent wetland plant communities and palustrine deciduous forested areas are located southwest of the landfill, adjacent to WMPA property.

2.2.5 Climate

The area is characterized by a humid, continental climate with warm summers and long, cold winters. Average annual precipitation is 36.9 in. The average annual temperatures range between 36.4°F and 58.2°F.

2.3 SITE HISTORY

2.3.1 History Prior to Landfill Construction

The site was used for agricultural purposes until the 1940s. Industrial activity at the site began in the 1940s, when the site was owned by Mr. and Mrs. Harry Rapp. Under their ownership, wells were drilled at the site for oil and gas production. By the late 1950s, the property was owned by Paul Teglo and operated as a sand and gravel mine.

2.3.2 Landfill Operations

The first landfilling began at the site in early 1963. Approximately one year after landfilling began, Bernard David, David David, and Joseph David, Jr., acquired the property. The site was operated solely as a landfill under the name of David Brothers until 1976. The site received sanitary and industrial wastes. In 1976, the ownership of the site was transferred to Bernard David and Mary Anne David who operated it as the River Road Enterprises Sanitary Landfill until 1980. Documents indicate that during this time the site received predominantly municipal solid waste.

The Pennsylvania Department of Environmental Resources (PADER) granted technical approval for landfill operations in January 1978. This approval allowed operations to continue until PADER issued a final Solid Waste Disposal Permit.

In August 1980, the landfill was purchased by Erie Disposal Company, a subsidiary of WMX Technologies Incorporated (WMX). The final Solid Waste Disposal Permit was issued by PADER in November 1984. It permitted the landfill to accept municipal wastes, demolition wastes, and residual wastes from Hodge Foundry (foundry sand, reclaim and shotblast baghouse dust, ladle slag, floor sweepings, furnace slag, and furnace refractory). The last load of refuse was received in May 1986.

2.3.3 Landfill Remediation and Monitoring

Starting in 1980, WMX began remediating the site with soil erosion and sediment control systems. A groundwater dam and groundwater/leachate collection system was constructed between 1980 and 1986. Additionally, leachate lagoons were closed in 1983, and, in accordance with PADER approval, sludge was removed from on-site sludge pits and disposed with refuse in the landfill between 1982 and 1985. Further upgrades to the groundwater/ leachate collection system were added through 1988. The purpose of the remediation was to prevent the off-site migration of contaminants and to protect human health and the environment. Specifically, the following remedial response actions have significantly reduced the potential for contaminant migration:

1980	A groundwater/leachate collection trench and pipe was installed at the downgradient perimeter (south) of the site, which is upgradient of the Shenango River
	A groundwater cut-off dam was constructed between the groundwater/leachate collection system and the Shenango River
1982 - 1987	A soil erosion and sedimentation control system was constructed, consisting of surface water diversion berms, drainage swales, and associated sedimentation basins and spillways
1983	The groundwater/leachate collection system was connected to the USVWPCA wastewater treatment plant sewer line
	The leachate lagoon was closed
1985	The groundwater/leachate collection system was extended around the eastern and northeastern perimeter of the site

1986	The groundwater/leachate collection system was extended around western and northwestern perimeters to include the entire site.
	Two 1,000-gal steel fuel tanks and an empty railroad car were removed
1986 - 1987	The landfill portion of the site was capped with approximately 3 feet of cover material in accordance with then-existing PADER regulations
1987	A 21,000-gal leachate storage tank was installed, with a spill containment structure and diesel generator for emergency power to pumps, leachate alarms, and recording equipment
1988	The site was bermed to limit surface water run-on
	The site was fenced, the landfill terraced, and diversion structures installed on the landfill to control erosion

2.3.4 Post-Construction History

The site stopped receiving waste in 1986, and remedial and closure activities were completed and certified in 1987 in accordance with the Closure Plan approved by PADER. The post-closure plans prepared by WMPA were submitted to PADER in September 1987, and were approved in November 1988.

In September 1989, the site was listed on the National Priorities List (NPL), and in March 1990, the AOC for the RI/FS signed. The RI was conducted from November 1991 through March 1993, and is now pending approval.

2.4 LANDFILL CHARACTERISTICS

2.4.1 Landfill Topography

The River Road Landfill is situated on the side slope between a topographic high beginning at River Road, and extending to the Shenango River. The maximum landfill elevation above natural contours is approximately 80 feet (955.2 feet MSL). The topographic map (Figure 2-2) shows that the landfill has a relatively flat top, which was graded to maintain an approximately 1.5 percent slope toward the side slopes. The sides are terraced every 10 to 20 feet of elevation drop. Side slopes between terraces range between 12 and 20 percent. Terraces have a one percent back slope, and a one percent side slope for surface water collection and runoff to the surface water control system.

2.4.2 Landfill Conditions

The River Road Landfill was closed with the intent of minimizing the off-site migration of contaminants to groundwater, surface water, and air. Toward this end, improvements were made to the site to control these potential pathways. The subsections below present detailed descriptions of the improvements made.

2.4.2.1 Landfill Cap - A soil cap was constructed over the landfill in 1986 and 1987, in accordance with the PADER-approved work plan. The cap was constructed with a gentle 1.5 percent slope on the top surface increasing to a six percent slope toward the sides of the landfill. The sides of the landfill are sloped between 12 and 20 percent. Terraces were constructed every 10 to 20 feet of elevation drop. Terraces have a one percent back slope to enhance surface water collection, and a one percent side slope to promote surface water runoff. A grass vegetation layer has been established over nearly 100 percent of the cap.

A surface water collection system was integrated into the cap to provide drainage and sediment collection. Two sedimentation basins (Basins A and B) were constructed at the southwestern and southeastern corners of the landfill, respectively, to receive surface water (Figure 2-2). Basin A receives surface water from a rip-rap and fabric-lined diversion channel that collects drainage from the western half of the landfill. Basin B collects drainage from a similar diversion channel located on the eastern side of the landfill. Discharge from each basin occurs through a corrugated metal riser pipe and horizontal outlet conduit to the principal spillway, which leads to the Shenango River. The riser pipes are equipped with trash racks and antivortex devices. During extreme storm events, the basins are designed to overtop a concrete spillway, and surface water flows through a rip-rap-lined emergency spillway to the Shenango River. Diversion channel and basin hydraulics were evaluated in the RI and are discussed in Section 3.3.2 of the RI Report.

The Closure Certification and Post-Closure Plan (Todd Giddings, 1987) demonstrated that the landfill was capped in accordance with the PADER-approved closure plan. Cap thickness ranges from 21 in. to 44 in., with an average of 40 in. Where cover thickness was less than 36 in., additional material was added to provide the minimum landfill cover thickness of 36 in. The USDA soil classification for the cap material ranged from loam to sandy loam, as specified by PADER.

Data obtained during the RI demonstrated the present cap is: structurally sound; free of cracks, deformities, major depressions, and seeps; and promotes surface water runoff. Cap depth and soil type are generally consistent with the closure plan. Additionally, a water balance study conducted during the RI demonstrated that the surface water control system collects approximately one-third of the total rainfall to the local watershed, versus less than ten percent collection in the groundwater/leachate collection system. It is likely that actual landfill runoff is greater than indicated by the groundwater modeling, due to steep landfill slopes, and collection channels that carry runoff directly to the sedimentation basins.

2.4.2.2 Groundwater Dam - The groundwater dam, located at the downgradient southern perimeter of the landfill (Figure 2-2), was constructed by WMPA to limit potential groundwater flow from the site to the Shenango River, and conversely, to limit flow from the Shenango River toward the groundwater/leachate collection system. As-built information indicates that the total length of the dam is 2,400 feet and the approximate width of the dam ranges from 16 feet at ground surface to 14 feet at the bottom. The minimum elevation of the base of the groundwater dam is approximately 846.0 feet MSL in the vicinity of former well 103. The maximum elevation of the top of the groundwater dam is approximately 866 feet MSL at the western extent of the dam, near sedimentation Basin A.

There were two types of soil material used in the dam construction. The optimum moisture content and maximum density of yellow sandy silt (till) used in the dam construction were 8.0 percent and 131.2 lb/ft^3, respectively. Those parameters for the blue sandy silt (till) used in the construction of the groundwater dam were 15.4 percent and 107.0 lb/ft^3, respectively. The till material used for the groundwater dam fill had a laboratory hydraulic conductivity of approximately 3 x 10^{-7} cm/sec.

During the RI, the groundwater dam investigation confirmed the presence of a 2,400 feet, compacted soil dam that is keyed into fine grained till foundation over at least 75 percent of its length. Even where it is keyed into coarse-grained material, the approximately nine-foot hydraulic head drop maintained between outside and inside the dam demonstrates the dams ability to limit groundwater flow.

2.4.2.3 Groundwater/Leachate Collection System - The groundwater/leachate collection system (Figure 2-3) was installed to prevent the off-site migration of contaminated leachate or groundwater through recovery and treatment. The system consists of a perforated PVC pipeline in a gravel envelope, which was installed below the water table. Groundwater beneath the landfill and leachate generated by the landfill drain into this system and are discharged to a local publicly owned treatment works (POTW) via an interceptor line.

The system was installed in three phases. The initial phase, completed in 1980, was constructed parallel to the southern boundary of the fill area. Pipe invert elevations range from 846 feet MSL at the discharge point of the system to 861 feet MSL at the capped end of the system at the southeast corner of the landfill. The groundwater elevation adjacent to the groundwater dam is approximately 865 feet MSL prior to influence from the groundwater/leachate collection system. The groundwater dam was constructed immediately downgradient of the collection system to prevent the flow of uncontaminated downgradient groundwater to the system, by induced recharge from the Shenango River.

The second and third phases were expansions of the original system. The second phase extended the system to surround the landfill on the eastern and northeastern sides. This expansion was completed in 1985. The third phase, which expanded the system to surround the western and northwestern perimeter, was completed in 1986. Leachate and groundwater collected by the original system flowed via gravity to a former leachate pond (Figure 2-2), which was located adjacent to the southwest corner of the landfill. The leachate pond was used for the storage of leachate from fall 1980 to spring 1983.

In 1983, the groundwater/leachate collection system was connected directly to the POTW sewer line of the USVWPCA, which runs parallel to the Shenango River and discharges to the

Sharon Sewage Treatment Plant (STP). This system was upgraded in 1987 through installation of a 21,000-gal leachate storage tank with a spill containment structure, a diesel generator for emergency power to the pumps, leachate level alarms, and recording equipment.

During the RI, both the effect of rainfall on the system and leachate flow through the system were evaluated. Data revealed that the groundwater/leachate collection system is functioning to collect leachate percolating from the landfill and groundwater flowing beneath the landfill. Collection volumes are directly related to rainfall, with actual system response variable depending on moisture levels of surface soils. Over half of the leachate/groundwater collected is collected from the southern segment of the system, demonstrating that the groundwater dam and leachate collection system are working together, preventing the flow of leachate from the site, and collecting the leachate for treatment.

2.4.2.4 Landfill Gas - Monitoring for combustible gas was conducted from gas monitoring points and buildings as early as 1985 and has been conducted quarterly since 1987 as part of the post-closure plan. The monitoring is conducted quarterly to assess the potential for the off-site migration and accumulation of landfill gas within buildings and structures on or adjacent to the landfill property.

Landfill gas was not identified in significant quantities on the landfill surface during the RI. Quarterly monitoring for landfill gas at 13 perimeter monitoring stations (Figure 2-2) demonstrates that landfill gas is not leaving the WMPA property.

2.5 SURFACE WATER HYDROLOGY

2.5.1 Regional Surface Water Hydrology

The Shenango Dam, located approximately 1.25 miles upstream of the site (Figure 2-1), was constructed in 1965 for flood control and low level water regulation. Prior to dam construction, average yearly peak discharge fluctuated greatly with a high of 15,700 cubic feet/second (cfs) to a low of 3,320 cfs. Average yearly peak discharge, after the dam was built, has been fairly uniform, with a high of 4,560 cfs and a low of 2,380 cfs.

Flood stage information on the Shenango River from the U.S. Army Corps of Engineers (ACOE) in Pittsburgh, indicates that the 100-year flood elevation with the dam in place is estimated to be 866 feet MSL, which is below the lowest elevation of the landfill. The stream bed of the river at the ACOE station, approximately 1.25 miles upstream of the site, is at an elevation of 852 feet MSL.

2.5.2 Site Surface Water Hydrology

During the RI, a surface water assessment was performed to determine flow into and out of the sedimentation basins (Basin A and Basin B) under base flow conditions and in response to precipitation events. Measurements were obtained during April 1992. Base discharge from Basin A was measured at 0.12 cfs, and base discharge from Basin B was measured at 0.001 cfs.

Maximum basin discharge from storage during and after a rainfall event from Basin A was 1.8 cfs, while maximum basin discharge from storage from Basin B was 0.62 cfs. The results indicate that Basin B discharges little water to the Shenango River except in association with a precipitation event.

2.6 GEOLOGY

2.6.1 Regional Geologic Setting

The site is located in an area of predominantly flat-lying sedimentary rocks of Mississippian age (Figure 2-4). These rocks have been eroded in the area to form a bedrock valley with an axis oriented north-south. The uppermost bedrock units identified in the immediate site area, in order of decreasing age (bottom to top), include the Bedford Shale, the Berea Sandstone, and the Orangeville Shale (Schiner and Kimmel, 1976).

Bedrock in the area is overlain by glacially-derived surface materials that have been modified, in part, by Pleistocene stream activity (Figure 2-5). The uppermost stratigraphic units exposed are glacial ground moraines in upland areas; and glacial outwash, ice contact, and stream alluvium deposits in the valleys. The glacial deposits in the area have been attributable to the Kent advance of the Wisconsinan stage. The earliest Wisconsinan stage advance is marked by a coarse grained till. The Kent ice sheet deposited a fine grained till (Shepps et al., 1959 and White et al., 1969).

2.6.2 Site Geology

The geology underlying the River Road Landfill site was documented during the RI. A cross section was generated, the orientation of which is shown on Figure 2-6. Cross-section A-A' is presented in Figure 2-7. The figures show that the site is underlain by between 10 and 100 feet of unconsolidated deposits overlying sandstone or shale bedrock. The stratigraphic units which were encountered at the site, in ascending order, are:

- Berea Sandstone
- Orangeville Shale
- Coarse-grained till
- Fine-grained till
- Alluvium

The bedrock surface exhibits about 10 feet of relief beneath most of the site, ranging in elevation from about 810 feet to 820 feet MSL. The Berea Sandstone is generally the uppermost bedrock unit. However, in some locations the sandstone is overlain by as much as 22 feet of the Orangeville Shale.

The unconsolidated units beneath the site consist of two till units and an overlying alluvial and lacustrine deposit. In general, the unconsolidated deposits are thickest in the uplands in the northern portion of the site, and thin in a southerly direction, reflecting the ground surface topography. The lower-most till unit (coarse-grained till), composed of fine to coarse sand, overlies bedrock beneath all but the north-central portion of the site. The fine-grained till, composed of fine to medium sandy silt, is present overlying the coarse-grained till beneath most of the site. It is absent in the far southeast corner of the site. The alluvium, a veneer of variable sands and silts, overlies the till layers at the site. (This variable unit was termed alluvium for discussion purposes, but probably consists of a mixture of alluvium, lacustrine, and ice contact deposits.)

2.7 HYDROGEOLOGY

2.7.1 Regional Hydrogeologic Setting

Bedrock in the region is dissected by major and minor valleys, which generally create local groundwater flow systems between recharge areas in the bedrock highs and discharge zones in the valleys. Groundwater flows downward in the bedrock uplands and out toward the valley sides. Groundwater discharge forms the base flow of some of the small streams that descend from the uplands, or occurs as springs near the base of hill slopes. Groundwater recharge to the bedrock highs may flow vertically downward and outward to be discharged to the glacial drift deposits present along the axes of the bedrock valleys.

Groundwater flow in the bedrock occurs principally along fractures. The principal fracture orientations in the region are southwest to northeast and southeast to northwest. Since the fracture zones intersect, groundwater flows in the direction of decreasing hydraulic gradient, although individual flow paths may be variable. The region is underlain at depth by formations containing saline water, oil, and gas.

In the region, private wells draw primarily from the bedrock units. The unconsolidated surficial deposits are not reported to be extensively developed for water supplies.

2.7.2 Site Hydrogeologic Setting

A groundwater flow system, influenced primarily by hydraulic gradients and not stratigraphic controls, is present beneath the River Road site as shown in the conceptual model in Figure 2-8. Four stratigraphic units (bedrock, coarse-grained till, fine-grained till, and alluvium) have been identified at the site based on visual characteristics. However, the hydraulic characteristics of these units are not sufficiently distinct to differentiate groundwater flow. Specifically, the hydraulic conductivity within each unit varies locally, and the variability of conductivity values measured within each unit is as great as that calculated among units as shown below:

- Bedrock Mean: 1.5×10^{-5} cm/sec (3.0×10^{-5} ft/min)
  Bedrock Range: 9.6×10^{-3} cm/sec (1.9×10^{-2} ft/min) to less than 1.8×10^{-7} cm/sec (3.5×10^{-7} ft/min)

- Coarse-grained till Mean: 6.2×10^{-4} cm/sec (1.2×10^{-3} ft/min)
  Coarse-grained till Range: 8.9×10^{-3} cm/sec (1.8×10^{-2} ft/min) to 4.0×10^{-5} cm/sec (7.9×10^{-5} ft/min)

- Fine-grained till matrix Mean: 6.1×10^{-5} cm/sec (1.2×10^{-4} ft/min)
  Fine-grained till matrix Range: 2.9×10^{-4} cm/sec (5.7×10^{-4} ft/min) to 1.3×10^{-5} cm/sec (2.5×10^{-5} ft/min)

- Fine-grained till Range (including matrix and sand seams) 1.3×10^{-5} cm/sec (2.5×10^{-5} ft/min) to 1.4×10^{-3} cm/sec (2.7×10^{-3} ft/min)

- Alluvium Mean: 3.6×10^{-4} cm/sec (7.2×10^{-4} ft/min)
  Alluvium Range: 2.6×10^{-2} cm/sec (5.1×10^{-2} ft/min) and 1.2×10^{-6} cm/sec (2.3×10^{-6} ft/min)

Both vertical and horizontal components of groundwater flow were assessed beneath the site to determine that a three-dimensional flow system exists with horizontal and vertical gradients of approximately the same magnitude (0.01 to 0.05 ft/ft). Therefore, groundwater is as likely to flow in a vertical direction as it is to flow in a horizontal direction. Horizontal flow is in a southerly direction, toward the Shenango River. Vertical flow is predominately upward, demonstrating that the Shenango River is a regional groundwater discharge area. Figure 2-9 presents a water table contour map for the site illustrating the horizontal component of flow. Figure 2-10 presents a potentiometric cross-section constructed parallel to the principal flow direction illustrating the vertical component of groundwater flow.

The RI data was further used to calculate the relative contribution to surface water discharge in the Shenango River, from groundwater that flows beneath the site. The volume of groundwater discharged to the river was calculated using Darcy's Law ($Q = KiA$). This calculation illustrated that total groundwater discharge to the Shenango River along the 2,000 foott frontage is minuscule in comparison to the total surface water discharge of the river. The maximum likely groundwater discharge from beneath the site to the Shenango River is 90 gpm. The discharge released by the Shenango Dam averages 345,600 gpm. At a maximum, the total groundwater discharge to the river from beneath the landfill is less than 0.03 percent of the total river flow.

The groundwater/leachate collection system creates a localized flow system. Shallow groundwater flow is diverted into the groundwater/leachate collection system, due to the low hydraulic head maintained in the collection line. Diversion of shallow groundwater flow into the groundwater/leachate collection system creates an inward gradient toward the landfill preventing the migration of leachate into surrounding groundwater. (Data collected during the RI indicated that there are small zones areas of outward gradient at several locations along the leachate collection system, with resulting localized breaches in leachate collection.)

Precipitation patterns, in combination with Shenango River discharge, are the predominant controls on groundwater elevations at the site, except in the vicinity of the groundwater/leachate collection system/groundwater dam. Groundwater elevations in the vicinity of the groundwater/leachate collection system/groundwater dam are controlled by the system itself.

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3

SITE CHARACTERIZATION

The purpose of this section is to discuss findings and conclusions of the RI. The nature and extent of contamination at the site was determined from the analytical data collected during the RI. Sampling locations are shown on Figure 3-1. The potential migration pathways between the source of the contamination and the potential receptors were also identified and evaluated to establish the fate and transport of the contamination. Then, based on this information, measurements were made of the risk the site presents to human health and the environment. The risks calculated for the site are summarized in Sections 3.3 and 3.4.

3.1 NATURE AND EXTENT OF CONTAMINATION

An assessment of the nature and extent of contaminants present at the River Road Landfill site indicates that the extensive remedial actions performed at the site have, for the most part, been successful in controlling contaminant migration from the landfill to the surrounding environment. Limited migration of contaminants from the landfill is demonstrated by the findings summarized below.

3.1.1 Source Characterization

The source characterization activities performed during the RI included:

- Sampling and chemical characterization of leachate
- Sampling and analysis of sediment from drainageways leading to the site sedimentation basins, and the basins themselves
- Sampling and analysis of soil near the entrance where polychlorinated biphenyls (PCBs) had been detected during a previous investigation

- Sampling and analysis of soils beneath the former leachate pond, and composing the groundwater dam

The extent and concentrations of contaminants in these potential source areas were found to be limited, as presented below:

- Leachate was considered the primary potential source at the River Road site. However, analysis of the leachate indicated that it is limited as a potential source. No pesticides or PCBs were detected in the leachate samples. Total concentrations of volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs) in leachate were relatively low (e.g., less than 150 micrograms per liter (ug/L)).

- The drainageways leading to the sedimentation basins and the basins themselves, were found to have limited potential to act as sources. VOCs, SVOCs, pesticides, and PCBs were not detected in the drainageways leading to the sedimentation basins, with the exception of low concentrations of polycyclic aromatic hydrocarbons (PAHs) (individual compounds present at concentrations less than 100 ug/L). Basin sediments were also free of detectable levels of organics, with the exception of concentrations below the contract required quantitation limit (CRQL) of Aroclor 1248 in samples in Basin B.

- Metals concentrations varied little among the inlet drainageway, basins, and outlet drainageways with the exception of a limited area in the spillway from Basin B, which contained elevated chromium concentrations. The extent of elevated chromium is limited to an area approximately 20 feet in length, and is located at the downstream end of the drainage system. This small area with elevated chromium levels is considered to be a source.

- Soil near the site entrance has only limited potential as a source of PCBs, since the detection of PCBs was limited to one sample out of a total of nine collected.

Soil underlying the former leachate pond does not appear to represent a significant source of contamination and does not appear to be the source of VOCs detected in well W104. Only two VOCs were detected in these samples (2-butanone at an estimated concentration of 15 micrograms per kilogram (ug/kg), and 1,1,1-trichloroethane at an estimated concentration of 1 ug/kg). Neither of these compounds were detected in a nearby well. Metals concentrations detected in the soil beneath the former leachate pond were within the range expected for Eastern U.S. soils (Conner and Shacklette, 1975).

Soil composing the groundwater dam does not constitute a significant source of contamination at the site. The only organics detected in the dam soil were SVOCs at concentrations below the CRQL. Of the SVOCs detected in the groundwater dam soil, only bis(2-ethylhexyl) phthalate was detected in the groundwater downgradient of the landfill at 26 ug/L. This detection was not considered evidence of groundwater impact, because bis(2-ethylhexyl)phthalate was present in laboratory blank samples and is a common laboratory contaminant.

3.1.2 Migration Pathway Assessment

Migration pathway assessment activities performed during the RI included:

- Sampling and analysis of sediments in the sedimentation basin spillways
- Sampling and analysis of surface water samples collected at site springs and in the sedimentation basins
- Sampling and analysis for indicator parameters of selected monitoring wells
- Analysis of ambient air quality
- Analysis for the presence of landfill gas

No substantial contamination was detected along potential migration pathways, as presented below:

- There is no evidence that contaminants are migrating through the drainageways around the landfill. The only organic compounds detected in the basin spillways were low concentrations of PAHs below the CRQL in samples from the Basin B spillway.
- Surface water quality in the sedimentation basins is similar to that of background springs. Samples collected from the basins during rainfall events could not be differentiated from natural background conditions.
- Analysis of groundwater samples for indicator parameters did not show landfill impacts. Concentrations of major cations and anions detected in the groundwater samples indicated that samples from the shallow and intermediate wells exhibited similar ionic composition (calcium-sulfate-carbonate) while samples collected from the bedrock wells exhibited a differing composition (sodium-potassium-carbonate).
- Ambient air quality at the landfill is not being impacted by landfill gas emissions. Methane concentrations in ambient air are substantially below explosive limits, and non-methane VOCs are not measurable in either the ambient air or the leachate headwells and manholes. Methane concentrations were elevated inside confined manholes and leachate headwells, as would be expected.

Arsenic was detected in all sediment samples collected on-site, but it was not possible to collect background samples for comparison purposes. The concentrations of arsenic were within the documented natural range for arsenic in soils in the eastern U.S. However, these concentrations resulted in an unacceptable cancer risk ($5x10^{-6}$) for a highly conservative future land use scenario, for "ingestion while wading."

3.1.3 Chemical Characterization

Chemical characterization of the following media was performed during the RI:

- Groundwater at site monitoring wells and from an off-site private well and the on-site water supply well

- Sediment sampling in the Shenango River

Only limited impacts to on-site groundwater have occurred, and no impacts to river sediments are attributable to the landfill, as described below:

- There is no plume of contaminated groundwater associated with the landfill. Of the 22 downgradient or sidegradient wells sampled at the site, only four contained detectable concentrations of organics similar to leachate compounds: two shallow groundwater wells adjacent to the groundwater/leachate collection system, and one shallow groundwater well downgradient of the groundwater dam. The two wells adjacent to the leachate collection system represent areas where the leachate collection system is apparently not fully effective. The organic compounds detected downgradient of the groundwater dam may be residual impacts of historical leachate storage in this area. In addition, total xylenes were detected at a concentration of 2 ug/L at MW105DR during the Round 1 sampling event only.

- The private wells sampled exhibited no groundwater quality affects attributable to the site. No target compounds list (TCL) VOCs, SVOCs, pesticides, or PCBs were detected in these private well samples.

- The only PCB detected in site media (Aroclor 1248) was not detected in the river sediments. PCB concentrations detected in sediments adjacent to and downstream of the landfill were within the range detected upstream. Therefore, these concentrations represent background river conditions.

3.2 CONTAMINANT FATE AND TRANSPORT

Contaminants introduced to the environment may migrate through a variety of pathways to reach potential receptors. The following could happen to a contaminant. It could contact the groundwater, be dispersed by groundwater, discharged to a surface water body or soil or volatilized, emitted from the surface, and dispersed to the air. The results presented in the RI demonstrate that little migration of contaminants is occurring at the site. Specifically:

- There is no evidence that contaminants are migrating along the site surface water drainage system
- The landfill is not contributing detectable concentrations of contaminants to the Shenango River
- The ambient air above the landfill is not being impacted by landfill emissions
- Only limited and isolated groundwater impacts have been documented

Groundwater is the only pathway along which migration is apparently occurring at the site.

3.2.1 Groundwater

Groundwater provides the primary potential migration pathway for contaminant transport at the site. The extent of migration of contaminants in the groundwater is dependent on the interrelationship between site-specific geological and hydrochemical conditions, and the physical and chemical properties of the contaminant itself.

Low levels of VOCs and SVOCs have been detected at only four isolated locations in groundwater at the site (Figure 3-2). Physical and chemical processes that may affect the migration of these organic compounds include: dilution, adsorption/absorption, and biodegradation. The mechanism dominating fate and transport of these contaminants is not obvious in most cases. Varying retardation factors slow the transport of specific compounds, while biodegradation rates are likely to vary from shallow to deep locations in the saturated zone. It can be expected that constituents in the groundwater will be diluted by advection as the groundwater flows toward the Shenango River.

While the mechanisms of biodegradation and adsorption/absorption are not easily quantified, each mechanism results in the reduction of contaminant concentrations in groundwater. Dilution also results in reduced contaminant concentrations and dilution factors can be quantified. Groundwater discharge from beneath the landfill accounts for less than 0.03 percent of total river discharge. Therefore, any organic constituents present in the groundwater would be diluted to non-detectable concentrations upon discharge to the river.

3.2.1.1 Occurrence of Aluminum and Manganese - During performance of the Baseline Risk Assessment, hazard indices (HI) of 50 and 200 were calculated for the Average (AVG) and Reasonable Maximum Exposure (RME), respectively. These HI were associated with ingestion of groundwater under a future land use scenario. Further evaluation of the sampling data indicated anomalies existed in the analytical data used in the HI risk calculations. A brief discussion of the occurrence of each of these metals is presented below.

Aluminum was retained as a contaminant of concern (COC) for the following reasons:

- On-site samples failed the statistical comparison with background samples

- Both the on-site investigative samples and the background samples exceeded the Region III risk-based screening concentrations (11,000 μg/l).

Upon review of the data, no clear upgradient or downgradient correlation was found in the aluminum concentrations. A strong correlation was found, however, between the aluminum concentrations and the sampling event. High aluminum concentrations occurred primarily in the Round 1 sampling event, including the Round 1 field blank.

Although it was not possible to definitively identify the cause of the anomalous aluminum concentrations, it was apparent that the Round 1 samples were not representative of actual site conditions. It is likely that the aluminum concentrations in the samples were contributed by the filtering device. This type of metals contamination has been documented for other metals.

Since the Round 1 concentrations were believed to be non-representative, U.S. EPA's approved statistical method was performed using Round 2 data only. Using only Round 2 data, aluminum was not a COC. However, because of the remaining uncertainty, aluminum has been retained as a COC.

Manganese was retained as a COC for the following reasons:

- On-site samples failed the statistical comparison with background samples (i.e. on-site UL95 concentrations were greater than background UL95 concentrations);

- On-site investigative samples and background samples exceeded the U.S. EPA Region III risk-based screening concentration (18 μg/l).

Manganese is relatively common in mineral and organic soil and rock. The concentration of manganese in natural water is a function of the manganese content in the contacting materials and the chemical makeup of the water. As with iron, the solubility of manganese species is higher under anoxic (low redox) conditions. Therefore, given the availability of manganese in naturally occurring soil, the concentrations observed in groundwater will be higher in or near reducing (or anoxic) conditions. When anoxic groundwater comes in contact with manganese bearing aquifer materials, equilibrium conditions are shifted toward higher groundwater manganese concentrations.

Elevated manganese levels were observed in some monitoring wells near the groundwater/ leachate collection system and in some wells in the shallow aquifer near the Shenango River. The observed concentrations of manganese in groundwater samples collected from wells near the landfill might be attributable to the reducing conditions associated with the landfill, or with the landfill leachate. On the other hand, a strong case can be made that the detected concentrations are the result of naturally-occurring reducing conditions combined with manganese occurrence in natural sediments.

A USGS Report (1989) indicates that naturally occurring manganese can be mobilized by fluctuating water levels, such as at the water table. Hem (1989) describes high manganese concentrations in groundwater withdrawn from sand and gravel deposits adjacent to or within stream channels.

Although groundwater samples collected downgradient of the landfill showed somewhat higher concentrations of manganese than the upgradient samples, it was determined that the manganese concentrations could not be attributed solely to landfill influences. This, coupled with the specific statistical method employed to calculate the health risk, resulted in an HI which did not accurately reflect landfill-related effects. However, because of the uncertainty of the cause of elevated manganese levels, manganese has been retained as a COC.

3.3 HUMAN HEALTH EVALUATION

A Baseline Risk Assessment was performed by RUST Environment and Infrastructure (RUST Environment, 1995). The assessment consisted of a human health risk assessment and an ecological risk assessment. The Risk Assessment and Ecological Assessment indicated that there were no unacceptable levels of risk under the current land use scenario, and that under the current land use scenario, estimated carcinogenic risks were less than 1×10^{-6} with hazard indices (HI) also less than one.

Under the future residential land use scenario, which is a highly unlikely scenario, carcinogenic risks in excess of 1×10^{-6} were calculated for three potential exposure pathways: groundwater ingestion, ingestion of sediment while wading, and dermal contact with soil.

The major contributor to potential risk from groundwater exposure in the future land use scenario is vinyl chloride. This compound was detected in only one groundwater sample (MW113S) at a concentration of 2 ug/L. A detection of 1,2-Dibromo 3-chloropropane in monitoring well (MW117S) also contributed to the risk calculation. The exposure point concentration used in calculating risk values for vinyl chloride was developed using one-half the sample quantitation limit in all groundwater samples where vinyl chloride was not detected. Therefore, the risks assigned to vinyl chloride are largely an artifact of the conservative calculation procedure used to assign concentrations where vinyl chloride was not detected.

The contaminants responsible for carcinogenic risk associated with sediment ingestion were

Aroclor 1248 and arsenic. Aroclor 1248 was detected in the three samples of sediment collected from sedimentation Basin B. Arsenic was detected in all of the soil and sediment samples collected during the RI. There were no background sediment samples available for comparison. However, all the soil and sediment concentrations from RI samples were within the documented range for natural soils in the eastern United States. Estimated arsenic intake for the risk assessment was three orders of magnitude less than the average daily dietary uptake of arsenic in the United States. In addition, the conservative assumption was made that the entire daily sediment ingestion rate (100 mg) would be ingested by the residential receptors (adult and child) during each exposure to sediment (i.e., Fraction Ingested = 1.0). A more reasonable assumption, based on the proportion of time spent in contact with contaminated sediment, results in a risk of 1×10^{-7}, which is less than the U. S. EPA point of departure.

Because of the arsenic and Aroclor 1248 detected in sediment, the sediments in sedimentation Basins A and B are retained as media of concern.

The contaminant responsible for carcinogenic risk (2×10^{-6}) associated with soil ingestion is Aroclor 1248. Aroclor 1248 was found in only one soil sample (SD22) on the western end of the site. Subsequent sampling conducted in the vicinity of SD22 did not detect its presence. Therefore soil is not a media of concern to be addressed in the FS.

The HIs for the future residential land use scenario exceeded unity for two groundwater pathways: ingestion (200 RME and 50 AVG) and dermal contact (8 RME and 2 AVG). An HI greater than one indicates potential concern for adverse noncarcinogenic effects. The HIs resulted from the presence of aluminum and manganese. These HIs are believed to be non-representative of site risks, as described in Section 3.2.1.1. Because of the uncertainty regarding the sources of aluminum and manganese in groundwater samples, aluminum and manganese are being considered as COCs in the FS.

The HIs for exposure to surface water and sediment were all less than unity.

3.4 ECOLOGICAL ASSESSMENT

The ecological risk assessment was conducted by RUST utilizing the U.S. EPA *Risk Assessment Guidance for Superfund, the Framework for Ecological Risk Assessment*, the quotient method (Barnthouse et al. 1982, Urban & Cook 1986), and available bioconcentration data. The environmentally based toxicity quotients and the bioconcentration data provide a semi-quantitative evaluation of potential ecological risk. The results indicated:

- The surface waters of the western drainage area (Basin A) contained aluminum and calcium at concentrations within the probable significant effects-range. In addition, lead was detected at a concentration which may pose possible significant effects.

Similarly, the surface waters of the eastern drainage area (Basin B) contained aluminum at concentrations within the probable significant effects range, and lead within the possible significant effects range. However, the risks associated with these metals in surface water was found to be no greater than the risk associated with background concentrations in upgradient surface water locations. Therefore, potential ecological risks associated with surface water will not be addressed in the FS.

- The sediments of the western drainage area contained arsenic, 4,4'-DDD, mercury, and nickel at concentrations that may pose possible significant effects. In the eastern drainage area, Aroclor 1248, arsenic, cadmium, dieldrin, and nickel were detected at concentrations within the possible significant effects range. In addition, chromium was detected in one location at a concentration that may pose an ecological risk. Of the analytes listed above, cadmium, mercury, and nickel are naturally-occurring metals, and will not be addressed in the FS. The occurrence of arsenic, Aroclor 1248, and chromium in sediment will be addressed.

  Also, 4,4'-DDD, and dieldrin were detected in several samples. Their occurrence is noted because of their potential to bioaccumulate. However, the detection of these compounds were low and limited, so it is not necessary to address them in the Feasibility Study.

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4

IDENTIFICATION AND SCREENING OF TECHNOLOGIES

The objective of the identification and screening of technologies process is to identify a manageable number of applicable remedial technologies which can then be assembled into remedial action alternatives (see Section 5). For the River Road Landfill, this process first consisted of identifying:

- Media of concern
- Remedial action objectives
- General response actions
- Volumes or areas of media

These tasks are presented in Sections 4.1 through 4.4, respectively.

Following the assembly of this information, related remedial technologies and process options were identified, and screened. This process is presented in:

- Identification and screening of remedial technologies (Section 4.5)
- Evaluation and selection of technology process options (Section 4.6)

The following subsections provide a discussion of each of these tasks.

4.1 MEDIA OF CONCERN

The Baseline Risk Assessment and Ecological Assessment (summarized in Sections 3.3 and 3.4, respectively) present an evaluation of possible risks to human health and the environment from potential exposure to contaminants present at the site. The evaluations considered both land use conditions that currently exist at the site, and potential future residential development of property located immediately downgradient of the landfill. (The future residential scenario is unlikely because the area downgradient from the landfill is in the flood plane of the Shenango River.)

Using the Baseline Risk Assessment, Ecological Assessment, and an engineering evaluation of the landfill, the following three media of potential concern were identified:

- Groundwater
- Leachate
- Sediment

The following describes the rational through which each of these media were selected for consideration.

4.1.1 Groundwater

Groundwater is a media of concern not because of current conditions, but because of the future risk scenario developed in the Baseline Risk Assessment and described in Section 3.3. Under current conditions, there are no wells, private or public, within the small zones of impacted groundwater. Under the future risk scenario, it is assumed that groundwater downgradient of the landfill will be ingested, and it is assumed that the groundwater will have contaminant concentrations equal to those present in monitoring wells MW113S and MW117S.

4.1.2 Leachate

Leachate is a media of concern because it is the probable source of low level groundwater contamination found in monitoring wells MW113S and MW117S. A variety of VOCs, SVOCs, and inorganic compounds were detected in the leachate samples.

4.1.3 Sediment

Sediment is a media of concern to be addressed due to a potential ecological risk at three distinct locations. Aroclor 1248 was detected in samples of sediment from sedimentation Basin B, and is discussed in Section 3.1.1. Chromium was found in the discharge channel from sedimentation Basin B and is discussed in Section 3.1.2. Arsenic was detected in all the sediment samples collected during the RI as discussed in Section 3.1.2. Although the occurrence of arsenic is very likely natural and not related to the landfill, it resulted in an unacceptable cancer risk in a highly conservative future land use risk for "ingestion while wading" in the sedimentation basins.

4.2 REMEDIAL ACTION OBJECTIVES

Remedial action objectives are media-specific goals for protecting human health and the environment. Several specific remedial action objectives were developed for each media of concern identified above which achieve the long-term goals of protecting human health and the environment, preventing or minimizing exposure to contaminants, and complying with Applicable or Relevant and Appropriate Requirements (ARARs).

The remedial action objectives for each of the three media of concern are:

Groundwater - Preventing off-site migration of groundwater containing leachate constituents that represent an unacceptable health risk

Preventing ingestion of groundwater containing leachate constituents that represent an unacceptable health risk

Leachate - Minimizing the release of leachate constituents with the potential to cause unacceptable health risks to groundwater

Sediment - Preventing exposure to sediment impacted by arsenic, Aroclor 1248, and chromium

4.3 GENERAL RESPONSE ACTIONS

General response actions describe broad types of actions which could be conducted to satisfy the remedial action objectives identified in Section 4.2. These potential general response actions are gathered from U.S. EPA guidance documents, literature review, and experience at other sites. The general response actions developed for groundwater, leachate, and sediment at the River Road Landfill are discussed below and shown in Table 4-1. In the following sections of this chapter, these general response actions are expanded to include remedial technologies and process options, which are then evaluated and screened.

4.3.1 Groundwater

The following general response actions address site groundwater:

- No action
- Groundwater use restrictions
- Monitoring
- Gradient controls
- Direct treatment on-site
- In-situ treatment
- Treatment off-site
- Discharge

4.3.2 Leachate

The following general response actions address the leachate:

- No action
- Leachate use restrictions

- Monitoring
- Containment
- Gradient controls
- Direct treatment on-site
- In-situ treatment
- Treatment off-site
- Discharge

4.3.3 Sediment

The following general response actions address on-site sediment:

- No action
- Access restrictions
- Monitoring
- Surface stabilization
- Removal and off-site disposal
- Treatment off-site
- In-situ control/treatment
- Direct treatment on-site

4.4 VOLUMES OR AREAS OF MEDIA

The purpose of this task is to make an initial assessment of the volume or area of each of the media of concern to which general response actions might be applied. In this section, the three media are quantified for use throughout the Feasibility Study. The quantities reflect reasonably accurate estimates and are provided for comparing different remedial alternatives on an equal basis. The estimated quantities do not necessarily represent actual quantities which may be remediated, if necessary, during a remedial action phase of the project.

4.4.1 Groundwater

Groundwater containing low levels of VOCs has been identified in two widely separated monitoring wells (MW113S and MW117S), located immediately adjacent to the groundwater/leachate collection system. It is evident that the VOCs detected in these monitoring wells represent minor breaches of the groundwater/leachate collection system, and are not an indication of an extensive plume of contaminants. Due to the low contaminant concentrations identified in these two wells, it is thought that dilution and natural attenuation is limiting the development of a plume.

4.4.2 Leachate

The volume of leachate produced by the landfill was estimated to be 22,600 gpd. This value was calculated using the U.S. EPA's HELP model (Schroeder, 1988). The HELP model estimate is based on a total rainfall of 36.17 in. per year. The model predicts that 22

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percent of the rainfall percolates through the 37.5 acre cap. The landfill is then assumed to be at steady state, with discharge from the landfill equal to percolation through the cap.

4.4.3 Sediment

Contaminated sediment is limited to sedimentation Basins A and B and the downstream outlet ditch. The sediment in Basin B contains low levels of Aroclor 1248. The sediment in both Basin A and B contain arsenic. The outlet ditch contains a small area with elevated chromium. The total volume of sediment contained in Basins A and B is estimated to be approximately 2,000 cubic yards. The zone of sediment in the downstream outlet ditch from Basin B is estimated to be approximately six (6) cubic yards.

4.5 IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES

The purpose of this task is to identify a broad range of remedial technologies and process options based on the general response actions developed in Section 4.3. Remedial technologies are general categories of technologies within each general response action type. Process options are specific processes within each remedial technology type. The remedial technologies and process options are screened based on technical implementability based on the volume or area of media identified in Section 4.4. Remedial technologies and process options which are applicable are carried forward for further evaluation; those not applicable are dropped from further consideration.

The identification and screening process is described in detail in the following subsections and is summarized schematically in Table 4-1. This table provides a brief description of each process option by remedial technology, by general response action, and by media type. It also includes rational for retaining or eliminating each individual process option.

4.5.1 Groundwater

In Section 4.3, eight general response actions were developed to meet the remedial action objectives for groundwater. Table A, (on page 4-7), and Table 4-1, present the remedial technologies identified for each general response action and a concise rational for retaining or eliminating the technology from further consideration.

The general response actions for groundwater, with associated remedial technologies, identified and retained for detailed evaluation include:

- No action
- Groundwater use restrictions
- Monitoring

- Gradient controls
  - Vertical barriers
  - Horizontal barriers
  - Extraction and/or recharge
- Direct treatment on-site
  - Biological treatment
  - Chemical treatment
  - Physical treatment
- In-situ treatment
  - Biological treatment
  - Physical/chemical treatment
- Treatment off-site
- Discharge

Thermal Destruction was the only remedial technology eliminated. It was eliminated because incineration and wet air oxidation consist of treating groundwater in a thermal treatment unit at elevated temperatures. These technologies are generally not applicable to the treatment of primarily aqueous liquids.

The remedial technologies were further broken down into process options as shown on Table 4-1, for further screening. Two process options were also eliminated:

- Injection Wells
  Injections wells are part of the extraction and/or recharge remedial technology under gradient controls. Injection wells used to prevent downgradient contaminant migration are not applicable. The current groundwater dam and groundwater/leachate collection system are effectively preventing downgradient contaminant migration.

- Deep Well Injection
  Deep well injection is part of the discharge remedial technology and general response action. Deep well injection of groundwater is not a generally accepted treatment/disposal method.

TABLE A

Identification and Screening of Remedial Technologies for Groundwater

General Response Action	Remedial Technology	Action	Comments
No Action	No Action	Retained	The NCP requires no action to be carried forward through the Detailed Analysis of Alternatives.
Groundwater Use Restrictions	Groundwater Use Restrictions	Retained	Use restrictions prevent use of contaminated groundwater as a potable water supply.
Monitoring	Monitoring	Retained	Monitoring groundwater is a method to document groundwater quality and collection system effectiveness.
Gradient Controls	Vertical Barriers	Retained	The soil dam is currently in place. Other barrier technologies are potentially applicable for soil dam enhancement.
	Horizontal Barriers	Retained	Horizontal barriers are potentially applicable for eliminating the potential for downgradient migration of contaminants.
	Extraction and/or Recharge	Retained	Contaminated groundwater is currently extracted by the groundwater/ leachate collection system. Cleanout of the existing system and installing extraction wells are potentially applicable. Injection wells are not applicable since the groundwater dam and groundwater/ leachate collection system control the downgradient groundwater elevation.
Direct Treatment On-site	Biological Treatment	Retained	Aerobic and anaerobic digestion are potentially applicable for the treatment of organic contaminants identified in the groundwater.
	Chemical Treatment	Retained	Chemical treatment is potentially applicable for the inorganic and organic contaminants identified in the groundwater.
	Physical Treatment	Retained	Physical treatment is potentially applicable for the removal of inorganic and organic contaminants identified in the groundwater.
	Thermal Destruction	Eliminated	Incineration and wet air oxidation are not applicable for the destruction of a primarily aqueous liquid.
In-situ Treatment	Biological Treatment	Retained	Bioreclamation is potentially applicable for the treatment of organic contaminants identified in the groundwater.
	Physical/Chemical Treatment	Retained	Treatment beds and chemical injection of oxidizers for degradation of organic contaminants are potentially applicable for the treatment of organic contaminants in groundwater.
Treatment Off-site	Treatment Off-site	Retained	Contaminated groundwater is currently treated at a local POTW.
Discharge	Discharge	Retained	Discharge of treated groundwater to surface water, or an infiltration basin is potentially applicable. Deep well injection is not generally accepted by regulatory authorities.

4.5.2 Leachate

In Section 4.3, nine general response actions were developed to meet the remedial action objective for leachate. Table B, which follows this page, and Table 4-1, present the remedial technologies identified for each general response action and a concise rational for eliminating or retaining each technology for further consideration.

The general response actions for leachate, with associated remedial technologies, identified, screened, and retained include:

- No action
- Leachate use restrictions
- Monitoring
- Containment
  - Cap
  - Surface stabilization
- Gradient controls
  - Vertical barriers
  - Extraction and/or recharge
- Direct treatment on-site
  - Biological treatment
  - Chemical treatment
  - Physical treatment
- In-situ treatment
  - Biological treatment
  - Physical/chemical treatment
- Treatment off-site
- Discharge

Horizontal Barriers and Thermal Destruction were the only two remedial technologies eliminated. They were eliminated for the following reasons:

- Horizontal Barriers
  Pressure injection of grout through closely spaced drilled holes is applicable to repairing a current barrier, but will not create a new barrier between leachate and groundwater.

- Thermal Destruction
  Incineration and wet air oxidation consists of treating leachate in a thermal treatment unit at elevated temperatures. These technologies are generally not applicable to the treatment of a primarily aqueous liquid.

TABLE B
Identification and Screening of Remedial Technologies for Leachate

General Response Action	Remedial Technology	Action	Comments
No Action	No Action	Retained	The NCP requires no action to be carried forward through the Detailed Analysis of Alternatives.
Leachate Use Restrictions	Leachate Use Restrictions	Retained	Leachate use restrictions are potentially applicable to prevent placement of on-site potable water wells.
Monitoring	Monitoring	Retained	Monitoring of the leachate is a method to document leachate quality and treatment system effectiveness.
Containment	Cap	Retained	Containment is listed in "Guidance for Conducting RI/FSs Under CERCLA", Interim Final, October 1988 as the preferred alternative for large municipal landfills. RCRA Subtitle C cap is not applicable since the site is not a hazardous waste landfill.
	Surface Stabilization	Retained	The site has been graded to control surface water. Revegetation and habitat enhancement would be potentially applicable to preventing transport and/or direct contact/ingestion of contaminants.
Gradient Controls	Vertical Barriers	Retained	A soil dam is currently in place. Other barrier technologies are potentially applicable for soil dam enhancement.
	Horizontal Barriers	Eliminated	Horizontal barriers to prevent leachate migration to groundwater are not applicable. This technology will not create a new barrier between leachate and groundwater.
	Extraction and/or Recharge	Retained	Contaminated groundwater is currently extracted by the groundwater/leachate collection system. Cleanout of the existing system and installing extraction wells are potentially applicable. Injection wells are not applicable since the groundwater dam and groundwater/leachate collection system control the downgradient groundwater elevation.
Direct Treatment On-site	Biological Treatment	Retained	Aerobic and anaerobic digestion are potentially applicable to the treatment of organic contaminants identified in the leachate.
	Chemical Treatment	Retained	Chemical treatment is potentially applicable for the treatment of inorganic and organic contaminants identified in the leachate.
	Physical Treatment	Retained	Physical treatment is potentially applicable for the removal of inorganic and organic contaminants identified in the leachate.
	Thermal Destruction	Eliminated	Incineration and wet air oxidation are not applicable for the destruction of a primarily aqueous liquid.

In-Situ Treatment	Biological Treatment	Retained	Bioreclamation is potentially applicable for the treatment of organic contaminants identified in the leachate.
	Physical/ Chemical Treatment	Retained	Treatment beds and chemical injection of oxidizers for degradation of organic contaminants are potentially applicable to treat organic contaminants in the leachate.
Treatment Off-Site	Treatment Off-site	Retained	Extracted leachate is currently treated at a local POTW.
Discharge	Discharge	Retained	Discharge of treated leachate to surface water or an infiltration system is potentially applicable. Deep well injection of leachate is generally not accepted by regulatory authorities.

The remedial technologies were further broken down into process options for further screening as shown on Table 4-3. As a result, three process options were also eliminated:

- RCRA Subtitle C Cap
  The RCRA Subtitle C cap is part of the cap remedial technology under the containment general response action. The RCRA Subtitle C cap is not applicable because the site is not a hazardous waste landfill.

- Injection Wells
  Injections wells are part of the extraction and/or recharge remedial technology under gradient controls. Injection wells used to prevent downgradient contaminant migration are not applicable. The current groundwater dam and groundwater/leachate collection system are effectively preventing downgradient contaminant migration.

- Deep Well Injection
  Deep well injection is part of the discharge remedial technology and general response action. Deep well injection of leachate is not a generally accepted method of leachate discharge.

4.5.3 Sediment

In Section 4.3 eight general response actions were developed to meet the remedial action objective for sediment. Table C, which follows this page, and Table 4-1, present the remedial technologies identified for each general response action and a concise rational for eliminating or retaining each technology for further consideration.

The general response actions for sediment, with associated remedial technologies, identified, and retained for detailed evaluation include:

- No action
- Access restrictions
- Monitoring
- Surface stabilization
- Removal and disposal
  - Excavate and landfill
- Treatment off-site
- In-Situ treatment
- Direct treatment on-site

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TABLE C

Identification and Screening of Remedial Technologies for Sediment

General Response Action	Remedial Technology	Action	Comments
No Action	No Action	Retained	The NCP requires no action to be carried through to the Detailed Analysis of Alternatives.
Access Restrictions	Access Restrictions	Retained	Access restrictions are potentially applicable to prevent direct contact with or ingestion of contaminated sediment.
Monitoring	Monitoring	Retained	Monitoring is a method to document contaminant levels and sediment transport.
Surface Stabilization	Surface Stabilization	Retained	Grading and revegetation are potentially applicable to prevent transport and/or impact to ecological receptors.
Removal and Disposal	Excavate and Landfill	Retained	Removal and disposal of contaminated sediments is potentially applicable.
Treatment Off-site	Thermal Destruction	Eliminated	Thermal destruction is not applicable due to low concentration of organic contaminants.
	Biological Treatment	Eliminated	Biological treatment is not applicable due to low concentration of organic contaminants.
In-Situ Treatment	Biological Treatment	Eliminated	Biological treatment is not applicable due to low concentration of organic contaminants.
	Chemical Treatment	Eliminated	Chemical treatment is not applicable due to low concentration of organic contaminants.
	Physical Treatment	Eliminated	Physical treatment to remove or stabilize sediment contaminants is not applicable due to low concentration of organic contaminants, low vapor pressure, and low volume of materials.
Direct Treatment On-site	Biological Treatment	Eliminated	Biological treatment is not applicable due to low concentration of organic contaminants.
	Chemical Treatment	Eliminated	Chemical treatment is not applicable due to low concentration of organic contaminants.
	Physical Treatment	Eliminated	Physical treatment is not applicable due to low organic contaminant concentrations.
	Thermal Destruction	Eliminated	Thermal destruction is not applicable due to low organic contaminant concentrations, and low volume of material.

Nine remedial technologies were eliminated, including:

- Thermal Destruction (Off-site)
- Biological Treatment (Off-site)
- Biological Treatment (In-situ)
- Chemical Treatment (In-situ)
- Physical Treatment (In-situ)
- Biological Treatment (On-site)
- Chemical Treatment (On-site)
- Physical Treatment (On-site)
- Thermal Destruction (On-site)

These technologies were eliminated from consideration because the organic contaminant concentrations are too low to warrant in-situ, on-site, or off-site treatment technologies.

4.6 EVALUATION AND SELECTION OF TECHNOLOGY PROCESS OPTIONS

The last task prior to assembling the alternatives is to evaluate and select the process options that will represent each technology type. The purpose of this task is to select a limited number of promising process options for consideration in assembling remedial action alternatives. Process options are evaluated with regard to:

1) Effectiveness
2) Implementability
3) Cost

Effectiveness is the primary criterion used to screen process options in the Feasibility Study. Effectiveness is evaluated with respect to the potential end results, for example, the ability of the technology to meet the remedial action objective, and the ability of the technology to adequately accommodate the relevant waste type and volume.

Implementability is evaluated considering the technical and administrative feasibility of applying the technology. Technical implementability considers a range of factors relevant to obtaining, installing, and using a particular technology. Some remedial technologies are proven and readily available, while others are in the research and development stages. Insufficiently developed technologies are screened out. Site conditions must be compatible with the feasible range of a given technology's capabilities, considering for example, depth to bedrock, depth to groundwater, space requirements, and the ability of technology to treat identified contaminants. Administrative implementability considers a range of factors relevant to the testing, review, approval, and/or permitting of a particular technology.

Cost is evaluated relative to capital, and operation and maintenance costs. Cost plays a limited role in the screening of process options at this stage. However, remedial technologies that are very expensive but also equally or only marginally more effective than much lower cost technologies are screened out.

The evaluation and selection of process options is described in the following subsections and summarized on Table 4-2. Table 4-2 includes the evaluation of each process option retained from Table 4-1 for effectiveness implementability and relative cost.

4.6.1 Groundwater

Based on effectiveness, implementability, and relative cost, the following process options, under their associated general response actions, were retained for groundwater. A summary of the process option evaluation and selection is shown in Table 4-2.

- No action
- Groundwater use restrictions
  - Deed restrictions
  - Well closure
  - Zoning restrictions
- Monitoring
- Gradient controls
  - Soil dam
  - Drains
  - Drain enhancement
- Treatment off-site
  - POTW

Several process options were eliminated in the evaluation on the basis of effectiveness, implementability, or relative cost. For each process option eliminated, a brief explanation is given below.

- Gradient Controls/Vertical Barriers
  Four process options were eliminated in this category including Slurry Wall, Grout Curtain, Sheet Piles and Vibrating Beam Wall. These process options were eliminated because the results of the RI demonstrate that the existing groundwater dam and groundwater/leachate collection system are effectively preventing downgradient migration of contaminants. Therefore, continued use of the existing system is proven effective, already implemented, and less expensive than installing a new vertical barrier system.

- Gradient Controls/Horizontal Barriers
  Grout Injection was eliminated because the effectiveness and implementability of the process option is uncertain due to the large area (approximately 40 acres) that would require treatment.

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- Gradient Controls/Extraction and/or Recharge
  Two process options were eliminated in this category including Trenches and Extraction Wells. The existing groundwater/leachate collection system is effectively serving the same purpose as an interceptor trench, and an enhanced groundwater/leachate collection system would be more cost effective than installing pumping wells in the isolated areas of groundwater contamination.

- Direct Treatment On-site/Biological
  Two process options were eliminated in this category including Aerobic Digestion and Anaerobic Digestion. The existing groundwater/leachate collection system that surrounds River Road Landfill discharges the waste to a local POTW. On-site treatment would not be as effective as the existing POTW due to the operational problems typically associated with small on-site treatment systems. In addition, a small on-site treatment system would be less cost effective.

- Direct Treatment On-site/Chemical
  Four process options were eliminated in this category including Precipitation, Oxidation, Photolysis, and Reduction. The existing groundwater/leachate collection system that surrounds River Road Landfill discharges the waste to a local POTW. On-site treatment would not be as effective as the existing POTW due to the operational problems typically associated with small on-site treatment systems.

- Direct Treatment On-site/Physical
  Six process options were eliminated in this category including Air Stripping, Steam Stripping, Carbon Adsorption, Reverse Osmosis, Ion Exchange, and Spray Evaporation. The existing groundwater/leachate collection system that surrounds River Road Landfill discharges the waste to a local POTW. On-site treatment would not be as effective as the existing POTW due to the operational problems typically associated with small on-site treatment systems.

- In-situ Treatment/Biological Treatment
  Bioreclamation was eliminated as a process option because of the uncertainly in its effectiveness to remove or digest the organic contaminants present in the groundwater. A pilot study would be required to determine if site contaminants could be effectively removed through this method. The process option of POTW Discharge is more cost effective.

- In-situ Treatment/Physical/Chemical Treatment
  Two process options were eliminated in this category including Permeable Treatment Beds and Chemical Reaction. Both process options were eliminated due to the uncertainty of effectiveness at the River Road site. A pilot study would be required to determine if site contaminants could be effectively removed through

either of the two methods. Additionally, the soil downgradient of the landfill is sandy, so for the Permeable Treatment Bed option, the groundwater would not preferentially drain to the treatment beds for removal of contaminants. The process option of POTW discharge is more cost effective.

- Discharge/Discharge
  Two process options were eliminated in this category including Surface Water and Infiltration Basin. Both options were eliminated because on-site treatment would not be as effective as the existing groundwater/leachate collection system due to the operational problems typically associated with small scale systems.

4.6.2 Leachate

Based on effectiveness, implementability, and relative cost, the following process options, under their associated general response actions, were selected for leachate. A summary of the process option evaluation and selection is shown on Table 4-2.

- No action
- Leachate use restrictions
  - Deed restrictions
  - Well closure
  - Zoning restrictions
- Monitoring
- Containment
  - PA solid waste cap
  - RCRA Subtitle D cap
  - Grading
  - Revegetation
  - Habitat Enhancement
- Vertical barriers
  - Soil dam
  - Drains
  - Drain enhancement
- Treatment off-site
  - POTW

Several process options were eliminated due to effectiveness, implementability, or relative cost. For each process option eliminated, a brief explanation is given below.

- Containment/Cap
  Pavement cap was eliminated from this category. The Pavement cap would not be implementable due to differential settlement of refuse and frost action which would tend to crack and heave the cover material.

- Gradient Controls/Vertical Barriers
  Four process options were eliminated in this category including Slurry Wall, Grout Curtain, Sheet Piles and Vibrating Beam Wall. These process options were eliminated because the results of the RI demonstrate that the existing groundwater dam and groundwater/leachate collection system are effectively preventing downgradient migration of contaminants. Therefore, continued use of the existing system is effective, already implemented, and less expensive than installing a new vertical barrier system.

- Gradient Controls/Extraction and/or Recharge
  Two process options were eliminated in this category including Trenches and Extraction Wells. The existing groundwater/leachate collection system is effectively serving the same purpose as an interceptor trench, and an enhanced groundwater/ leachate collection system would be more cost effective than installing pumping wells in the areas of groundwater contamination.

- Direct Treatment On-site/Biological
  Two process options were eliminated in this category including Aerobic Digestion and Anaerobic Digestion. The existing groundwater/leachate collection system that surrounds River Road Landfill discharges the waste to a local POTW. On-site treatment would not be as effective as the existing POTW due to the operational problems typically associated with small on-site treatment systems.

- Direct Treatment On-site/Chemical
  Four process options were eliminated in this category including Precipitation, Oxidation, Photolysis, and Reduction. The existing groundwater/leachate collection system that surrounds River Road Landfill discharges the waste to a local POTW. On-site treatment would not be as effective as the existing POTW due to the operational problems typically associated with small on-site treatment systems.

- Direct Treatment On-site/Physical
  Six process options were eliminated in this category including Air Stripping, Steam Stripping, Carbon Adsorption, Reverse Osmosis, Ion Exchange, and Spray Evaporation. The existing groundwater/leachate collection system that surrounds River Road Landfill discharges the waste to a local POTW. On-site treatment would not be as effective as the existing POTW due to the operational problems typically associated with small on-site treatment systems.

- In-situ Treatment/Biological Treatment
  Bioreclamation was eliminated as a process option because of uncertainty in its effectiveness to remove or digest the organic contaminants present in the leachate. A pilot study would be required to determine if site contaminants could be effectively removed through this method.

- In-Situ Treatment/Physical/Chemical Treatment
  Two process options were eliminated in this category including Permeable Treatment Beds and Chemical Reaction. Both process options were eliminated due to the uncertainty of effectiveness at the River Road site. A pilot study would be required to determine if site contaminants could be effectively removed through either of the two methods. Additionally, the soil downgradient of the landfill is sandy, so for the Permeable Treatment Bed option, the groundwater would not preferentially drain to the treatment beds for removal of contaminants.

- Discharge/Discharge
  Two process options were eliminated in this category including Surface Water and Infiltration Basin. Both options were eliminated because the existing groundwater/ leachate collection system is effective. On-site treatment would not be as effective due to the operational problems typically associated with small scale systems.

4.6.3 Sediment

Based on effectiveness, implementability, and relative cost, the following process options, under their associated general response actions, were selected for sediment. A summary of the process option evaluation and selection is shown on Table 4-2.

- No action
- Access restrictions
  - Deed restrictions
  - Fence
  - Zoning restrictions
- Monitoring
- Removal and disposal
  - Off-site landfill

Several process options were eliminated due to effectiveness, implementability, or relative cost. For each process option eliminated, a brief explanation is given below.

- Surface Stabilization/Surface Stabilization
  Two process options were eliminated in this category including Grading and Revegetation. These process options were eliminated because neither option would effectively prevent potential exposure of ecological receptors to contaminants present in the sediment.

- Removal and Disposal/Excavate and Landfill
  On-site Disposal was eliminated as a process option because of the practicality and cost compared to off-site disposal. On-site disposal would include excavating the existing cap, replacing the cap, and revegetating the disturbed area.

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5

Development of Remedial Action Alternatives

The objective of developing alternatives is to assemble the process options and technologies which survived through the initial screening into remedial action alternatives that protect human health and the environment and encompass a range of potentially appropriate remedial options.

5.1 DEVELOPMENT OF REMEDIAL ACTION ALTERNATIVE COMPONENTS

The following table is a listing of the process options for each media retained through the screening of technologies in Section 4. These remedial options were assembled into remedial action alternative components, by combining several similar and complementary process options into components that create a process system.

Process Options Retained for Each Media of Concern through Screening

Groundwater	Leachate	Sediment
No Action	No Action	No Action
Deed Restriction	Deed Restriction	Deed Restriction
Well Closure	Well Closure	Fencing
Zoning Restriction	Zoning Restriction	Zoning Restriction
Monitoring	Monitoring	Monitoring
Soil Dam	PA Solid Waste Cap	Off-site Disposal
Drains	RCRA Subtitle D Cap	
Drain Enhancement	Grading	
POTW	Revegetation	
	Habitat Enhancement	
	Soil Dam	
	Drains	
	Drain Enhancement	
	POTW	

The following combinations were made of similar process options for the various media of concern at the River Road Landfill Site:

- Process options "grading" and "revegetation", were grouped together to create the remedial action alternative component "Surface Water Collection System".
- Process options "drains" and "discharge to the POTW", were grouped together to create the remedial action alternative component "Groundwater/Leachate Collection System".
- Process options "zoning restrictions" and "deed restrictions", were grouped together to create the remedial action alternative component "Institutional Controls".
- Fencing was separated out as an active access restriction.

By combining these process options, the following list of remedial action alternative components was assembled.

1. Fence
2. Monitoring
3. PADER Solid Waste Cap
4. Surface Water Collection System
5. Groundwater Dam
6. Groundwater/Leachate Collection System
7. Institutional Controls
8. Off-Site Disposal of Sediment
9. Habitat Enhancement
10. Groundwater/Leachate System Enhancement
11. Solid Waste Cap (RCRA Subtitle D)

5.2 SUMMARY OF DEVELOPED REMEDIAL ACTION ALTERNATIVES

Five Remedial Action Alternatives have been developed from the 11 remedial action alternative components as shown on the following table. The alternatives have been developed to provide a range of options and sufficient information to identify the potential advantages and disadvantages of implementing various treatment systems, and are increasingly conservative in nature. The alternatives have been assembled to take full advantatge of the significant remedial systems currently in place. Alternative 1, the No Action Alternative is required by the NCP. Alternative 2 is the No Further Action

Alternative. It consists of items 1 through 6 in the list above, which are the signficant remedial components which have already been implemented on the site. Alternative 3 is constructed by adding site-use restrictions and sediment removal (numbers 7 and 8, respectively from the list) to prevent inappropriate future use and potential ecological risk.

Alternatives 4 and 5 then introduce a variety of increasingly costly modifications to the landfill, intended to physically remove or better contain site contaminants. These more costly alternatives may minimize the mobilization of site contaminants, but do not significantly reduce site risk.

Alternative 1- No Action

Alternative 2 - No Further Action. (Fence, PADER Solid Waste Cap, Groundwater Dam, Groundwater/Leachate Collection System, and Monitoring).

Alternative 3 - Fence, PADER Solid Waste Cap, Groundwater Dam, Groundwater/ Leachate Collection System, Monitoring, Institutional Controls, Off-Site Disposal of Sediment, and Habitat Enhancement.

Alternative 4 - Fence, PADER Solid Waste Cap, Groundwater Dam, Groundwater/ Leachate Collection System, Monitoring, Institutional Controls, Off-Site Disposal of Sediment, Groundwater/Leachate System Enhancement, and Habitat Enhancement

Alternative 5 - Fence, Groundwater Dam, Groundwater/Leachate Collection System, Monitoring, Institutional Controls, Off-Site Disposal of Sediment, Groundwater/Leachate System Enhancement, RCRA Subtitle D Cap, and Habitat Enhancement.

The following table graphically demonstrates how the 11 remedial action alternative components were assembled into the five remedial action alternatives.

Assembly of Remedial Action Alternatives

	Remedial Action Alternatives				
Remedial Action Components	**1**	**2**	**3**	**4**	**5**
Fence	X	X	X	X	X
Monitoring		X	X	X	X
PADER Solid Waste Cap	X	X	X	X	X
Surface Water Collection System	X	X	X	X	X
Groundwater Dam	X	X	X	X	X
Groundwater/Leachate Collection System		X	X	X	X
Institutional Controls			X	X	X
Off-site Disposal of Sediment			X	X	X
Habitat Enhancement			X	X	X
Groundwater/Leachate System Enhancement				X	X
Solid Waste Cap RCRA Subtitled Cap					X

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6

DETAILED ANALYSIS OF ALTERNATIVES

6.1 INTRODUCTION

The objective of the detailed analysis of alternatives is to review each of the remedial action alternatives identified in Section 5 against the initial seven of the nine criteria developed by the U.S. EPA to address both the statutory requirements and statutory considerations prescribed in CERCLA. (The last two criteria are considered later in the CERCLA process.) The nine evaluation criteria are:

- Overall protection of human health and the environment
- Compliance with applicable or relevant and appropriate requirements (ARARs)
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume
- Short-term effectiveness
- Implementability
- Cost
- State acceptance
- Community acceptance

A description of the nine criteria is presented below.

6.1.1 Overall Protection of Human Health and the Environment

This evaluation criterion assesses whether an alternative provides adequate protection of human health and the environment from the short-term and long-term risks posed by hazardous substances, pollutants, or contaminants present at the site. This protection can be accomplished by eliminating, reducing, or controlling exposures to contaminants to levels established during the development of remedial action objectives. Overall protection of human health and the environment draws on the assessments of other evaluation criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs.

6.1.2 Compliance With ARARs

This evaluation criterion assesses whether an alternative can comply with Federal and State ARARs. An alternative that does not comply with an ARAR may provide grounds for invoking a waiver as described in the NCP under paragraph 40 CFR 300.430(f)(1)(ii)(C). ARARs are discussed in terms of chemical-specific, location-specific, and action-specific ARARs.

Chemical-specific ARARs are numerical standards that establish the acceptable amount or concentration of a chemical that may be found in, or discharged to the environment. Chemical-specific ARARs may be derived from several standards including Resource Conservation and Recovery Act (RCRA) Maximum Concentration Limits (MCLs) in groundwater, Safe Drinking Water Act (SDWA) MCLs, and Water Quality Criteria.

Location-specific ARARs are restrictions placed on the concentration of hazardous substances or the conduct of activities solely because they are in specific locations such as floodplains, wetlands, historic places, sensitive ecosystems, or habitats. Location-specific ARARs may be derived from several standards including RCRA Location Requirements, National Historic Preservation Act of 1966 (NHPA), Endangered Species Act, Wilderness Act, Fish and Wildlife Coordination Act, Wild and Scenic Rivers Act, Coastal Zone Management Act, and Clean Water Act.

Action-specific ARARs are technology-based or activity-based requirements or limitations on actions taken with respect to hazardous wastes. These requirements are triggered by the particular remedial activities that are selected to accomplish a remedy.

The following definitions of "applicable" and "relevant and appropriate" are presented for the readers information:

> Applicable requirements means those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site.

"Applicability" implies that the remedial action or the circumstances at the site satisfy all of the jurisdictional prerequisites of a requirement.

If a requirement is not applicable, one must consider whether it is both relevant and appropriate.

> Relevant and appropriate requirements mean those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. However, in some circumstances, a requirement may be relevant, but not appropriate for the site-specific situation.

The determination that a requirement is relevant and appropriate is a two-step process: (1) determination if a requirement is relevant and (2) determination if a requirement is appropriate. In some cases, a requirement may be relevant, but not appropriate, given site-specific circumstances. Such a requirement would not be an ARAR for the site.

In determining whether a requirement is relevant and appropriate, a comparison is made to the pertinence of several factors such as:

- The purpose of the requirement and the purpose of the CERCLA action
- The medium regulated or affected by the requirement and the medium contaminated or affected at the CERCLA site
- The substances regulated by the requirement and the substances found at the CERCLA site
- The actions or activities regulated by the requirement and their availability for the circumstances at the CERCLA site
- Any variances, waivers, or exemptions of the requirement and their availability for the circumstances at the CERCLA site
- The type of place regulated and the type of place affected by the release or CERCLA action
- The type and size of structure or facility regulated and the type and size of structure affected by the release or contemplated by the CERCLA action
- Any consideration of use or potential use of affected resources in the requirement and the use or potential use of the affected resource at the CERCLA site

The pertinence of each of the factors depends, in part, on whether a requirement addresses a chemical, the location or a specific remedial action.

In addition to applicable or relevant and appropriate requirements, the lead and support agencies may, as appropriate, identify other advisories, criteria, or guidance to be considered for a particular release. The "to be considered" (TBC) category consists of advisories, criteria, or guidance that were developed by the U.S. EPA, other federal agencies, or states that may be useful in developing CERCLA remedies.

Tables 6-1 through 6-3 summarizes potential federal and state ARARs for this site. (To date, WMPA has not received specific ARARs for the River Road Landfill site from U.S. EPA.)

6.1.3 Long-Term Effectiveness and Permanence

This evaluation criterion assesses the long-term effectiveness and permanence an alternative affords, along with the degree of certainty that the alternative will prove successful. Factors that are considered, as appropriate, include:

- Magnitude of residual remaining from untreated waste, or treatment residuals remaining at the conclusion of the remedial activities. The characteristics of the residuals should be considered to the degree that they remain hazardous, taking into account their volume, toxicity, mobility, and propensity to bioaccumulate.

- Adequacy and reliability of controls, such as containment systems and institutional controls, that are necessary to manage treatment residuals and untreated waste. This factor addresses in particular the uncertainties associated with land disposal for providing long-term protection from residuals, an assessment of the potential need to replace technical components of the alternative, and the potential exposure pathways and risks posed should the remedial action need replacement.

6.1.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

This evaluation criterion assesses the degree to which an alternative employs recycling or treatment that reduces toxicity, mobility, or volume, including how treatment is used to address the principal threats posed by the site. Factors that are considered, as appropriate, include:

- Treatment or recycling processes the alternative employs and the materials that are treated

- Amount of hazardous substances, pollutants, or contaminants that will be destroyed, treated, or recycled

- Degree of expected reduction in toxicity, mobility, or volume of the waste due to treatment or recycling and the specification of which reduction(s) are occurring

- Degree to which the treatment is irreversible

- Type and quantity of residuals that will remain following treatment, considering the persistence, toxicity, mobility, and propensity to bioaccumulate of such hazardous substances and their constituents

- Degree to which treatment reduces the inherent hazards posed by the principal threats at the site

6.1.5 Short-Term Effectiveness

This evaluation criterion assesses the short-term impacts of alternatives including:

- Short-term risks that might be posed to the community during implementation of an alternative

- Potential impacts on workers during remedial action, and the effectiveness and reliability of protective measures

- Potential environmental impacts of the remedial action, and the effectiveness and reliability of mitigative measures during implementation

- Time until remedial action objectives are achieved

6.1.6 Implementability

This evaluation criterion assesses the ease or difficulty of implementing the alternative by considering the following types of factors, as appropriate:

- Technical feasibility, including technical difficulties and unknowns associated with the construction and operation of a technology, the reliability of the technology, ease of undertaking additional remedial actions, and the ability to monitor the effectiveness of the remedy

- Administrative feasibility, including activities needed to coordinate with other offices and agencies, and the ability and time required to obtain any necessary approvals and permits from other agencies (for off-site actions)

- Availability of services and materials necessary for implementing the alternative, including the availability of adequate off-site treatment, storage capacity, and disposal capacity and services; the availability of necessary equipment and specialists, and provisions to provide any necessary additional resources; and availability of prospective technologies

6.1.7 Cost

This evaluation criterion assesses various types of costs, including:

- Capital costs
- Annual operation and maintenance (O & M) costs
- Present Net Worth (PNW) of capital and O & M costs

Cost figures obtained from readily available sources (e.g., Means Site Work Cost Data and local suppliers) are used to estimate costs for each of the alternatives for comparison purposes. These cost estimates provide relative costs among the alternatives, using consistent assumptions and estimating methods, and should not be considered the actual cost of designing and implementing a remedial action. According to *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (U.S. EPA, 1988), cost estimates provided in the FS are expected to provide a level of accuracy of +50 to -30 percent. A more detailed cost estimate will be prepared during the Remedial Design phase.

Capital costs presented in this report include allowances for administration (5%), engineering (20%), and contingency (20%). The 5 year review cost is included in the 5% administration costs. Operation and maintenance (O&M) costs include a contingency of 15%. The present net worth (PNW) is based on a 30 year project duration, and it assumes a 5% discount rate.

A cost summary of the alternatives described in this report is presented in Tables 6-4. The estimated capital costs, O&M costs, and PNW costs are itemized in Appendix A.

6.1.8 State Acceptance
This evaluation criterion assesses the technical and administrative preferences and concerns that the Commonwealth of Pennsylvania may have about each alternative. This criterion has not been addressed in this draft of the Feasibility Study. PADER will review this draft and provide comments regarding acceptance.

6.1.9 Community Acceptance
This criterion will incorporate public comments which have been provided to Federal and State agencies during the Remedial Investigation/Feasibility Study process. The analysis will address those alternatives which the community formally supports, has reservations about, or opposes. Community input regarding the Feasibility Study will be solicited during the public comment period, during which time the Feasibility Study report will be available for public review. A responsiveness summary will be prepared to address comments received during the public comment period. The public comments and responsiveness summary will be made a part of the Record of Decision. Therefore, community acceptance issues are not included in this document.

The following subsections are presented by remedial action alternative. Each subsection provides a brief description of the alternative, and a subsequent point-for-point description of how that alternative addresses the first seven criteria presented above.

6.2 REMEDIAL ACTION ALTERNATIVE 1
NO ACTION

(Fence, the PADER Solid Waste Cap, the Surface Water Collection System, and the Groundwater Dam)

6.2.1 *Remedial Components*

Remedial Action Alternative 1 constitutes the "No Action" Alternative, and is required by the guidance document to provide a baseline for the site. In the case of the River Road site, several remedial systems have previously been implemented, and are therefore included in the "No Action" Alternative. It is comprised of four Remedial Action Components, including Fencing, the PADER Solid Waste Cap, the Surface Water Collection System, and the Groundwater Dam. Each of the components is described in further detail below.

6.2.1.1 Fence

The **Fence** is comprised of an 8-ft high chain-link fence. The fence surrounds the site on three sides, with access from the fourth side blocked by the Shenango River, as shown on Figure 2-3. The fence is maintained to control site access, thus limiting exposure to the site.

6.2.1.2 PADER *Solid* Waste Cap

In 1986 and 1987, the **PADER Solid Waste Cap** was constructed over the entire landfill in accordance with a PADER-approved work plan (Figure 2-3). Data obtained during the RI demonstrate that the cap was constructed in accordance with both the work plan and 25 PA Code, Section 75, as amended June 11, 1977 (the regulations under which the landfill was closed). The RI also confirmed that the landfill cap construction adequately promotes surface water runoff.

6.2.1.3 Surface Water Collection System

A **Surface Water Collection System** was integrated into the cap to promote surface water runoff and collect sediment. The cap was constructed with a gentle 1.5 percent slope on the top surface increasing to a six percent slope toward the sides of the landfill. The sides of the landfill are sloped between 12 and 20 percent. Terraces were constructed every 10 to 20 ft of elevation drop. The terraces are sloped into the landfill to collect and channel surface water to ditches located on the east and west sides of the landfill. Two sedimentation basins (Basin A and Basin B) were constructed at the southwestern and southeastern corners of the landfill, respectively, to receive surface water runoff from the ditches. Surface water runoff is discharged from the basins to the Shenango River.

Data gathered during the RI demonstrate the effectiveness of the surface water collection system. It shows that approximately 60 percent of rainfall is captured by the surface water collection system, versus the approximately 10 percent captured by the groundwater/leachate collection system. Therefore, the combination of the PADER solid waste cap and the surface water collection system is minimizing infiltration through the cap, and maximizing runoff from the landfill.

6.2.1.4 Groundwater Dam

The **Groundwater Dam** is located at the downgradient (southern) perimeter of the landfill. It was constructed in a trench (Figure 2-3). The bottom of the trench is typically 10 feet wide expanding to approximately 30 to 50 feet at the surface. The base of the dam is located at approximately 855 to 850 feet MSL (15 to 20 feet below the current ground surface). The top of the dam is located 0 to 5 feet below grade. A 10 feet wide zone within the trench was compacted in lifts. The remaining volume of the trench on both sides of the groundwater dam is backfilled with a mixture of excavated site material and material used for dam construction.

The dam is keyed into a foundation of natural fine-grained hard gray silt till over the western 75 percent of its length at a depth of 10 to 20 feet. In the eastern portion, the dam is keyed into a coarser grained till or sand material, and possibly shale bedrock further east.

The groundwater dam was constructed by WMPA to limit potential groundwater flow from the site to the Shenango River, and conversely, to limit flow from the Shenango River toward the groundwater/leachate collection system. The results from the RI indicate that the groundwater dam is effective, and meets both objectives.

The existing remedial systems included in Alternative 1 minimize infiltration and leachate generation. However, in the case of a true "No Action" Alternative, the groundwater/leachate collection system would not be functioning, and leachate produced by the landfill would not be prevented from reaching groundwater. A detailed analysis of Alternative 1 is presented below.

6.2.2 Overall Protection of Human Health and the Environment

This criterion addresses the adequacy with which Alternative 1 provides protection of human health and the environment by limiting exposure to contaminants. The adequacy of the alternative is evaluated by comparison to the results of the Baseline Risk Assessment and by assessing effectiveness in accomplishing remedial action objectives.

Alternative 1 would not provide adequate protection of human health or the environment under a potential future residential land use scenario. Calculations in the Baseline Risk Assessment indicate that unacceptable risk to human health may occur under a potential future residential land use scenario, through ingestion of groundwater containing leachate constituents if a drinking water well were constructed in an area with groundwater contamination. The risk posed under the potential future residential scenario would not be reduced by the no action alternative, except through the natural processes of attenuation and dilution. Risk might actually increase over time, since the groundwater/leachate collection system would no longer be operational under Alternative 1. With the groundwater/leachate collection system no longer functioning, leachate could migrate into groundwater and elevate the concentrations of leachate constituents in groundwater downgradient of the site.

Alternative 1 would not provide adequate protection of human health under the future land use scenario of sediment ingestion by a wader in the sedimentation basins. In addition, the ecological assessment performed for the site indicates that unacceptable risk to ecological

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communities may potentially occur at isolated locations, due to sediment exposure. This potential risk would not be reduced under the no action alternative except through natural processes.

Remedial action objectives are media-specific goals for protecting human health and the environment. Remedial action objectives were developed to address site contaminants and to address the identified potential site risks by preventing or minimizing exposure to contaminants potentially present in groundwater, leachate, and sediment. Compliance with remedial action objectives is discussed in the following paragraphs, on a media-specific basis.

6.2.2.1 Groundwater

The remedial action objectives developed to address site groundwater include preventing off-site migration and/or ingestion of groundwater containing leachate constituents at concentrations that represent an unacceptable health risk. Alternative 1 does not meet these remedial action objectives for the future land use scenarios.

Under the no action alternative, the existing groundwater/leachate collection system would be shut down. Shutdown of the groundwater/leachate collection system would allow the migration of leachate constituents to groundwater beneath the site. In addition, no monitoring would be performed to document groundwater quality changes which could lead to off-site migration of groundwater containing leachate constituents at concentrations that represent an unacceptable health risk. However, if such migration would occur, dilution of contaminants upon discharge to the Shenango River would likely reduce contaminant concentrations to levels below concentrations that represent an unacceptable health risk.

Ingestion would only be a concern under a potential future residential scenario involving consumption of water from a water supply well contaminated by leachate constituents. There is little likelihood that this scenario would occur, since the affected area is located on landfill property within the 100-yr floodplain of the Shenango River. Future residential development would not be expected to occur in the flood plain, between the landfill and the river.

6.2.2.2 Leachate

The remedial action objective developed to address leachate at the site consists of minimizing the release of leachate constituents to groundwater that represent unacceptable health risks. This alternative does not include maintenance of the current cap or operation of the groundwater/leachate collection system and, therefore, does not meet this remedial action objective.

6.2.2.3 Sediment

The remedial action objective developed to address potential risk associated with sediment includes preventing exposure to sediment impacted by arsenic, Aroclor 1248, and chromium. Alternative 1 does not meet this objective.

6.2.3 Compliance with ARARs

This criterion describes the chemical-specific, location-specific, and action-specific ARARs potentially applicable to Alternative 1. Potential ARARs are summarized in Tables 6-1 through 6-3.

Since "No Action" would be taken under this alternative, no ARARs would be triggered. However, current conditions at the site may not be consistent with promulgated regulations or established remedial goals. On-site groundwater quality does not reflect background quality in two locations adjacent to the landfill. However, groundwater quality at the downgradient property boundary is equivalent to background quality. Therefore, it is not necessary to focus remediation toward groundwater extraction or treatment.

6.2.4 Long-Term Effectiveness and Permanence

This criterion describes factors including: 1) the magnitude of residual risk, 2) the remaining sources of residual risk following implementation of the remedy, 3) the need for a five-year review, and 4) the adequacy and reliability of controls. This latter factor considers the long-term management of treatment residuals, long-term reliability of engineering and institutional controls, and the potential need for the replacement of the alternative. These four factors are discussed below.

6.2.4.1 Magnitude of Residual Risk

Residual risk to human health and the environment may be increased versus those calculated in the Baseline Risk Assessment, because the existing remedial actions would be discontinued under a true "no action" alternative. The Risk Assessment indicates that unacceptable risks to human health would result from the potential future land use scenarios of drinking contaminated groundwater and ingesting sediment while wading in the sedimentation basins. If the groundwater/leachate collection system is not operated, groundwater contaminant concentrations could increase over time. Therefore, the cancer risk associated with the future potential risk scenario might increase accordingly. The Ecological Assessment indicates that unacceptable risk to ecological communities is found in sedimentation Basins A and B and the discharge channel from Basin B. This potential risk would not be reduced under the no action alternative except through natural processes.

<u>Remaining Sources of Residual Risk</u>

Following implementation of Alternative 1, remaining sources of residual risk would be present from the refuse, groundwater, leachate, and sediment.

The refuse present beneath the cap represents the primary remaining source of residual risk. The refuse has and will continue to anaerobically degrade, releasing contaminants. Rainwater percolating through the landfill will continue to carry these contaminants to groundwater beneath the landfill.

Groundwater contaminants continue to be minimized through installation of the PADER solid waste cap, the groundwater dam, and proper grading and vegetation of the site. To date, VOCs have been detected in only two site monitoring wells (MW113S and MW117S), located immediately adjacent to the groundwater/leachate system. However, implementation of Alternative 1 would include shutting down the groundwater/leachate collection system. Due to this action, residual contaminant concentrations might increase over time.

Leachate generation has been significantly reduced through the installation of the existing remedial systems. Leachate generation has been minimized through installation of the PADER solid waste cap. Site grading, including diversion ditches, rip-rap lined channels, and two sedimentation basis, have maximized surface water runoff, further minimizing infiltration. However, implementation of Alternative 1 would discontinue site maintenance. Due to this action, leachate generation might increase over time.

Residual concentrations of arsenic, Aroclor 1248, and chromium in sediment would not be reduced in this alternative.

Five Year Review

A five-year review of the landfill would not be conducted under this baseline alternative.

6.2.4.2 Adequacy and Reliability of Controls

The existing remedial systems would not adequately and reliably control site risk. Potential risk from sediment and future risk from groundwater would not be addressed, since contaminated sediment would remain on-site, and potential for residential development would exist if WMPA were to sell any portion of the site to a private party.

Since this alternative represents a baseline no action scenario and since no engineering controls would be implemented under this alternative, there would be no long-term management, monitoring, or operation and maintenance issues. On-site treatment activities would include sedimentation Basins A and B. Residual sediments would settle in the basins. These treatment residuals would not be managed.

6.2.5 Reduction of Toxicity, Mobility, and Volume Through Treatment

This criterion considers: 1) the treatment process used and the material treated, 2) the amount of hazardous material destroyed or treated, 3) the reduction in toxicity, mobility, or volume through treatment, 4) the degree to which treatment is irreversible, 5) the type and quantity of treatment residuals, and 6) the reduction of inherent hazards. These factors are considered where appropriate.

6.2.5.1 Treatment Processes Used and Materials Treated

Sedimentation Basins A and B would remove residual sediment from the site. Storm water treatment would be accomplished through gravitational settling.

6.2.5.2 Amount of Hazardous Material Destroyed or Treated

Current sediment deposition has been estimated to be approximately 130 cubic yards per year, resulting in approximately 2,000 cubic yards of sediment accumulating in the basins since their construction. In Alternative 1, these sediments would be left in place and continue to accumulate.

6.2.5.3 Degree of Expected Reductions in Toxicity, Mobility, or Volume Through Treatment

Under Alternative 1, the toxicity, mobility, and volume of contaminants released by degradation of the site refuse would be reduced. The following is a description of how this reduction would be obtained.

Toxicity

Toxicity of sediment collected in the sedimentation basins would not be reduced. However, sediment contaminant concentrations have been historically low.

Mobility

The mobility of sediment contaminants would be minimized through settling in sedimentation Basins A and B.

Volume

The volume of sediment contaminants would not be reduced because they would remain on site in Alternative 1.

6.2.5.4 Degree to which Treatment is Irreversible

Treatment of sediment contaminants is not occurring on site. The sedimentation basins are designed to trap and contain sediment. In Alternative 1, the sediments would remain in place.

6.2.5.5 Type and Quantity of Residuals Remaining After Treatment

Leachate contaminants would be treated at the Sharon STP. The wastewater treatment process would convert organic contaminants into carbon dioxide, water, and biomass. The quantity of residuals remaining after treatment would be negligible since VOCs bould be easily digested by the treatment system process.

Residual contaminant concentrations would potentially be present in some sediment trapped by the basins. However, these concentrations have been historically low.

6.2.5.6 Reduction of Inherent Hazards

Alternativel would reduce the inherent hazards posed to surface water through sediment migration. Surface water would be protected through continued collection of sediment in the sedimentation basins.

6.2.6 Short-term Effectiveness

This criterion addresses the effects of Alternative 1 during the construction and implementation phase until remedial response objectives are met, with particular emphasis on protection of the community during remedial actions, protection of workers during remedial actions, environmental impacts occurring during construction, and estimate of the time required to achieve remedial response objectives.

Under Remedial Action Alternative 1, there would be no construction, and therefore, there would be no construction related effects or concerns.

6.2.7 Implementability

This criterion considers factors, where appropriate, such as technical feasibility, administrative feasibility, and the availability of services and materials. Alternative 1 considers the presence of existing remedial components, including the fence, Pennsylvania solid waste cap, groundwater dam, and surface water collection system, but does not include the construction of new remedial systems or operation and maintenance of existing remedial components. Therefore, the implementatibility analysis factors described above are not applicable.

6.2.8 Cost

This criterion addresses the cost of implementing the alternative. The cost includes both direct and indirect capital costs, annual operations and maintenance costs, and net present worth costs. Direct costs include expenditures for equipment, labor, and materials required to install the remedial systems. Indirect costs include expenditures for engineering and financial, and other services that are not part of the actual installation activities, but necessary for successful completion of the project. Operation and maintenance costs are post-construction costs necessary to ensure the continued effectiveness of the remedial systems. The present worth analysis includes the total project cost projected over 30 years assuming a five percent discount rate.

The capital costs for Remedial Action 1 would be $1,345,000. These costs include construction of the fence, PADER solid waste cap, surface water collection system, and the groundwater dam. There would be no operation and maintenance costs, since the remedial systems would not be maintained. The present worth for Alternative 1 would be $1,950,000. A summary of the Alternative 1 project costs is included as Table 6-4. The cost detail for Remedial Action Alternative 1 is presented in Appendix A.

6.3 REMEDIAL ACTION ALTERNATIVE 2
NO FURTHER ACTION

(Fence, PADER Solid Waste Cap, Groundwater Dam, Groundwater/Leachate Collection System, and Monitoring)

6.3.1 Remedial Components

Remedial Action Alternative 2 is the "No Further Action" alternative. It includes the remedial systems that make up Remedial Action Alternative 1, as well as the substantial active remedial systems that already have been implemented at the River Road Landfill as part of the upgrade and closure activities performed by WMPA. It is comprised of six Remedial Action Components, including Fencing, the PADER Solid Waste Cap, the Surface Water Collection System, and the Groundwater Dam, already described in Remedial Action Alternative 1, as well as the active Monitoring program and the Groundwater/Leachate Collection System. Each of the components is described below.

6.3.1.1 Fencing

The **Fence** is comprised of an 8-ft high chain-link fence. The fence surrounds the site on three sides, with access from the fourth side blocked by the Shenango River, as shown on Figure 2-3. The fence is maintained to control site access, thus limiting exposure to the site.

6.3.1.2 PADER Solid Waste Cap

In 1986 and 1987, the **PADER Solid Waste Cap** was constructed over the entire landfill in accordance with a PADER-approved work plan (Figure 2-3). Data obtained during the RI demonstrate that the cap was constructed in accordance with both the work plan and 25 PA Code, Section 75, as amended June 11, 1977 (the regulations under which the landfill was closed). The RI also confirmed that the landfill cap construction adequately promotes surface water runoff.

6.3.1.3 Surface Water Collection System

A **Surface Water Collection System** was integrated into the cap to promote surface water runoff and collect sediment. The cap was constructed with a gentle 1.5 percent slope on the top surface increasing to a six percent slope toward the sides of the landfill. The sides of the landfill are sloped between 12 and 20 percent. Terraces were constructed every 10 to 20 ft of elevation drop. The terraces are sloped into the landfill to collect and channel surface water to ditches located on the east and west sides of the landfill. Two sedimentation basins (Basin A and Basin B) were constructed at the southwestern and southeastern corners of the landfill, respectively, to receive surface water runoff from the ditches. Surface water runoff is discharged from the basins to the Shenango River.

Data gathered during the RI demonstrate the effectiveness of the surface water collection system. It shows that approximately 60 percent of rainfall is captured by the surface water collection system, versus the approximately 10 percent captured by the groundwater/leachate collection system. Therefore, the combination of the PADER solid waste cap and the surface water collection system is minimizing infiltration through the cap, and maximizing runoff from the landfill.

6.3.1.4 Groundwater Dam

The **Groundwater Dam** is located at the downgradient (southern) perimeter of the landfill. It was constructed in a trench (Figure 2-3). The bottom of the trench is typically 10 feet wide expanding to approximately 30 to 50 feet at the surface. The base of the dam is located at approximately 855 to 850 feet MSL (15 to 20 feet below the current ground surface). The top of the dam is located 0 to 5 feet below grade. A 10 feet wide zone within the trench was compacted in lifts. The remaining volume of the trench on both sides of the groundwater dam is backfilled with a mixture of excavated site material and material used for dam construction.

The dam is keyed into a foundation of natural fine-grained hard gray silt till over the western 75 percent of its length at a depth of 10 to 20 feet. In the eastern portion, the dam is keyed into a coarser grained till or sand material, and possibly shale bedrock further east.

The groundwater dam was constructed by WMPA to limit potential groundwater flow from the site to the Shenango River, and conversely, to limit flow from the Shenango River toward the groundwater/leachate collection system. The results from the RI indicate that the groundwater dam is effective, and meets both objectives.

6.3.1.5 Groundwater/Leachate Collection System

The **Groundwater/Leachate Collection System** (Figure 2-3) consists of a perforated pipeline in a gravel envelope, which was installed around the entire landfill, below the water table, in three phases. The initial phase, completed in 1980, was constructed parallel to the southern boundary of the fill area. The groundwater dam was constructed immediately downgradient of the collection system to prevent flow of uncontaminated groundwater to the system, by induced recharge from the Shenango River. The second and third phases were expansions of the original system. The second phase extended the system, surrounding the landfill on the eastern and northeastern sides. The third phase, which expanded the system surrounding the western and northwestern sides, was completed in 1986. Groundwater beneath the landfill, and leachate generated by the landfill, drain into this system and are discharged to the USVWPCA interceptor line.

The results of the RI show that the groundwater/leachate collection system is effectively collecting leachate percolating from the landfill and groundwater flowing beneath the landfill.

6.3.1.6 Monitoring

Since this is the "no further action" alternative, the monitoring for the alternative would be the monitoring which is currently conducted. The current **Monitoring** program is three-fold. It includes sampling and analysis of groundwater, leachate, and landfill gas.

WMPA currently monitors seven groundwater wells (MW101, MW102A, MW103A, MW104, MW104A, MW105, and MW106) quarterly for specific conductance, chemical oxygen demand (COD), pH, total dissolved solids (TDS), total organic carbon (TOC), total organic halides

(TOX), and 16 VOCs. Once annually, the list is expanded to include a variety of indicator parameters, including alkalinity, turbidity, inorganic cations and anions, and VOCs.

The current leachate sampling consists of quarterly monitoring at manhole MH-2, which is located adjacent to the discharge point to the USVWPCA interceptor line. The analytical parameters include a variety of indicator parameters, inorganic cations and anions, total organic carbon, total organic halogens, and PCBs. Additionally, each quarter, the total is recorded from the totalizer which records the flow volume of leachate discharged to the USVWPCA interceptor line.

Landfill gas is currently monitored quarterly at 13 bar-hole probe locations (B-1 through B-13) along the perimeter of the property, as well as in the on-site building and structures (S-1, S-2, and S-3) where the potential exists for accumulation of gas within a confined area. Monitoring includes measuring landfill gas as percent methane.

6.3.2 Overall Protection of Human Health and the Environment

This criterion addresses the adequacy with which Alternative 2 provides protection of human health and the environment by limiting exposure to contaminants. The adequacy of the alternative is evaluated by comparison to the results of the Baseline Risk Assessment and by assessing effectiveness in accomplishing remedial action objectives.

Alternative 2 would not provide adequate protection of human health or the environment under a potential future residential land use scenario. Calculations in the Baseline Risk Assessment indicate that unacceptable risk to human health may occur under a potential future residential land use scenario, through ingestion of groundwater containing leachate constituents if a drinking water well was constructed in an area with groundwater contamination. This risk would not be reduced by implementation of Alternative 2. The groundwater/leachate collection system would continue to operate. However, additional risk associated with contaminants already in groundwater would not be reduced, except through the natural processes of attenuation and dilution.

Alternative 2 would not provide adequate protection of human health under the future land use scenario of sediment ingestion by a wader in the sedimentation basins. In addition, the ecological assessment performed for the site indicates that unacceptable risk to ecological communities may potentially occur at isolated locations, due to sediment exposure. This risk would not be reduced under Alternative 2, except through natural processes.

Remedial action objectives are media-specific goals for protecting human health and the environment. Remedial action objectives were developed to address site contaminants and to address the identified potential site risks by preventing or minimizing exposure to contaminants potentially present in groundwater, leachate, and sediment. Compliance with remedial action objectives is discussed in the following paragraphs, on a media-specific basis.

6.3.2.1 Groundwater

Alternative 2 would meet the remedial action objectives developed to address site groundwater, which include preventing off-site migration and/or ingestion of groundwater containing leachate constituents at concentrations that represent an unacceptable health risk.

In Alternative 2, the operation of the groundwater/leachate collection system would be maintained. The current groundwater/leachate collection system has functioned to prevent the off-site migration of groundwater containing leachate constituents at concentrations that represent an unacceptable health risk. Therefore, it is reasonable to assume that an operational groundwater/ leachate collection system would continue to prevent off-site migration in the future. Additionally, under this alternative, monitoring would be performed to document groundwater quality changes which may lead to off-site migration of contaminants at concentrations that represent an unacceptable health risk. If such off-site migration did occur, dilution of contaminants upon discharge to the Shenango River would likely reduce contaminant concentrations to below concentrations that represent an unacceptable health risk.

Ingestion would only be a concern under a potential future residential land use scenario involving consumption of water from a water supply well contaminated by leachate constituents. There is little likelihood that this scenario would occur, since the affected area is located on landfill property within the 100-yr floodplain of the Shenango River. Future residential development would not be expected to occur in the floodplain, between the landfill and the river.

6.3.2.2 Leachate

The remedial action objective developed to address leachate at the site consists of minimizing the release of leachate constituents with the potential to cause unacceptable heath risk to groundwater. Alternative 2 addresses this objective, through on-going maintenance of the current cap, the groundwater/leachate collection system, and the surface water collection system.

6.3.2.3 Sediment

The remedial action objective developed to address potential risk associated with sediment includes preventing exposure to sediment impacted by arsenic, Aroclor 1248 and chromium. Alternative 2 would not meet this objective.

6.3.3 Compliance with ARARs

This criterion describes the chemical-specific, location-specific, and action-specific ARARs potentially applicable to Alternative 2. Potential ARARs are summarized in Tables 6-1 through 6-3.

6.3.3.1 Chemical-Specific ARARs

Potential chemical-specific ARARs relate to groundwater, surface water, and leachate disposal.

Groundwater - The *Pennsylvania Groundwater Quality Protection Strategy* is a consideration when evaluating site groundwater. This document is not an ARAR, but it states a Commonwealth goal of remediating groundwater to background standards. Although an active groundwater/leachate collection system is in place at the site, vinyl chloride was detected in one well, on one of two sampling events, at a concentration of 2 ug/L. This is the detection limit and also the MCL for vinyl chloride. Although it results in a health risk which exceeds the $1x10^{-6}$ carcinogenic point of departure, this concentration is not evidence of significant groundwater contamination. It is typical of residual contamination in the immediate vicinity of an active remedial system. Natural attenuation is preventing migration of the contaminants any significant distance from the groundwater/leachate collection system. The groundwater quality at the downgradient property boundary is equivalent to background quality. Therefore, it not necessary to focus remediation toward groundwater extraction or treatment.

The federal and state *Safe Drinking Water Acts* are not ARARs for this site, since site groundwater is not and likely will not be considered a drinking water supply.

Leachate - Leachate discharged from the groundwater/leachate collection system is subject to the maximum concentrations and loading rates specified in the current permit from the USVWPCA. Quarterly monitoring, as described in Section 6.3.1.5, would document that compliance with these permit conditions is being maintained.

Surface Water - Water quality standards specified in 25 PA Code, Section 93, the water quality criteria specified in 25 PA Code, Section 16, and state NPDES regulations are applicable to the surface water discharge from the on-site sedimentation basins. Section 93 presents specific water quality criteria and designated water use protection for each stream in Pennsylvania. Chapter 16 presents criteria for toxic substances which are to be used in developing effluent limits for NPDES permits. NPDES regulations establish permitting and discharge limits applicable for storm water discharges to a surface water body.

Surface water analyses collected during the RI indicate that water quality criteria may be exceeded in the discharge from the sedimentation basins. The on-site surface water sources include both runoff of surface water and discharge of groundwater. Runoff occurs from the 40 acre landfill as well as the surrounding acreage. Discharge from groundwater is exclusively natural groundwater from upgradient and side gradient to the landfill (since the groundwater/leachate collection system lowers the water table and collects the leachate within the boundaries of the landfill). Therefore, the surface water quality is not representative of leachate leaking from the landfill. The surface water quality in samples collected from the surface water system are consistent with water discharging from springs in the natural soil upgradient from the landfill. Therefore, it is likely that the exceedances of water quality criteria are natural for the area, and not related to the landfill.

6.3.3.2 Location-Specific ARARs

Remedial Action Alternative 2 is not subject to location-specific ARARs.

6.3.3.3 Action-Specific ARARs

Potential action-specific ARARs relate to landfill closure design standards, monitoring, and surface water discharge.

Design Standards - 25 PA Code, Section 75.24, dated May 24, 1977 was the applicable regulation under which landfill closure was conducted. These regulations address landfill cap design, surface water control, leachate management, and landfill gas. The landfill was closed in substantial compliance with these regulations, and in accordance with a Closure Plan, which was conditionally approved by PADER on March 31, 1987. A letter from WMPA, dated April 15, 1987 responded to the specific conditions of the PADER conditional approval letter.

Monitoring - Monitoring of the site is required by the site's *Post Closure Plan*. The site is in compliance with the current plan that requires monitoring of groundwater, leachate, and landfill gas.

Surface Water Discharge - *The Clean Streams Law* prohibits discharge to surface water in violation of applicable limits. Surface water analyses collected during the RI indicate that water quality criteria for may be exceeded in the discharge from the sedimentation basins. The on-site surface water sources include both runoff of surface water and discharge of groundwater. The surface water quality in samples collected from the surface water system are consistent with water discharging from springs in the natural soil upgradient from the landfill. Therefore, it is likely that the exceedances of water quality criteria are natural for the area, and not related to the landfill.

Based on the discussions above, Alternative 2 would comply with the chemical-, location-, and action-specific ARARs identified.

6.3.4 Long-Term Effectiveness and Permanence

This criterion describes factors including: 1) the magnitude of residual risk, 2) the remaining source of residual risk following implementation of the remedy, 3) the need for a five-year review, and 4) the adequacy and reliability of controls. This latter factor considers the long-term management of treatment residuals, long-term reliability of engineering and institutional controls, and the potential need for the replacement of the alternative. These four factors are discussed below.

6.3.4.1 Magnitude of Residual Risk

Residual risks from Alternative 2 are those calculated in the Baseline Risk Assessment, because the existing groundwater/leachate collection system would continue to operate and the existing remedial systems would be maintained. The Risk Assessment indicates that unacceptable risks to human health would result from the potential future land use scenarios of drinking contaminated groundwater and ingesting sediment while wading in the sedimentation basins. The Ecological Assessment indicates that unacceptable risk to ecological communities is limited to sediments found in sedimentation Basin B and its discharge channel.

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Remaining Sources of Residual Risk

Following implementation of Alternative 2, remaining sources of residual risk would be present from refuse, groundwater, and sediment. Leachate generation would be minimized through continued maintenance of the PADER solid waste cap and the surface water collection system.

The refuse present beneath the cap would represent the primary remaining source of residual risk. The refuse would continue to anaerobically degrade, releasing contaminants. Rainwater would continue to percolate through the landfill and continue to carry these contaminants to groundwater beneath the landfill, where they would be collected by the groundwater/leachate collection system.

Groundwater contamination has been effectively minimized through the installation, operation and maintenance of the groundwater/leachate collection system, the PADER solid waste cap, the groundwater dam, and proper grading and vegetation of the site. Due to the effectiveness of these remedial components, VOCs have been detected in only two site monitoring wells (MW113S and MW117S), located immediately adjacent to the groundwater/leachate collection system.

Residual concentrations of arsenic, Aroclor 1248, and chromium in sediment would not be reduced through implementation of this alternative.

Five Year Review

The accumulated database of groundwater and landfill gas monitoring would be evaluated after five years to assess the continued effectiveness of the existing remedial actions.

Groundwater monitoring results would be evaluated to assess groundwater quality down-gradient of the landfill. This program would evaluate the remedial action objectives of preventing off-site migration and/or ingestion of leachate constituents that represent an unacceptable health risk.

The landfill gas monitoring results would be reviewed for continued documentation that off-site migration or on-site buildup of landfill gas is not occurring.

6.3.4.2 Adequacy and Reliability of Controls

The existing remedial systems would not adequately and reliably control site risk. Potential risk from sediment and additional future risk from groundwater would not be addressed, since contaminated sediment would remain on-site, and potential for residential development would exist if WMPA were to sell any portion of the site to a private party.

Engineering controls, implemented under this alternative, would consist of long-term management, monitoring, operation and maintenance of the existing landfill components by WMPA, and system replacement. There are not expected to be any difficulties or uncertainties associated with operation and maintenance activities. Operation and maintenance would include: cap maintenance, vegetation maintenance, groundwater/leachate collection system maintenance, and continued off-site treatment of extracted groundwater/leachate. It is anticipated that the groundwater/leachate collection system transfer pumps would require replacement every five years.

On-site treatment activities include sedimentation Basins A and B. Residual sediments would settle in the basins and be removed as necessary. Site vegetative maintenance would minimize sediment production.

6.3.5 Reduction of Toxicity, Mobility, and Volume Through Treatment

This criterion considers: 1) the treatment process used and the material treated, 2) the amount of hazardous material destroyed or treated, 3) the reduction in toxicity, mobility, or volume through treatment, 4) the degree to which treatment is irreversible, 5) the type and quantity of treatment residuals, and 6) the reduction of inherent hazards. These factors are considered where appropriate.

6.3.5.1 Treatment Processes Used and Materials Treated

This alternative would include two treatment processes: off-site treatment of leachate contaminants at the Sharon Sewage Treatment Plant (Sharon STP), and on-site sediment removal.

The Sharon STP would utilize biological treatment for the digestion of organic material. The treatment plant consists of two treatment systems: sedimentation, which is used to remove suspended soils; and aerobic and anaerobic digestion, which breaks down organic matter into methane gas, carbon dioxide, and water. Effluent from the biological treatment system flows through a clarifier and is discharged to the Shenango River at a location downstream from the site. Solids are thickened, dewatered, and disposed of in a secure landfill.

Sedimentation Basins A and B would remove residual sediment from site storm water. Treatment would be accomplished through gravitational settling.

6.3.5.2 Amount of Hazardous Material Destroyed or Treated

The average monthly volume of groundwater/leachate collected and treated from the River Road Landfill site is 1.17 million gallons, based on records of liquid transfer to the sewer interceptor line. This volume varies considerably due to seasonal changes in soil moisture content and precipitation patterns. Collection volume typically peaks in the early spring, when saturated soils and heavy rains yield monthly flows as high as 1.8 million gallons. Minimum flow volume is typically experienced in the winter, when soils are dry or frozen, and precipitation is absorbed by surface soils or falls as snow. Flow through the system during this period can be as low as 0.7 million gallons per month.

Current sediment deposition has been estimated to be approximately 130 cubic yards per year, resulting in approximately 2,000 tons of sediment accumulating in the basins since their construction. The sediment would continue to accumulate in the basins in Alternative 2.

6.3.5.3 Degree of Expected Reductions in Toxicity, Mobility, or Volume Through Treatment

Under Alternative 2, the toxicity, mobility, and volume of contaminants would reduce those contaminants released by degradation of the site refuse and those identified in site sediment. The following is a description of how this reduction would be obtained.

Toxicity

The contaminants released by the landfill as leachate would be collected by the groundwater/ leachate collection system, and treated at the Sharon STP. Toxicity would be reduced to levels below the plant's NPDES effluent standards.

Toxicity of sediment collected in the sedimentation basins would not be reduced. However, sediment contaminant concentrations have been historically low.

Mobility

The mobility of leachate contaminants would be decreased, following a short term increase while being conveyed to the Sharon STP. However, this short term mobility would be contained and controlled within the USVWPCA interceptor line. Ultimately, contaminant mobility would be eliminated through biological digestion, or dewatering and placing contaminants in a secure landfill.

The mobility of sediment contaminants would be minimized through settling in sedimentation Basins A and B.

Volume

The volume of leachate contaminants would be reduced to a negligible amount. The Sharon STP would reduce the volume of contaminants through digestion to water, carbon dioxide, and biomass.

The volume of sediment contaminants would not be reduced in Alternative 2, and would continue to accumulate in Basins A and B.

6.3.5.4 Degree to which Treatment is Irreversible

Leachate collection and treatment would irreversibly reduce the toxicity of landfill leachate contaminants. The toxicity of the contaminants would be reduced by digesting organic contaminants and removing suspended solids. Treatment of organics would be irreversible due to the digestion of the treated organic compounds to form water, carbon dioxide, methane, and biomass. Suspended solids and biomass would be dewatered, and placed in a secure landfill.

Treatment of sediment contaminants would not occur on site. The sedimentation basins are designed to trap and contain sediment. In Alternative 2, the sediments would remain in place.

6.3.5.5 Type and Quantity of Residuals Remaining After Treatment

Leachate contaminants would be treated at the Sharon STP. The wastewater treatment process would convert organic contaminants into carbon dioxide, water, and biomass. The quantity of residuals remaining after treatment would be negligible since VOCs would be easily digested by the treatment system process.

Residual contaminant concentrations would likely be present in some sediment trapped by the basins. However, the concentrations of these sediments have been historically low.

6.3.5.6 Reduction of Inherent Hazards

Alternative 2 would reduce the inherent hazards posed to groundwater from leachate migration, and to surface water through sediment migration. The principle threat to groundwater is mitigated through continued collection and treatment of contaminated groundwater/leachate present beneath the landfill. Surface water would be protected through continued collection of sediment in the sedimentation basins.

6.3.6 Short Term Effectiveness

This criterion addresses the effects of Alternative 2 during the construction and implementation phase until remedial response objectives are met, with particular emphasis on protection of the community during remedial actions, protection of workers during remedial actions, environmental impacts occurring during construction, and estimate of the time required to achieve remedial response objectives.

Under Remedial Action Alternative 2, there would be no construction. Therefore, there would be no construction related effects or concerns.

6.3.7 Implementability

This criterion considers factors, where appropriate, such as technical feasibility, administrative feasibility, and availability of services and materials.

6.3.7.1 Technical Feasibility

Alternative 2 would be technically feasible. Continued operation and maintenance of the existing remedial components is a readily implementable, well developed, and reliable method of preventing off-site migration of contaminants. Monitoring of groundwater, leachate, and landfill gas is a reliable technology, and is a sufficient method to detect failures in the existing remedial systems. Alternative 2 does not address construction of new remedial components. Therefore, Implementability analysis factors relating to construction are not applicable.

6.3.7.2 Administrative Feasibility

Alternative 2 does not introduce additional remedial components. Therefore, this alternative would be administratively feasible.

6.3.7.3 Availability of Services and Materials

Materials, services, and equipment required to implement this alternative are readily available. Local contractors would be utilized to maintain the existing remedial components. Sampling and analytical services to perform monitoring would be available in house, and by a local laboratory, respectively.

6.3.8 Cost

This criterion addresses the cost of implementing the alternative. The cost includes both direct and indirect capital costs, annual operations and maintenance costs, and net present worth costs. Direct costs include expenditures for equipment, labor, and materials required to install the remedial systems. Indirect costs include expenditures for engineering, financial, and other services that are not part of the actual installation activities, but necessary for successful completion of the project. Operation and maintenance costs are post-construction costs necessary to ensure the continued effectiveness of the remedial systems. The present worth analysis looks at the total project cost projected over 30 years assuming a five percent discount rate.

The capital costs for Remedial Action 2 would be $1,814,000. These costs include construction of the Fence, PADER solid waste cap, surface water collection system, groundwater dam, groundwater/leachate collection system, and monitoring. Operation and maintenance costs would range from $122,000 to $229,000, and would include operation of the groundwater/ leachate collection system, monitoring, and maintenance of the remedial systems . The present worth for Alternative 2 would be $6,976,000. A summary of the Alternative 2 project costs is included as Table 6-4. The cost detail for Remedial Action Alternative 2 is presented in Appendix A.

6.4 REMEDIAL ACTION ALTERNATIVE 3

(Fence, PADER Solid Waste Cap, Groundwater Dam, Groundwater/Leachate Collection System, Monitoring, Institutional Controls, Off-Site Disposal of Sediment, and Habitat Enhancement)

6.4.1 Remedial Components

Remedial Action Alternative 3 augments the remedial systems already in place with three additional remedial action components, including Institutional Controls, Off-Site Disposal of Sediment, and Habitat Enhancement. In addition, an expanded monitoring program is proposed. Each of the components is described below.

6.4.1.1 Fencing

The Fence is comprised of an 8-ft high chain-link fence. The fence surrounds the site on three sides, with access from the fourth side blocked by the Shenango River, as shown on Figure 2-3. The fence is maintained to control site access, thus limiting exposure to the site.

6.4.1.2 PADER Solid Waste Cap

In 1986 and 1987, the **PADER Solid Waste Cap** was constructed over the entire landfill in accordance with a PADER-approved work plan (Figure 2-3). Data obtained during the RI demonstrate that the cap was constructed in accordance with both the work plan and 25 PA Code, Section 75, as amended June 11, 1977 (the regulations under which the landfill was closed). The RI also confirmed that the landfill cap construction adequately promotes surface water runoff.

6.4.1.3 Surface Water Collection System

A **Surface Water Collection System** was integrated into the cap to promote surface water runoff and collect sediment. The cap was constructed with a gentle 1.5 percent slope on the top surface increasing to a six percent slope toward the sides of the landfill. The sides of the landfill are sloped between 12 and 20 percent. Terraces were constructed every 10 to 20 ft of elevation drop. The terraces are sloped into the landfill to collect and channel surface water to ditches located on the east and west sides of the landfill. Two sedimentation basins (Basin A and Basin B) were constructed at the southwestern and southeastern corners of the landfill, respectively, to receive surface water runoff from the ditches. Surface water runoff is discharged from the basins to the Shenango River.

Data gathered during the RI demonstrate the effectiveness of the surface water collection system. It shows that approximately 60 percent of rainfall is captured by the surface water collection system, versus the approximately 10 percent captured by the groundwater/leachate collection system. Therefore, the combination of the PADER solid waste cap and the surface water collection system is minimizing infiltration through the cap, and maximizing runoff from the landfill.

6.4.1.4 Groundwater Dam

The **Groundwater Dam** is located at the downgradient (southern) perimeter of the landfill. It was constructed in a trench (Figure 2-3). The bottom of the trench is typically 10 feet wide expanding to approximately 30 to 50 feet at the surface. The base of the dam is located at approximately 855 to 850 feet MSL (15 to 20 feet below the current ground surface). The top of the dam is located 0 to 5 feet below grade. A 10 feet wide zone within the trench was compacted in lifts. The remaining volume of the trench on both sides of the groundwater dam is backfilled with a mixture of excavated site material and material used for dam construction.

The dam is keyed into a foundation of natural fine-grained hard gray silt till over the western 75 percent of its length at a depth of 10 to 20 feet. In the eastern portion, the dam is keyed into a coarser grained till or sand material, and possibly shale bedrock further east.

The groundwater dam was constructed by WMPA to limit potential groundwater flow from the site to the Shenango River, and conversely, to limit flow from the Shenango River toward the groundwater/leachate collection system. The results from the RI indicate that the groundwater dam is effective, and meets both objectives.

6.4.1.5 Groundwater/Leachate Collection System

The **Groundwater/Leachate Collection System** (Figure 2-3) consists of a perforated pipeline in a gravel envelope, which was installed around the entire landfill, below the water table, in three phases. The initial phase, completed in 1980, was constructed parallel to the southern boundary of the fill area. The groundwater dam was constructed immediately downgradient of the collection system to prevent flow of uncontaminated groundwater to the system, by induced recharge from the Shenango River. The second and third phases were expansions of the original system. The second phase extended the system, surrounding the landfill on the eastern and northeastern sides. The third phase, which expanded the system surrounding the western and northwestern sides, was completed in 1986. Groundwater beneath the landfill, and leachate generated by the landfill, drain into this system and are discharged to the USVWPCA interceptor line.

The results of the RI show that the groundwater/leachate collection system is effectively collecting leachate percolating from the landfill and groundwater flowing beneath the landfill.

6.4.1.6 Monitoring

Annual site inspections would be conducted to evaluate the condition of the landfill cover and sedimentation basins. A site walkover would be conducted during each inspection to look for any differential settlement or excessive erosion. Four media would be monitored as part of Alternative 3: groundwater, leachate, landfill gas, and sediment. A detailed monitoring plan would be developed during the remedial design stage. However, for cost estimating purposes in the FS, it is assumed that monitoring would include the following.

Groundwater Monitoring

The groundwater quality would be monitored at ten locations surrounding the landfill, including

three upgradient monitoring wells and seven downgradient monitoring wells.

Monitoring Well	Location	Geologic Unit Screened
MW110S	Upgradient	Alluvium
MW110D	Upgradient	Till
MW110B	Upgradient	Bedrock
MW104A	Downgradient	Alluvium
MW112S	Downgradient	Alluvium
MW113S	Downgradient	Alluvium
MW116S	Downgradient	Alluvium
MW117S	Downgradient	Alluvium
MW119D	Downgradient	Till
MW120B	Downgradient	Bedrock

Each well would be monitored quarterly for:

- Volatile Organic Compounds
- Metals: aluminum, iron, manganese
- TDS, TOC, TOX, COD
- pH, Specific Conductance, Turbidity
- Static Water Level

Once annually, the parameter list for the ten monitoring wells would be expanded to include:

- Alkalinity, ammonia, chloride, nitrates, sodium, sulfate
- Metals: arsenic, barium, cadmium, chromium, copper, iron, lead, mercury, selenium, silver, and zinc
- Total depth of each monitoring well

Once annually, the following parameters would be included in the analytical list for the five downgradient wells screened in the alluvium:

- Semi-volatile organic compounds.

Leachate Monitoring

Each quarter, a sample would be collected from MH-2, located adjacent to the discharge point to the USVWPCA interceptor line. The sample would be analyzed for VOCs, semi-volatile compounds, PCBs, aluminum, arsenic, chromium, and manganese. Each quarter, the totalizer volume would be recorded to indicate total flow volume of leachate discharged to the USVWPCA interceptor line.

Landfill Gas Monitoring

Landfill gas would be monitored quarterly at 13 bar-hole probe locations (B-1 through B-13) along the perimeter of the property and inside the on-site building structures (S-1, S-2, and S-3). The air at these locations would be analyzed for landfill gas as percent methane.

Sediment Monitoring
Once annually, two samples of sediment would be collected from the bottom of each sedimentation basin (A and B), and analyzed for arsenic, PCBs, and chromium. In each basin, one sample would be collected from the near the inflow area and the second sample would be collected from near the outflow area. The sampling results would be evaluated during the five-year review. Sampling might be discontinued, or the sampling interval could be modified, depending upon the results.

6.4.1.7 Institutional Controls

Institutional Controls would include both zoning and deed restrictions. Zoning restrictions would be implemented by the local zoning commission to prevent future zoning changes that would allow for residential development or other types of development that would be inappropriate for a former landfill. Deed restrictions would include preventing: residential construction on the site, on-site installation of extraction wells for potable water use, and construction of buildings on the filled area. It would be important that the institutional controls be designed to allow for beneficial use of the property, assuming that the beneficial use would not pose a risk to human health or potential ecological receptors. Beneficial use proposals would need to be approved by the appropriate regulatory agency.

6.4.1.8 Off-site Disposal of Sediment

Off-site Disposal of Sediment would include the excavation and off-site disposal of sediment contaminated with arsenic, Aroclor 1248, and chromium. Arsenic has been detected in Basins A and B, Aroclor 1248 has been detected in samples from Basin B, and chromium has been detected in the discharge channel from Basin B (Figure 2-3). Remediation of these areas would include removing a total of approximately 2,000 cubic yards of sediment from sedimentation Basins A and B, and approximately 6 cubic yards from the sedimentation Basin B discharge channel. Excavated material would be tested and then disposed at an off-site secure landfill.

6.4.1.9 Habitat Enhancement

Habitat Enhancement would be a proactive remedial action component, that would allow a Superfund site to be put to beneficial use. WMPA's plans would include both habitat and structural upgrade of the site to provide food and cover resources for birds and small animals. The community would then have access to limited portions of the facility to observe the wildlife attracted by the facility upgrades.

Habitat upgrades would be recommended by a consultant experienced in the creation and preservation of wildlife habitats. It would include specific seed mixtures of grasses, legumes, and windflowers that would both stabilize the cap and provide food and cover resources for birds and small mammals. Structural enhancement techniques would likely include installing nest boxes and perch poles. Community access would be provided through appropriate parking, recreational facilities, trails, and observation areas.

Under Remedial Action Alternative 3, implementation of institutional controls, sediment removal and disposal, and habitat enhancement, in addition to the already substantial existing remedial actions, would provide a safe, beneficial use for the landfill site that would be free of current and future risk to human health and ecological receptors. A detailed analysis of Alternative 3 is presented below.

6.4.2 Overall Protection of Human Health and the Environment

This criterion addresses the adequacy of Alternative 3 in providing protection of human health and the environment by limiting exposure to contaminants. The adequacy of the alternative is evaluated by comparison to the results of the Baseline Risk Assessment and by assessing effectiveness in accomplishing remedial action objectives.

Alternative 3 would provide adequate protection of human health and the environment. Calculations in the Baseline Risk Assessment indicate that unacceptable risk to human health would occur under a potential future residential land use scenario, through ingestion of contaminated groundwater and in the future land use scenario by ingestion of sediment while wading in a sedimentation basin. The risk from drinking contaminated groundwater would be mitigated through the establishment of institutional controls, which prohibit residential development and prevent the installation of drinking water wells. The risk from sediment ingestion would be mitigated by the removal of sediment from the sedimentation basins.

The ecological risk assessment indicates that unacceptable risks to ecological communities may potentially occur at isolated locations from exposure to sediment. This potential risk would be eliminated under Alternative 3 by the removal of impacted sediment.

Remedial action objectives are media-specific goals for protecting human health and the environment. Remedial action objectives were developed to address site contaminants and to address the identified potential site risks by preventing or minimizing exposure to contaminants potentially present in groundwater, leachate, and sediment. Compliance with remedial action objectives is discussed in the following paragraphs, on a media-specific basis.

6.4.2.1 Groundwater

The remedial action objectives developed to address site groundwater include preventing off-site migration and/or ingestion of groundwater containing leachate constituents that present an unacceptable health risk. Alternative 3 would meet these remedial action objectives.

Under the already implemented remedial components of Alternative 3, the operation of the groundwater/leachate collection system would be maintained. The current groundwater/ leachate collection system has functioned to prevent the off-site migration of groundwater containing leachate constituents. Therefore, it is reasonable to assume that an operational groundwater/leachate collection system would continue to prevent off-site migration in the future. Additionally, under this alternative, monitoring would be performed to document groundwater quality changes which may lead to off-site migration of contaminants at concentrations that represent an unacceptable health risk. If such off-site migration did occur, concentrations would likely be reduced to levels below those representing an unacceptable health risk upon discharge to the Shenango River.

Ingestion would only be a concern under a potential future residential land use scenario involving the consumption of water from a contaminated water supply well. Alternative 3 would prevent ingestion of contaminated groundwater through the establishment of institutional controls. Institutional controls would prevent residential development of the site, and prevent installation of water supply wells.

6.4.2.2 Leachate

The remedial action objective for leachate at the site consists of minimizing the release of leachate constituents with the potential to cause unacceptable health risk to groundwater. Alternative 3 would address this objective, through maintenance of the current cap, the groundwater/leachate collection system, and the surface water collection system.

6.4.2.3 Sediment

The remedial action objective developed to address potential risk associated with sediment includes preventing exposure to sediment impacted by arsenic, Aroclor 1248, and chromium. Alternative 3 would meet this objective through the excavation and off-site disposal of the impacted sediment.

6.4.3 Compliance with ARARs

This criterion describes the chemical-specific, location-specific, and action-specific ARARs potentially applicable to Alternative 3. Potential ARARs are summarized in Tables 6-1 through 6-3.

6.4.3.1 Chemical-Specific ARARs

Potential chemical-specific ARARs relate to groundwater, surface water, and leachate disposal.

Groundwater - The *Pennsylvania Groundwater Quality Protection Strategy* is a consideration when evaluating site groundwater. This document is not an ARAR, but it states a Commonwealth goal of remediating groundwater to background standards. Although an active groundwater/leachate collection system is in place at the site, vinyl chloride was detected in one well, on one of two sampling events at a concentration at the of 2 ug/L. This is the detection limit and also the MCL for vinyl chloride. Although it results in a health risk which exceeds the $1x10^{-6}$ carcinogenic point of departure, this concentration is not evidence of significant groundwater contamination. It is typical of residual contamination in the immediate vicinity of an active remedial system. Natural attenuation is preventing migration of the contaminants any significant distance from the groundwater/leachate collection system. The groundwater quality at the downgradient property boundary is equivalent to background quality. Therefore, it not necessary to focus remediation toward groundwater extraction or treatment.

The federal and state *Safe Drinking Water Acts* are not ARARs for this site, since site groundwater is not and likely will not be considered a drinking water supply.

Leachate - Leachate discharged from the groundwater/leachate collection system is subject to the maximum concentrations and loading rates specified in the current permit from the USVWPCA. Quarterly monitoring, as described in Section 6.4.1.5 would document that compliance with these permit conditions is being maintained.

Surface Water - Water quality standards specified in 25 PA Code, Section 93, the water quality criteria specified in 25 PA Code, Section 16, and state NPDES regulations are applicable to the surface water discharge from the on-site sedimentation basins. Section 93 presents specific water quality criteria and designated water use protection for each stream in Pennsylvania. Section 16 presents criteria for toxic substances which are to be used in developing effluent limits for NPDES permits. NPDES regulations establish permitting and discharge limits applicable for stormwater discharges to a surface water body.

Surface water analyses collected during the RI indicate that water quality criteria may be exceeded in the discharge from the sedimentation basins. The on-site surface water sources include both runoff of surface water and discharge of groundwater. Runoff occurs from the 40 acre landfill as well as the surrounding acreage. Discharge from groundwater is exclusively natural groundwater from upgradient and side gradient to the landfill (since the groundwater/ leachate collection system lowers the water table and collects the leachate within the boundaries of the landfill). Therefore, the surface water quality is not representative of leachate leaking from the landfill. The surface water quality in samples collected from the surface water system are consistent with water discharging from springs in the natural soil upgradient from the landfill. Therefore, it is likely that the exceedances of water quality criteria are natural for the area, and not related to the landfill.

6.4.3.2 Location-Specific ARARs

Potential location-specific ARARs relate to construction activities involving the excavation of sediments in potential wetlands, within the 100 year floodplain, and in habitats of endangered species. Prior to the removal of sediment, a joint permit from PADER and the U.S. Army Corps of Engineers (Joint Application for U.S. Army Corps of Engineers Section 404 Permit and Pennsylvania Water Obstruction and Encroachment Permit) would be required. This joint permit requires information concerning the dredging operation, disturbance of aquatic habitat, wetlands destruction, disturbance of endangered species, changes to flow rates to the river, and erosion and sedimentation control. Removal of sediment would have to be conducted in accordance with the permit requirements.

6.4.3.3 Action-Specific ARARs

Potential action-specific ARARs relate to landfill closure design standards, monitoring, surface water discharge, erosion and sedimentation control, and OSHA construction requirements.

Design Standards - 25 PA Code, Section 75.24, dated May 24, 1977 was the applicable regulation under which landfill closure was conducted. These regulations address landfill cap design, surface water control, leachate management, and landfill gas. The landfill was closed in substantial compliance with these regulations, and in accordance with a Closure Plan, which was conditionally approved by PADER on March 31, 1987. A letter from WMPA, dated April

15, 1987 responded to the specific conditions of the PADER conditional approval letter.

Monitoring - Monitoring of the site is required by the site's *Post Closure Plan*. The current plan requires monitoring of groundwater, leachate, and landfill gas. The site is in compliance with the plan.

Surface Water Discharge - The *Clean Streams Law* prohibits contaminant discharge to surface water in violation of applicable limits. Surface water analyses collected during the RI indicate that water quality criteria may be exceeded in the discharge from the sedimentation basins. The on-site surface water sources include both runoff of surface water and discharge of groundwater. The surface water quality in samples collected from the surface water system are consistent with water discharging from springs in the natural soil upgradient from the landfill. Therefore, it is likely that the exceedances of water quality criteria are natural for the area, and not related to the landfill.

Erosion Control - An Erosion and Sedimentation Control Plan is required for the excavation and removal of sediment from the surface water collection system (25 PA Code, Section 102.4). Excavation activities would have to be conducted in compliance with this requirement.

OSHA - The *OSHA Occupational Safety and Health Standards* (29 CFR 1910) and the *Health and Safety Standards for Construction* (29 CFR 1926) are relevant and appropriate to the construction activities proposed under Alternative 3. Threshold limit values would be monitored in the breathing zone during construction and monitoring activities.

Based on the discussions above, Alternative 3 would comply with the chemical-, location- and action-specific ARARs identified.

6.4.4 Long-Term Effectiveness and Permanence

This criterion describes factors including: 1) the magnitude of residual risk, 2) the remaining source of residual risk following implementation of the remedy, 3) the need for a five-year review, and 4) the adequacy and reliability of controls. This latter factor considers the long-term management of treatment residuals, long-term reliability of engineering and institutional controls, and the potential need for the replacement of the alternative. These four factors are discussed below.

6.4.4.1 Magnitude of Residual Risk

Alternative 3 would eliminate risk to human health and the environment discussed in the Baseline Risk Assessment and the Ecological Assessment, through implementation of institutional controls, and sediment removal. The Risk Assessment indicates that unacceptable risks to human health would result from the potential future land use scenarios of drinking contaminated groundwater and ingesting sediment while wading in the sedimentation basins. The Ecological Assessment indicates that unacceptable risk to ecological communities is limited to sediment found in sedimentation Basin B and its discharge channel. The potential future risk from groundwater would be mitigated through establishment of institutional controls which prohibit residential development and the installation of drinking water wells. The potential ecological risk from sediment would be mitigated through excavation and off-site disposal of the contaminated sediment.

Remaining Sources of Residual Risk

Following implementation of Alternative 3, the remaining sources of residual risk would be present from refuse and groundwater. Leachate generation would be minimized through continued maintenance of the PADER solid waste cap and the surface water collection system. Contaminated sediment would be removed from the site.

The refuse present beneath the cap would represent the primary remaining source of residual risk. The refuse would continue to anaerobically degrade, releasing contaminants. Rainwater woud continue to percolate through the landfill and continue to carry these contaminants to groundwater beneath the landfill, where they would be collected by the groundwater/leachate collection system.

Groundwater contamination has been effectively minimized through the installation, operation and maintenance of the groundwater/leachate collection system, the PADER solid waste cap, the groundwater dam, and proper grading and vegetation of the site. Due to the effectiveness of these remedial components, VOCs have been detected in only two of the site monitoring wells (MW113S and MW117S), are located immediately adjacent to the groundwater/leachate collection system.

Five Year Review

The accumulated database from groundwater monitoring and landfill gas monitoring would be evaluated after five years to assess the continued effectiveness of the existing remedial systems.

Groundwater monitoring results would be evaluated to assess groundwater quality downgradient of the landfill. This program would evaluate the remedial action objectives of preventing off-site migration and/or ingestion of leachate constituents that represent an unacceptable health risk.

The landfill gas monitoring results would be reviewed for continued documentation that off-site migration or on-site build-up of landfill gas is not occurring.

6.4.4.2 Adequacy and Reliability of Controls

The existing and proposed remedial systems would adequately and reliably control site risk. Potential risk from sediment and potential additional future risk from groundwater would be addressed by sediment removal and institutional controls, respectively.

Engineering controls, implemented under this alternative, would consist of long-term management, monitoring, operation and maintenance of the existing landfill components by WMPA, and system replacement. There are not expected to be any difficulties or uncertainties associated with operation and maintenance activities. Operation and maintenance would include: cap maintenance, vegetation maintenance, groundwater/leachate collection system maintenance, and continued off-site treatment of extracted groundwater/leachate. It is anticipated that the groundwater/leachate collection system transfer pumps would require replacement every five years.

Alternative 3 contains on-site treatment activities in sedimentation Basins A and B. Residual sediments would settle in the basins and be removed as necessary. Site vegetative maintenance would minimize sediment production.

6.4.5 Reduction of Toxicity, Mobility, and Volume Through Treatment

This criterion considers: 1) the treatment process used and the material treated, 2) the amount of hazardous material destroyed or treated, 3) the reduction in toxicity, mobility, or volume through treatment, 4) the degree to which treatment is irreversible, 5) the type and quantity of treatment residuals, and 6) the reduction of inherent hazards. These factors are considered where appropriate.

6.4.5.1 Treatment Processes Used and Materials Treated

This alternative would include two treatment processes: off-site treatment of leachate contaminants at the Sharon Sewage Treatment Plant (Sharon STP), and collection and off-site disposal of contaminated sediment.

The Sharon STP would utilize biological treatment for the digestion of organic material. The treatment plant would consist of two treatment systems: sedimentation, which would be used to remove suspended soils; and aerobic and anaerobic digestion, to breaks down organic matter into methane gas, carbon dioxide, and water. Effluent from the biological treatment system would flow through a clarifier and would be discharged to the Shenango River downstream from the site. Solids would be thickened, dewatered, and disposed of in a secure landfill.

Sedimentation Basins A and B would remove residual sediment from site stormwater. Treatment would be accomplished through gravitational settling and off-site disposal in a secure landfill.

6.4.5.2 Amount of Hazardous Material Destroyed or Treated

Leachate and sediment contaminants would be destroyed or treated in Alternative 3.

The average monthly volume of groundwater/leachate collected and treated from the River Road Landfill site is 1.17 million gallons per month based on records of liquid transfer to the sewer interceptor line. This volume varies considerably due to seasonal changes in soil moisture content and precipitation patterns. Collection volume typically peaks in the early spring, when saturated soils and heavy rains yield monthly flows as high as 1.8 million gallons. Minimum flow volume is typically experienced in the winter, when soils are dry or frozen, and precipitation is absorbed by surface soils or falls as snow. Flow through the system during this period can be as low as 0.7 million gallons.

Current sediment deposition has been estimated to be approximately 130 cubic yards per year, resulting in approximately 2,000 cubic yards of sediment accumulating in the basins since their construction.

6.4.5.3 Degree of Expected Reductions in Toxicity, Mobility, or Volume Through Treatment

Under Alternative 3, the toxicity, mobility, and volume of contaminants released by degradation of the site refuse and those identified in site sediment would be reduced. The following is a description of how these reductions would be obtained.

Toxicity

The toxicity of contaminated leachate and sediment would be reduced through off-site treatment and landfilling.

The contaminants released by the landfill as leachate would be collected by the groundwater/leachate collection system, and treated at the Sharon STP. A direct reduction of leachate toxicity would occur by treatment at the Sharon STP. Toxicity would be reduced to levels at or below the plant's NPDES effluent standards.

The toxicity of site sediments containing arsenic, Aroclor 1248, and chromium would be controlled through excavation, and off-site disposal in a secure landfill.

Mobility

The mobility of contaminated leachate and sediment would be reduced through off-site treatment and settling.

The mobility of leachate contaminants would decrease, following a short term increase while being conveyed to the Sharon STP. However, this short term mobility would be contained and controlled within the USVWPCA interceptor line. Ultimately, contaminant mobility would be eliminated through biological digestion, or dewatering and by placement of contaminants in a secure landfill.

The mobility of sediment contaminants would be minimized through settling in sedimentation Basins A and B, and placement of this material in a secure landfill.

Volume

The volume of contaminants present at the site would be reduced through off-site treatment of leachate, and off-site disposal of sediment.

The volume of leachate contaminants would be reduced to a negligible amount. The Sharon STP would reduce the volume of contaminants through digestion to water, carbon dioxide, and biomass.

The on-site volume of contaminated sediment would be eliminated through excavation and off-site disposal in a secure landfill.

6.4.5.4 Degree to which Treatment is Irreversible

Leachate collection and treatment would irreversibly reduce the toxicity of landfill leachate contaminants. The toxicity of the contaminants would be reduced by digesting organic contaminants and removing suspended solids. Treatment of organics would be irreversible due to the digestion of the treated organic compounds to form water, carbon dioxide, methane, and biomass. Suspended solids and biomass would be dewatered, and placed in a secure landfill.

Sediment would be collected in the sedimentation basins by gravitational settling and transported off-site to be placed in a secure landfill.

6.4.5.5 Type and Quantity of Residuals Remaining After Treatment

For Alternative 3, treatment would be limited to leachate and sediment contaminants.

The Sharon STP would convert organic contaminants into carbon dioxide, water, and biomass. The quantity of residuals remaining after treatment would be negligible since VOCs would be easily digested by the treatment system process.

Residual contaminant concentrations would likely be present in some sediment trapped by the basins. However, the contamiant concentrations of these sediments have historically been low.

6.4.5.6 Reduction of Inherent Hazards

Alternative 3 would reduce the inherent hazards posed to groundwater through leachate migration, and to surface water through sediment migration. The principle threat to groundwater would be mitigated through continued collection and treatment of contaminated groundwater/leachate present beneath the landfill. The potential risk from sediment would be removed from the site through excavation, and off-site disposal.

6.4.6 Short Term Effectiveness

This criterion addresses the effects of the alternative during the construction and implementation phase until remedial response objectives are met, with particular emphasis on protection of the community during remedial actions, protection of workers during remedial actions, environmental impacts occurring during construction, and estimate of the time required to achieve remedial response objectives. These factors are discussed below.

6.4.6.1 Risks to Community During Remedial Actions

Implementation of Alternative 3 would pose minimal risk to the community. Sediment removal would be limited to approximately 2,000 cubic yards, and habitat enhancement would require minimal construction activities. Therefore, the on-site activities would not generate significant dust, runoff, or contaminant migration that could potentially impact the local community. Transportation of sediments and construction supplies would create minimal additional truck traffic, and therefore would not create a significant traffic hazard.

6.4.6.2 Risk to Workers During Remedial Action

Risk to workers would include chemical exposure and heavy equipment operation during construction activities, and chemical exposure during continued monitoring of groundwater, leachate, and landfill gas.

Off-site disposal of sediment, and habitat enhancement might expose remediation workers to chemicals through direct contact, ingestion, or inhalation. Workers would also incur risk of injury or death while performing construction activities and to operating heavy equipment. These risks could be minimized by use of dust control measures, personal protective equipment, and safety procedures.

Workers performing sampling activities as part of the monitoring program would incur potential risk through exposure to chemicals in groundwater, leachate, sediment, and landfill gas. These risks could be minimized by use of personal protective equipment, and safety procedures.

6.4.6.3 Environmental Impacts

Environmental impacts resulting from Alternative 3 remedial action would not be anticipated except for sediment removal activities. Sediment removal would disturb the habitat of aquatic and vegetative species living in sedimentation Basins A and B and the discharge channel from Basin B. Following removal of the sediment, these areas would be replanted to restore the area to its present condition.

6.4.6.4 Time Until Remedial Action Objectives are Achieved

Remedial action objectives associated with sediment are addressed by construction activities included in this alternative. Construction related activities associated with groundwater, leachate, and landfill gas are not addressed, and are therefore not discussed below.

The time frame for completion of the sediment removal response action would be approximately six months. This time frame would include excavation, loading, off-site disposal, sampling and analysis of sediment removal areas and characterization of excavated sediment.

6.4.7 Implementability

This criterion considers factors, where appropriate, such as technical feasibility, administrative feasibility, and availability of services and materials.

6.4.7.1 Technical Feasibility

Alternative 3 would be technically feasible. Removal of contaminated sediment, and continued operation and maintenance of the existing remedial components would be readily implementable, well developed, and reliable methods of preventing on-site exposure to and off-site migration of contaminants. These actions would not inhibit further remedial actions, if they should become required or appropriate. Monitoring of groundwater, leachate, and landfill gas would be a reliable technology, and is a sufficient method to document the success of the remedial systems.

6.4.7.2 Administrative Feasibility

Alternative 3 would be administratively feasible. Zoning restrictions would require the assistance of City of Hermitage and South Pymatuning Township zoning board officials. Restrictions would be added to the property deed by counsel. A PADER Form U approval might be required for off-site disposal of sediment. Habitat enhancement activities may require construction permits.

6.4.7.3 Availability of Services of Materials

Materials, services, and equipment required to implement this alternative would be readily available. Local contractors would be utilized to remove contaminated sediment, construct habitat enhancements, and maintain the existing remedial components. Sampling and analytical services to perform monitoring would be available in house, and by a local laboratory, respectively.

6.4.8 Cost

This criterion address the cost of implementing the alternative. The cost includes both direct and indirect capital costs, annual operations and maintenance costs, and net present worth costs. Direct costs include expenditures for equipment, labor, and materials required to install the remedial systems. Indirect costs include expenditures for engineering and financial, and other services that are not part of the actual installation activities, but necessary for successful completion of the project. Operation and maintenance costs are post-construction costs necessary to ensure the continued effectiveness of the remedial systems. The present worth analysis is a calculation of the total project cost projected over 30 years assuming a five percent discount rate.

The capital costs for Remedial Action 3 would be $2,061,000. These costs include construction of the Fence, PADER solid waste cap, surface water collection system, groundwater dam, groundwater/leachate collection system, institutional controls, off-site disposal of sediment, and habitat enhancement. Operation and maintenance costs would range from $169,000 to $298,000, and would include operation of the groundwater/leachate collection system, monitoring, and maintenance of the remedial systems. The present worth for Alternative 3 would be $8,430,000. A summary of the Alternative 3 project costs is included as Table 6-4. The cost detail for Remedial Action Alternative 3 is presented in Appendix A.

6.5 REMEDIAL ACTION ALTERNATIVE 4

(Fence, PADER Solid Waste Cap, Groundwater Dam,
Groundwater/Leachate Collection System, Monitoring,
Institutional Controls, Off-Site Disposal of Sediment,
Groundwater/Leachate System Enhancement,
and Habitat Enhancement)

6.5.1 Remedial Components

Remedial Action Alternative 4 adds a Groundwater/Leachate System Enhancement component to the Institutional Controls, Off-site Disposal of Sediment, Habitat Enhancement and existing remedial systems described in Remedial Action Alternative 3. Each of the components is described below.

6.5.1.1 Fencing

The **Fence** is comprised of an 8-ft high chain-link fence. The fence surrounds the site on three sides, with access from the fourth side blocked by the Shenango River, as shown on Figure 2-3. The fence is maintained to control site access, thus limiting exposure to the site.

6.5.1.2 PADER Solid Waste Cap

In 1986 and 1987, the **PADER Solid Waste Cap** was constructed over the entire landfill in accordance with a PADER-approved work plan (Figure 2-3). Data obtained during the RI demonstrate that the cap was constructed in accordance with both the work plan and 25 PA Code, Section 75, as amended June 11, 1977 (the regulations under which the landfill was closed). The RI also confirmed that the landfill cap construction adequately promotes surface water runoff.

6.5.1.3 Surface Water Collection System

A **Surface Water Collection System** was integrated into the cap to promote surface water runoff and collect sediment. The cap was constructed with a gentle 1.5 percent slope on the top surface increasing to a six percent slope toward the sides of the landfill. The sides of the landfill are sloped between 12 and 20 percent. Terraces were constructed every 10 to 20 ft of elevation drop. The terraces are sloped into the landfill to collect and channel surface water to ditches located on the east and west sides of the landfill. Two sedimentation basins (Basin A and Basin B) were constructed at the southwestern and southeastern corners of the landfill, respectively, to receive surface water runoff from the ditches. Surface water runoff is discharged from the basins to the Shenango River.

Data gathered during the RI demonstrate the effectiveness of the surface water collection system. It shows that approximately 60 percent of rainfall is captured by the surface water collection system, versus the approximately 10 percent captured by the groundwater/leachate collection system. Therefore, the combination of the PADER solid waste cap and the surface water collection system is minimizing infiltration through the cap, and maximizing runoff from the landfill.

6.5.1.4 Groundwater Dam

The **Groundwater Dam** is located at the downgradient (southern) perimeter of the landfill. It was constructed in a trench (Figure 2-3). The bottom of the trench is typically 10 feet wide expanding to approximately 30 to 50 feet at the surface. The base of the dam is located at approximately 855 to 850 feet MSL (15 to 20 feet below the current ground surface). The top of the dam is located 0 to 5 feet below grade. A 10 feet wide zone within the trench was compacted in lifts. The remaining volume of the trench on both sides of the groundwater dam is backfilled with a mixture of excavated site material and material used for dam construction.

The dam is keyed into a foundation of natural fine-grained hard gray silt till over the western 75 percent of its length at a depth of 10 to 20 feet. In the eastern portion, the dam is keyed into a coarser grained till or sand material, and possibly shale bedrock further east.

The groundwater dam was constructed by WMPA to limit potential groundwater flow from the site to the Shenango River, and conversely, to limit flow from the Shenango River toward the groundwater/leachate collection system. The results from the RI indicate that the groundwater dam is effective, and meets both objectives.

6.5.1.5 Groundwater/Leachate Collection System

The **Groundwater/Leachate Collection System** (Figure 2-3) consists of a perforated pipeline in a gravel envelope, which was installed around the entire landfill, below the water table, in three phases. The initial phase, completed in 1980, was constructed parallel to the southern boundary of the fill area. The groundwater dam was constructed immediately downgradient of the collection system to prevent flow of uncontaminated groundwater to the system, by induced recharge from the Shenango River. The second and third phases were expansions of the original system. The second phase extended the system, surrounding the landfill on the eastern and northeastern sides. The third phase, which expanded the system surrounding the western and northwestern sides, was completed in 1986. Groundwater beneath the landfill, and leachate generated by the landfill, drain into this system and are discharged to the USVWPCA interceptor line.

The results of the RI show that the groundwater/leachate collection system is effectively collecting leachate percolating from the landfill and groundwater flowing beneath the landfill.

6.5.1.6 Monitoring

Annual site inspections would be conducted to evaluate the condition of the landfill cover and sedimentation basins. A site walkover would be conducted during each inspection to look for any differential settlement or excessive erosion. Four media would be monitored as part of Alternative 3: groundwater, leachate, landfill gas, and sediment. A detailed monitoring plan would be developed during the remedial design stage. However, for cost estimating purposes in the FS, it is assumed that monitoring would include the following.

Groundwater Monitoring

The groundwater quality would be monitored at ten locations surrounding the landfill, including

three upgradient monitoring wells and seven downgradient monitoring wells.

Monitoring Well	Location	Geologic Unit Screened
MW110S	Upgradient	Alluvium
MW110D	Upgradient	Till
MW110B	Upgradient	Bedrock
MW104A	Downgradient	Alluvium
MW112S	Downgradient	Alluvium
MW113S	Downgradient	Alluvium
MW116S	Downgradient	Alluvium
MW117S	Downgradient	Alluvium
MW119D	Downgradient	Till
MW120B	Downgradient	Bedrock

Each well would be monitored quarterly for:

- Volatile Organic Compounds
- Metals: aluminum, iron, manganese
- TDS, TOC, TOX, COD
- pH, Specific Conductance, Turbidity
- Static Water Level

Once annually, the parameter list for the ten monitoring wells would be expanded to include:

- Alkalinity, ammonia, chloride, nitrates, sodium, sulfate
- Metals: arsenic, barium, cadmium, chromium, copper, iron, lead, mercury, selenium, silver, and zinc
- Total depth of each monitoring well

Once annually, the following parameters would be included in the analytical list for the five downgradient wells screened in the alluvium:

- Semi-volatile organic compounds.

Leachate Monitoring

Each quarter, a sample would be collected from MH-2, located adjacent to the discharge point to the USVWPCA interceptor line. The sample would be analyzed for VOCs, semi-volatile compounds, PCBs, aluminum, arsenic, chromium, and manganese. Each quarter, the totalizer volume would be recorded to indicate total flow volume of leachate discharged to the USVWPCA interceptor line.

Landfill Gas Monitoring

Landfill gas would be monitored quarterly at 13 bar-hole probe locations (B-1 through B-13) along the perimeter of the property and inside the on-site building structures (S-1, S-2, and S-3). The air at these locations would be analyzed for landfill gas as percent methane.

Sediment Monitoring

Once annually, two samples of sediment would be collected from the bottom of each sedimentation basin (A and B), and analyzed for arsenic, PCBs, and chromium. In each basin, one sample would be collected from the near the inflow area and the second sample would be collected from near the outflow area. The sampling results would be evaluated during the five-year review. Sampling might be discontinued, or the sampling interval could be modified, depending upon the results.

6.5.1.7 Institutional Controls

Institutional Controls would include both zoning and deed restrictions. Zoning restrictions would be implemented by the local zoning commission to prevent future zoning changes that would allow for residential development or other types of development that would be inappropriate for a former landfill. Deed restrictions would include preventing: residential construction on the site, on-site installation of extraction wells for potable water use, and construction of buildings on the filled area. It would be important that the institutional controls be designed to allow for beneficial use of the property, assuming that the beneficial use would not pose a risk to human health or potential ecological receptors. Beneficial use proposals would need to be approved by the appropriate regulatory agency.

6.5.1.8 Off-site Disposal of Soil and Sediment

Off-site Disposal of Sediment would include the excavation and off-site disposal of sediment contaminated with arsenic, Aroclor 1248, and chromium. Arsenic has been detected in Basins A and B, Aroclor 1248 has been detected in samples from Basin B, and chromium has been detected in the discharge channel from Basin B (Figure 2-3). Remediation of these areas would include removing a total of approximately 2,000 cubic yards of sediment from sedimentation Basins A and B, and approximately 6 cubic yards from the sedimentation Basin B discharge channel. Excavated material would be tested and then disposed at an off-site secure landfill.

6.5.1.9 Habitat Enhancement

Habitat Enhancement would be a proactive remedial action component, that would allow a Superfund site to be put to beneficial use. WMPA's plans would include both habitat and structural upgrade of the site to provide food and cover resources for birds and small animals. The community would then have access to limited portions of the facility to observe the wildlife attracted by the facility upgrades.

Habitat upgrades would be recommended by a consultant experienced in the creation and preservation of wildlife habitats. It would include specific seed mixtures of grasses, legumes, and windflowers that would both stabilize the cap and provide food and cover resources for birds and small mammals. Structural enhancement techniques would likely include installing nest boxes and perch poles. Community access would be provided through appropriate parking, recreational facilities, trails, and observation areas.

6.5.1.10 Groundwater/Leachate System Enhancement

The **Groundwater/Leachate System Enhancement** would include a program of cleaning the existing groundwater/leachate collection system lines. It is suspected that the collection system is partially blocked in one or more areas, as would be expected for a system of this age. This blockage is suspected of being the reason that minor amounts of contamination have migrated to the groundwater immediately adjacent to the northwest and east sides of the landfill as described in Section 3.

Under Remedial Action Alternative 4, enhancement of the groundwater/leachate collection system, in addition to the substantial remedial action components already in place, would eliminate the last remaining source of contamination emitted from the landfill to the surrounding WMPA owned property. This alternative would provide a landfill that no longer discharges detectable levels of contaminants, and would allow for safe, beneficial use of the property for years to come. A detailed analysis of Alternative 4 is presented below.

6.5.2 Overall Protection of Human Health and the Environment

This criterion addresses the adequacy with which Alternative 4 provides protection of human health and the environment by limiting exposure to contaminants. The adequacy of the alternative is evaluated by comparison to the results of the Baseline Risk Assessment and by assessing effectiveness in accomplishing remedial action objectives.

Alternative 4 would provide adequate protection of human health and the environment. Calculations in the Baseline Risk Assessment indicate that unacceptable risk to human health may occur under a potential future residential land use scenario through ingestion of contaminated groundwater, and in the future land use scenario by ingestion of sediment while wading in a sedimentation basin. The risk from drinking contaminated groundwater would be mitigated through the establishment of institutional controls, which would prohibit residential development and prevent the installation of drinking water wells, and also by enhancement of the groundwater/leachate collection system to prevent future groundwater impact. The risk from sediment ingestion would be mitigated by the removal of sediment from the sedimentation basins.

The ecological risk assessment indicates that unacceptable risk to ecological communities may potentially occur at isolated locations from exposure to sediment. This potential risk would be eliminated by the removal of impacted sediment.

Remedial action objectives are media-specific goals for protecting human health and the environment. Remedial action objectives were developed to address site contaminants and to address the identified potential site risks by preventing or minimizing exposure to contaminants potentially present in groundwater, leachate, and sediment. Compliance with remedial action objectives is discussed in the following paragraphs, on a media-specific basis.

6.5.2.1 Groundwater

The remedial action objectives developed to address site groundwater include preventing off-site migration and/or ingestion of groundwater containing leachate constituents at concentrations that represent an unacceptable human health risk. Alternative 4 would meet these remedial action objectives.

The groundwater/leachate collection system enhancement component of Alternative 4 would prevent future migration from the site of groundwater containing contaminants that represent an unacceptable health risk. Under this alternative, the groundwater/leachate collection system would be cleaned periodically to maintain its efficiency of operation. This cleaning would enhance the system's ability to maintain an inward gradient toward the landfill in all areas. An inward gradient would prevent the migration of contaminants in the landfill to the surrounding groundwater.

Ingestion is only a concern under a potential future residential land use scenario involving the consumption of contaminated water from a contaminated water supply well. Ingestion would be prevented by both the institutional controls and groundwater/leachate collection system enhancement components of Alternative 4. Groundwater/leachate collection system enhancement would increase the system's ability to prevent migration of leachate constituents to groundwater at the site. In combination with natural attenuation and dilution, this component would, over time, reduce the risk associated with ingestion to groundwater to acceptable levels. Alternative 4 would also prevent ingestion of groundwater through the establishment of institutional controls. Institutional controls would prevent residential development of the site and prevent installation of water supply wells.

6.5.2.2 Leachate

The remedial action objective for leachate at the site consists of minimizing the release of leachate constituents that have the potential to cause unacceptable health risk to groundwater. Alternative 4 would address this objective, through on-going maintenance of the current cap, the groundwater/leachate collection system, and the surface water collection system.

6.5.2.3 Sediment

The remedial action objective developed to address potential risk associated with sediment includes preventing exposure to sediment impacted by arsenic, Aroclor 1248, and chromium. Alternative 4 would meet this objective through the excavation and off-site disposal of the impacted sediment.

6.5.3 Compliance with ARARs

This criterion describes the chemical-specific, location-specific, and action-specific ARARs potentially applicable to Alternative 4. Potential ARARs are summarized in Tables 6-1 through 6-3.

6.5.3.1 Chemical-Specific ARARs

Potential chemical-specific ARARs relate to groundwater, surface water, and leachate disposal.

Groundwater - The *Pennsylvania Groundwater Quality Protection Strategy* is a consideration when evaluating site groundwater. This document is not an ARAR, but it states a Commonwealth goal of remediating groundwater to background standards. Although an active groundwater/leachate collection system is in place at the site, vinyl chloride was detected in one well, in one of two sampling events, at a concentration of 2 ug/L. This is the detection limit and also the MCL for vinyl chloride. Although it results in a health risk which exceeds the $1x10^{-6}$ carcinogenic point of departure, this concentration is not evidence of significant groundwater contamination. It is typical of residual contamination in the immediate vicinity of an active remedial system. Natural attenuation is preventing migration of the contaminants any significant distance from the groundwater/leachate collection system. The groundwater quality at the downgradient property boundary is equivalent to background quality. Therefore, it not necessary to focus remediation toward groundwater extraction or treatment.

The federal and state *Safe Drinking Water Acts* are not ARARs for this site, since site groundwater is not and will not likely be considered a drinking water supply.

Leachate - Leachate discharged from the groundwater/leachate collection system would be subject to the maximum concentrations and loading rates specified in the current permit from the USVWPCA. Quarterly monitoring, as described in Section 6.5.1.5 would document that compliance with these permit conditions is being maintained.

Surface Water - Water quality standards specified in 25 PA Code, Section 93, the water quality criteria specified in 25 PA Code, Section 16, and state NPDES regulations are applicable to the surface water discharge from the on-site sedimentation basins. Section 93 presents specific water quality criteria and designated water use protection for each stream in Pennsylvania. Section 16 presents criteria for toxic substances which are to be used in developing effluent limits for NPDES permits. NPDES regulations establish permitting and discharge limits applicable for stormwater discharges to a surface water body.

Surface water analyses collected during the RI indicate that water quality criteria for may be exceeded in the discharge from the sedimentation basins. The on-site surface water sources include both runoff of surface water and discharge of groundwater. Runoff occurs from the 40 acre landfill as well as the surrounding acreage. Discharge from groundwater is exclusively natural groundwater from upgradient and side gradient to the landfill (since the groundwater/leachate collection system lowers the water table and collects the leachate within the boundaries of the landfill). Therefore, the surface water quality is not representative of leachate leaking from the landfill. The surface water quality in samples collected from the surface water system are consistent with water discharging from springs in the natural soil upgradient from the landfill. Therefore, it is likely that the exceedances of water quality criteria are natural for the area, and not related to the landfill.

6.5.3.2 Location-Specific ARARs

Potential location-specific ARARs relate to construction activities involving the excavation of sediments in potential wetlands, within the 100 year floodplain, and in habitats of endangered species. Prior to the removal of sediment, a joint permit from PADER and the U.S. Army Corps of Engineers (Joint application for U.S. Army Corps of Engineers Section 404 Permit and Pennsylvania Water Obstruction and Encroachment Permit) would be required. This joint permit requires information concerning the dredging operation, disturbance of aquatic habitat, wetlands destruction, disturbance of endangered species, changes to flow rates to the river, and erosion and sedimentation control. Removal of sediment would have to be conducted in accordance with the permit requirements.

6.5.3.3 Action-Specific ARARs

Potential action-specific ARARs relate to landfill closure design standards, monitoring, surface water discharge, erosion and sedimentation control, and OSHA construction requirements.

Design Standards - 25 PA Code, Section 75.24, dated May 24, 1977 was the applicable regulation under which landfill closure was conducted. These regulations address landfill cap design, surface water control, leachate management, and landfill gas. The landfill was closed in substantial compliance with these regulations, and in accordance with a Closure Plan, which was conditionally approved by PADER on March 31, 1987. A letter from WMPA, dated April 15, 1987 responded to the specific conditions of the PADER conditional approval letter.

Monitoring - Monitoring of the site is required by the site's *Post Closure Plan.* The site is in compliance with the current plan which requires monitoring of groundwater, leachate, and landfill gas.

Surface Water Discharge - *The Clean Streams Law* prohibits discharge to surface water in violation of applicable limits. Surface water analyses collected during the RI indicate that water quality criteria may be exceeded in the discharge from the sedimentation basins. The on-site surface water sources include both runoff of surface water and discharge of groundwater. The surface water quality in samples collected from the surface water system are consistent with water discharging from springs in the natural soil upgradient from the landfill. Therefore, it is likely that the exceedances of water quality criteria are natural for the area, and not related to the landfill.

Erosion Control - An Erosion and Sedimentation Control Plan is required for the proposed construction activities (25 PA Code, Section 102.4). Construction activities would have to be conducted in compliance with this requirement.

OSHA - The *OSHA Occupational Safety and Health Standards* (29 CFR 1910) and the *Health and Safety Regulations for Construction* (29 CFR 1926) are relevant and appropriate to the construction activities proposed under Alternative 4. Threshold limit values would be monitored in the breathing zone during construction and monitoring activities.

Based on the discussions above, Alternative 4 would comply with the chemical-, location-, and action-specific ARARs identified.

6.5.4 Long-Term Effectiveness and Permanence

This criterion describes factors including: 1) the magnitude of residual risk, 2) the remaining source of residual risk following implementation of the remedy, 3) the need for a five-year review, and 4) the adequacy and reliability of controls. This latter factor considers the long-term management of treatment residuals, long-term reliability of engineering and institutional controls, and the potential need for the replacement of the alternative. These four factors are discussed below.

6.5.4.1 Magnitude of Residual Risk

Alternative 4 would eliminate risk to human health and the environment discussed in the Baseline Risk Assessment and the Ecological Assessment, through enhancement of the groundwater/leachate collection system, implementation of institutional controls, and sediment removal. The Risk Assessment indicates that unacceptable risks to human health and the environment would result from the potential future land use scenarios of drinking contaminated groundwater and ingesting sediment while wading in the sedimentation basins. The Ecological Assessment indicates that unacceptable risks to ecological communities are limited to sediment found in sedimentation Basin B and its discharge channel. The potential future risk from groundwater would be mitigated through enhancement of the groundwater/leachate collection system to improve collection performance, and by establishing institutional controls to prohibit residential development and the installation of drinking water wells. The potential human health and ecological risk from sediment would be mitigated through excavation and off-site disposal of the contaminated sediment.

<u>Remaining Sources of Residual Risk</u>

Following implementation of Alternative 4, remaining sources of residual risk would be present from refuse. Groundwater contaminants would be removed through attenuation and dilution. Leachate generation would be minimized through continued maintenance of the PADER solid waste cap and the surface water collection system. Contaminated sediment would be removed from the site.

The refuse present beneath the cap would represent the primary remaining source of residual risk. The refuse would continue to anaerobically degrade releasing contaminants. Rain water would continue to percolate through the landfill and continue to carry these contaminants to groundwater beneath the landfill, where they would be collected by the groundwater/leachate collection system.

<u>Five-Year Review</u>

The accumulated database of groundwater and landfill gas monitoring would be evaluated after five years to assess the continued effectiveness of the enhanced remedial systems.

Groundwater monitoring results would be evaluated to assess groundwater quality downgradient of the landfill. This program would address the remedial action objectives of preventing off-site migration and/or ingestion of leachate constituents that present an unacceptable human health risk.

The landfill gas monitoring results would be reviewed for continued documentation that off-site migration and on-site build-up of landfill gas is not occurring.

6.5.4.2 Adequacy and Reliability of Controls

The existing and proposed remedial systems would adequately and reliably control site risk. Potential risk from sediment and potential additional future risk from groundwater would be addressed by sediment removal, groundwater/leachate collection system enhancement, and institutional controls.

Engineering controls, implemented under this alternative, would consist of long-term management, monitoring, operation and maintenance of the existing landfill components by WMPA, and system replacement. There are not expected to be any difficulties or uncertainties associated with operation and maintenance activities. Operation and maintenance would include: cap maintenance, vegetation maintenance, groundwater/leachate collection system maintenance, and continued off-site treatment of extracted groundwater/leachate. It is anticipated that the groundwater/leachate collection system transfer pumps would require replacement every five years.

Alternative 4 contains on-site treatment activities in sedimentation Basins A and B. Residual sediments would settle in the basins and be removed as necessary. Site vegetative maintenance would minimize sediment production.

6.5.5 Reduction of Toxicity, Mobility, and Volume Through Treatment

This criterion considers such factors as: 1) the treatment process used and the material treated, 2) the amount of hazardous material destroyed or treated, 3) the reduction in toxicity, mobility, or volume through treatment, 4) the degree to which treatment is irreversible, 5) the type and quantity of treatment residuals, and 6) the reduction of inherent hazards. These factors are considered where appropriate.

6.5.5.1 Treatment Processes Used and Materials Treated

This alternative would include two off-site treatment processes: off-site treatment of leachate contaminants at the Sharon Sewage Treatment Plant (Sharon STP), and collection and off-site disposal of sediment.

The Sharon STP would utilize biological treatment for the digestion of organic material. The treatment plant would consist of two treatment systems: sedimentation, which would be used to remove suspended soils; and aerobic and anaerobic digestion, to break down organic matter into methane gas, carbon dioxide, and water. Effluent from the biological treatment system would flow through a clarifier and be discharged to the Shenango River. Solids would be thickened, dewatered, and disposed of in a secure landfill.

Sedimentation Basins A and B would remove residual sediment from site stormwater. Treatment would be accomplished through gravitational settling, and off-site disposal in a secure landfill.

6.5.5.2 Amount of Hazardous Material Destroyed or Treated

Leachate and sediment contaminants would be destroyed or treated in Alternative 4.

Currently, the average volume of groundwater/leachate collected and treated from the River Road Landfill site is 1.17 million gallon per month, based on records of liquid transfer to the sewer interceptor line. This volume varies considerably due to seasonal changes in soil moisture content and precipitation patterns. Collection volume typically peaks in the early spring, when saturated soils and heavy rains yield flows as high as 1.8 million gallon per month. Minimum flow volume is typically experienced in the winter, when soils are dry or frozen, and precipitation is absorbed by surface soils or falls as snow. Flow through the system during this period can be as low as 0.7 million gallons per month. Assuming similar conditions in the future, this would be representative of the volume of leachate to be treated and destroyed in Alternative 4.

The current sediment deposition has been estimated to be approximately 130 cubic yards per year, resulting in approximately 2,000 cubic yards of sediment accumulated in the basins since their construction.

6.5.5.3 Degree of Expected Reductions in Toxicity, Mobility, or Volume Through Treatment

Under Alternative 4, the toxicity, mobility, and volume of contaminants produced by degradation of the site refuse and those identified in site sediment would be reduced. The following is a description of how these reductions would be obtained.

Toxicity

The toxicity of contaminated leachate and sediment would be reduced through off-site treatment and landfilling.

The contaminants released by the landfill as leachate would be collected by the groundwater/ leachate collection system, and treated at the Sharon STP. A direct reduction of leachate toxicity would occur by treatment at the Sharon STP. Toxicity would be reduced to levels at or below the plant's NPDES effluent standards.

The toxicity of site sediments containing arsenic, Aroclor 1248, and chromium would be controlled through excavation, stabilization, and off-site disposal in a secure landfill.

Mobility

The mobility of contaminated leachate and sediment would be reduced through off-site treatment and settling.

The mobility of leachate contaminants would decrease following a short term increase while being conveyed to the Sharon STP. However, this short term mobility would be contained and controlled within the USVWPCA sewer interceptor line. Ultimately, contaminant mobility would be eliminated through biological digestion, or dewatering and placing contaminants in a secure landfill.

The mobility of site sediment contaminants would be minimized through settling, excavation, and placement of this material in a secure landfill.

Volume

The volume of contaminants present at the site would be reduced through off-site treatment of leachate, and excavation, and off-site disposal of sediment.

The volume of leachate contaminants would be reduced to a negligible amount. The Sharon STP would reduce the volume of contaminants through digestion to water, carbon dioxide, and biomass.

The on-site volume of contaminated sediment would be eliminated through excavation, and off-site disposal in a secure landfill.

6.5.5.4 Degree to which Treatment is Irreversible

Leachate collection and treatment, and sediment excavation, settling, and landfilling, would irreversibly treat these materials.

Leachate collection and treatment would irreversibly reduce the toxicity of landfill leachate contaminants. The toxicity of the contaminants would be reduced by digesting organic contaminants and removing suspended solids. Treatment of organics would be irreversible due to the digestion of the treated organic compounds which forms water, carbon dioxide, methane, and biomass. Suspended solids and biomass would be dewatered, and placed in a secure landfill.

Sediment would be collected in the sedimentation basins by gravitiational settling and transported off-site to be placed in a secure landfill.

6.5.5.5 Type and Quantity of Residuals Remaining After Treatment

For Alternative 4, treatment would be limited to leachate and sediment contaminants.

The Sharon STP would convert organic contaminants into carbon dioxide, water, and biomass. The quantity of residuals remaining after treatment would be negligible since VOCs would be easily digested by the treatment system process.

Residual contaminant concentrations would likely be present in some sediment trapped by the basins. However, these concentrations have historically been low.

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6.5.5.6 Reduction of Inherent Hazards

Alternative 4 would reduce the inherent hazards posed to groundwater through leachate migration, and to Surface water through sediment migration. The principle threat to groundwater would be mitigated through continued collection and treatment of contaminated groundwater/leachate present beneath the landfill. The potential risk from sediment would be removed from the site through excavation, and off-site disposal.

6.5.6 Short Term Effectiveness

This criterion addresses the effects of the alternative during the construction and implementation phase until remedial response objectives are met. It puts particular emphasis on protection of the community during remedial actions, protection of workers during remedial actions, environmental impacts occurring during construction. It contains an estimate of the time required to achieve remedial response objectives. These factors are discussed below.

6.5.6.1 Risks to Community During Remedial Actions

Implementation of Alternative 4 would pose minimal risk to the community. Groundwater/ leachate collection system enhancement would potentially generate dust, and release volatile organic compounds into the air. However, these potential releases would be controlled through the use of engineering controls. Sediment removal would be limited to approximately 2,000 cubic yards. Habitat enhancement would require only minimal construction activities. Therefore, these on-site activities would not generate significant dust, runoff, or contaminant migration that could potentially impact the local community. Transportation of sediments and construction supplies would create minimal additional truck traffic, and therefore would not create a significant traffic hazard.

6.5.6.2 Risk to Workers During Remedial Action

Risk to workers would include chemical exposure and heavy equipment operation during construction activities, and chemical exposure during continued monitoring of groundwater, leachate, sediment, and landfill gas.

Groundwater/leachate system enhancement, off-site disposal of sediment, and habitat enhancement might expose remediation workers to chemicals through direct contact, ingestion, or inhalation. Workers would also incur risks of injury or death while performing construction activities due to operation of heavy equipment. These risks could be minimized by use of dust control measures, and personal protective equipment, and safety procedures.

Workers performing sampling activities as part of the monitoring program would incur potential risk through exposure to chemicals in groundwater, leachate, sediment, and landfill gas. These risks could also be minimized by use of personal protective equipment, and safety procedures.

6.5.6.3 Environmental Impacts

Environmental impact resulting from the proposed remedial action would not be anticipated, except for sediment removal activities. Sediment removal would disturb the habitat of aquatic and vegetative species living in sedimentation Basins A and B and the discharge channel from

Basin B. Following removal of the sediment, these areas would be replanted to restore the area to its present condition.

6.5.6.4 Time Until Remedial Action Objectives are Achieved

Remedial action objectives associated with groundwater, and sediment would be addressed by construction activities included in this alternative.

The remedial action objective for groundwater would be met upon completion of the groundwater/leachate collection system enhancement activities. It is estimated that these activities would take approximately 12 months to complete. This time frame would include installation of manholes, removal of sediments from piping, characterization of the sediments, and off-site disposal of the sediments in an approved landfill.

The time frame for completion of the sediment removal response action would be approximately six months. This time frame would include excavation, loading, off-site disposal, sampling and analysis of sediment removal areas, and characterization of excavated sediment.

6.5.7 Implementability

This criterion considers factors, where appropriate, such as technical feasibility, administrative feasibility, and availability of services and materials.

6.5.7.1 Technical Feasibility

Alternative 4 would be technically feasible. Habitat enhancement would be readily implementable and a beneficial future use of the property. Cleaning sediment from the groundwater/leachate collection system, and removing contaminated sediment from site discharge channels would be readily implementable. These procedures are well developed and reliable methods of preventing on-site exposure to and off-site migration of contaminants. These remedial actions would not inhibit implementation of further remedial components if they should become required or appropriate. Monitoring of groundwater, leachate, sediment, and landfill gas would be a reliable technology, and be a sufficient method to document the success or failure in the remedial systems.

6.5.7.2 Administrative Feasibility

Implementation of Alternative 4 would be administratively feasible. Enhancing the groundwater/leachate collection system might require construction permits. Disposal of contaminated sediments might require completion of PADER Form U. Zoning restrictions would require the assistance of the City of Hermitage and South Pymatuning Township zoning board officials. Restrictions would be added to the property deed by counsel. Habitat enhancement activities might require construction permits.

6.5.7.3 Availability of Services and Materials

Materials, services, and equipment required to implement this alternative would be readily available. Sewer cleaning contractors would be readily available for the enhancement of the groundwater/leachate collection system. Local contractors would be utilized to construct specific elements of the habitat enhancement, remove contaminated sediment, and maintain the remedial components. Sampling and analytical services to perform monitoring would be available in house, and by a local laboratory, respectively.

6.5.8 Cost

This criterion addresses the cost of implementing the alternative. The cost includes both direct and indirect capital costs, annual operations and maintenance costs, and net present worth costs. Direct costs include expenditures for equipment, labor, and materials required to install the remedial systems. Indirect costs include expenditures for engineering and financial, and other services that are not part of the actual installation activities, but necessary for successful completion of the project. Operation and maintenance costs are post-construction costs necessary to ensure the continued effectiveness of the remedial systems. The present worth analysis is a calculation of the total project cost projected over 30 years assuming a five percent discount rate.

The capital costs for Remedial Action 4 would be $2,389,000. These costs include construction of the Fence, PADER solid waste cap, surface water collection system, groundwater dam, groundwater/leachate collection system, institutional controls, off-site disposal of sediment, habitat enhancement, and groundwater/leachate system enhancement. Operation and maintenance costs would range from $169,000 to $298,000, and would include operation of the groundwater/leachate collection system, monitoring, and maintenance of the remedial systems. The present worth for Alternative 4 would be $8,904,000. A summary of the Alternative 4 project costs is included as Table 6-4. The cost detail for Remedial Action Alternative 4 is presented in Appendix A.

6.6 REMEDIAL ACTION ALTERNATIVE 5

(Fence, Groundwater Dam, Groundwater/Leachate Collection System, *Monitoring, Institutional Controls, On-Site Disposal of Sediment,* Groundwater/Leachate System Enhancement, RCRA Subtitle D Cap, and Habitat Enhancement)

6.6.1 Remedial Components

Remedial Action Alternative 5 includes placing a RCRA Subtitle D cap over the already capped landfill, in addition to Groundwater/Leachate System Enhancement, Institutional Controls, Off-Site Disposal of Sediment, Habitat Enhancement, and the existing remedial systems. Each of the components is described below.

6.6.1.1 Fencing

The **Fence** is comprised of an 8-ft high chain-link fence. The fence surrounds the site on three sides, with access from the fourth side blocked by the Shenango River, as shown on Figure 2-3. The fence is maintained to control site access, thus limiting exposure to the site.

6.6.1.2 PADER Solid Waste Cap

In 1986 and 1987, the **PADER Solid Waste Cap** was constructed over the entire landfill in accordance with a PADER-approved work plan (Figure 2-3). Data obtained during the RI demonstrate that the cap was constructed in accordance with both the work plan and 25 PA Code, Section 75, as amended June 11, 1977 (the regulations under which the landfill was closed). The RI also confirmed that the landfill cap construction adequately promotes surface water runoff.

6.6.1.3 Surface Water Collection System

A **Surface Water Collection System** was integrated into the cap to promote surface water runoff and collect sediment. The cap was constructed with a gentle 1.5 percent slope on the top surface increasing to a six percent slope toward the sides of the landfill. The sides of the landfill are sloped between 12 and 20 percent. Terraces were constructed every 10 to 20 ft of elevation drop. The terraces are sloped into the landfill to collect and channel surface water to ditches located on the east and west sides of the landfill. Two sedimentation basins (Basin A and Basin B) were constructed at the southwestern and southeastern corners of the landfill, respectively, to receive surface water runoff from the ditches. Surface water runoff is discharged from the basins to the Shenango River.

Data gathered during the RI demonstrate the effectiveness of the surface water collection system. *It shows that approximately 60 percent of rainfall is captured by the surface water* collection system, versus the approximately 10 percent captured by the groundwater/leachate collection system. Therefore, the combination of the PADER solid waste cap and the surface water collection system is minimizing infiltration through the cap, and maximizing runoff from the landfill.

6.6.1.4 Groundwater Dam

The **Groundwater Dam** is located at the downgradient (southern) perimeter of the landfill. It was constructed in a trench (Figure 2-3). The bottom of the trench is typically 10 feet wide expanding to approximately 30 to 50 feet at the surface. The base of the dam is located at approximately 855 to 850 feet MSL (15 to 20 feet below the current ground surface). The top of the dam is located 0 to 5 feet below grade. A 10 feet wide zone within the trench was compacted in lifts. The remaining volume of the trench on both sides of the groundwater dam is backfilled with a mixture of excavated site material and material used for dam construction.

The dam is keyed into a foundation of natural fine-grained hard gray silt till over the western 75 percent of its length at a depth of 10 to 20 feet. In the eastern portion, the dam is keyed into a coarser grained till or sand material, and possibly shale bedrock further east.

The groundwater dam was constructed by WMPA to limit potential groundwater flow from the site to the Shenango River, and conversely, to limit flow from the Shenango River toward the groundwater/leachate collection system. The results from the RI indicate that the groundwater dam is effective, and meets both objectives.

6.6.1.5 Groundwater/Leachate Collection System

The **Groundwater/Leachate Collection System** (Figure 2-3) consists of a perforated pipeline in a gravel envelope, which was installed around the entire landfill, below the water table, in three phases. The initial phase, completed in 1980, was constructed parallel to the southern boundary of the fill area. The groundwater dam was constructed immediately downgradient of the collection system to prevent flow of uncontaminated groundwater to the system, by induced recharge from the Shenango River. The second and third phases were expansions of the original system. The second phase extended the system, surrounding the landfill on the eastern and northeastern sides. The third phase, which expanded the system surrounding the western and northwestern sides, was completed in 1986. Groundwater beneath the landfill, and leachate generated by the landfill, drain into this system and are discharged to the USVWPCA interceptor line.

The results of the RI show that the groundwater/leachate collection system is effectively collecting leachate percolating from the landfill and groundwater flowing beneath the landfill.

6.6.1.6 Monitoring

Annual site inspections would be conducted to evaluate the condition of the landfill cover and sedimentation basins. A site walkover would be conducted during each inspection to look for any differential settlement or excessive erosion. Four media would be monitored as part of Alternative 3: groundwater, leachate, landfill gas, and sediment. A detailed monitoring plan would be developed during the remedial design stage. However, for cost estimating purposes in the FS, it is assumed that monitoring would include the following.

<u>Groundwater Monitoring</u>

The groundwater quality would be monitored at ten locations surrounding the landfill, including

three upgradient monitoring wells and seven downgradient monitoring wells.

Monitoring Well	Location	Geologic Unit Screened
MW110S	Upgradient	Alluvium
MW110D	Upgradient	Till
MW110B	Upgradient	Bedrock
MW104A	Downgradient	Alluvium
MW112S	Downgradient	Alluvium
MW113S	Downgradient	Alluvium
MW116S	Downgradient	Alluvium
MW117S	Downgradient	Alluvium
MW119D	Downgradient	Till
MW120B	Downgradient	Bedrock

Each well would be monitored quarterly for:

- Volatile Organic Compounds
- Metals: aluminum, iron, manganese
- TDS, TOC, TOX, COD
- pH, Specific Conductance, Turbidity
- Static Water Level

Once annually, the parameter list for the ten monitoring wells would be expanded to include:

- Alkalinity, ammonia, chloride, nitrates, sodium, sulfate
- Metals: arsenic, barium, cadmium, chromium, copper, iron, lead, mercury, selenium, silver, and zinc
- Total depth of each monitoring well

Once annually, the following parameters would be included in the analytical list for the five downgradient wells screened in the alluvium:

- Semi-volatile organic compounds.

Leachate Monitoring

Each quarter, a sample would be collected from MH-2, located adjacent to the discharge point to the USVWPCA interceptor line. The sample would be analyzed for VOCs, semi-volatile compounds, PCBs, aluminum, arsenic, chromium, and manganese. Each quarter, the totalizer volume would be recorded to indicate total flow volume of leachate discharged to the USVWPCA interceptor line.

Landfill Gas Monitoring

Landfill gas would be monitored quarterly at 13 bar-hole probe locations (B-1 through B-13) along the perimeter of the property and inside the on-site building structures (S-1, S-2, and S-3). The air at these locations would be analyzed for landfill gas as percent methane.

Sediment Monitoring

Once annually, two samples of sediment would be collected from the bottom of each sedimentation basin (A and B), and analyzed for arsenic, PCBs, and chromium. In each basin, one sample would be collected from the near the inflow area and the second sample would be collected from near the outflow area. The sampling results would be evaluated during the five-year review. Sampling might be discontinued, or the sampling interval could be modified, depending upon the results.

6.6.1.7 Institutional Controls

Institutional Controls would include both zoning and deed restrictions. Zoning restrictions would be implemented by the local zoning commission to prevent future zoning changes that would allow for residential development or other types of development that would be inappropriate for a former landfill. Deed restrictions would include preventing: residential construction on the site, on-site installation of extraction wells for potable water use, and construction of buildings on the filled area. It would be important that the institutional controls be designed to allow for beneficial use of the property, assuming that the beneficial use would not pose a risk to human health or potential ecological receptors. Beneficial use proposals would need to be approved by the appropriate regulatory agency.

6.6.1.8 Off-site Disposal of Soil and Sediment

Off-site Disposal of Sediment would include the excavation and off-site disposal of sediment contaminated with arsenic, Aroclor 1248, and chromium. Arsenic has been detected in Basins A and B, Aroclor 1248 has been detected in samples from Basin B, and chromium has been detected in the discharge channel from Basin B (Figure 2-3). Remediation of these areas would include removing a total of approximately 2,000 cubic yards of sediment from sedimentation Basins A and B, and approximately 6 cubic yards from the sedimentation Basin B discharge channel. Excavated material would be tested and then disposed at an off-site secure landfill.

6.6.1.9 Habitat Enhancement

Habitat Enhancement would be a proactive remedial action component, that would allow a Superfund site to be put to beneficial use. WMPA's plans would include both habitat and structural upgrade of the site to provide food and cover resources for birds and small animals. The community would then have access to limited portions of the facility to observe the wildlife attracted by the facility upgrades.

Habitat upgrades would be recommended by a consultant experienced in the creation and preservation of wildlife habitats. It would include specific seed mixtures of grasses, legumes, and windflowers that would both stabilize the cap and provide food and cover resources for birds and small mammals. Structural enhancement techniques would likely include installing nest boxes and perch poles. Community access would be provided through appropriate parking, recreational facilities, trails, and observation areas.

6.6.1.10 Groundwater/Leachate System Enhancement

The **Groundwater/Leachate System Enhancement** would include a program of cleaning the existing groundwater/leachate collection system lines. It is suspected that the collection system is partially blocked in one or more areas, as would be expected for a system of this age. This blockage is suspected of being the reason that minor amounts of contamination have migrated to the groundwater immediately adjacent to the northwest and east sides of the landfill as described in Section 3.

6.6.1.11 RCRA Subtitle D Cap

The **RCRA Subtitle D Cap** component would include constructing a RCRA Subtitle D equivalent cap over the entire surface of the landfill, which would include a passive landfill gas system. The initial step in constructing the cap would be stripping and stockpiling the top 6 in. of topsoil from the existing cap for later reuse. The top surface of the landfill (above the 940 feet MSL elevation) would then be graded to promote positive drainage, with a minimum two percent slope at the center. Grading in this area would be designed to promote surface water drainage to the existing rip-rap lined surface water control system channels located on the southeast and southwest sides of the landfill. The side slopes of the landfill would retain their existing contours.

Cap construction would include placing an HDPE FML over the landfill. This liner would have a permeability comparable to 2 feet of compacted clay ($1x10^{-7}$ cm/sec).

A geonet geocomposite drainage layer, or equivalent, consisting of a geonet layer between two geotextile layers, would be placed over the FML. The composite drainage layer would collect infiltrating rainwater, which would flow within the layer to the edge of the cap. A gravel filled trench containing perforated pipe would be placed at the cap perimeter to transfer the rainwater to the rip-rap lined channels described above. The drainage layer would then be covered with 1.5 feet of cover soil. Cover soil would be placed in a single layer and graded.

Stockpiled topsoil would then be placed and graded over the cover soil layer to a minimum thickness of 6 in. Fertilizer, seed, and mulch would then be applied to the topsoil layer to re-establish the erosion-resistant vegetative cover. The resulting cap would meet the requirements of 40 CFR 258.40 Subpart F and 25 PA Code, Section 288.

A passive landfill gas system would be an integral component of the RCRA Subtitle D Cap, allowing for the release of landfill gas. This would be necessary only for a RCRA Subtitle D Cap, and not for other alternatives. The lower permeability of the cap for this alternative could result in trapping more gas beneath the cap, unless passive venting were provided. (This is in spite of the fact that the results of the ongoing perimeter monitoring and RI demonstrate that off-site landfill gas migration is not a concern.) The passive landfill gas system would consist of a series of perforated HDPE or PVC conduits installed in gravel envelopes within trenches. These trenches would be installed on approximately 50 foot intervals in the current cap material. PVC riser pipes would be installed every 400 feet of conduit to vent the landfill gas collected by the conduit to the atmosphere.

Alternative 5 would essentially eliminate percolation of rain water to the refuse. This offers both benefits and drawbacks to final remediation of the site. The advantage of a RCRA Subtitle D cap is that leachate production is nearly eliminated. However, this would increase the total time frame associated with final landfill stabilization, since rain water percolation is necessary for successful anaerobic digestion of the refuse. Further, landfill gas generated would be potentially trapped beneath the RCRA Subtitle D cap, requiring simultaneous installation of a passive landfill gas system. A detailed analysis of Alternative 5 is presented below.

6.6.2 Overall Protection of Human Health and the Environment

This criterion addresses the adequacy with which Alternative 5 provides protection of human health and the environment by limiting exposure to contaminants. The adequacy of the alternative is evaluated by comparison to the results of the Baseline Risk Assessment and by assessing effectiveness in accomplishing remedial action objectives.

Alternative 5 would provide adequate protection of human health and the environment. Calculations in the Baseline Risk Assessment indicate that unacceptable risk to human health might occur under a potential future residential land use scenario, through ingestion of contaminated groundwater and in the future land use scenario by ingestion of sediment while wading in a sedimentation basin. The risk from drinking contaminated groundwater would be mitigated under Alternative 5 through three actions: 1) establishment of institutional controls which prohibit residential development and prevent the installation of drinking water wells; 2) enhancement of the groundwater/leachate collection system to prevent future groundwater impact, and 3) installation of a RCRA Subtitle D cap to reduce infiltration and, therefore, leachate production. The risk fromcontaminated sediment ingestion would be mitigated by the removal of sediment from the sedimentation basins.

The ecological risk assessment indicates that unacceptable risk to ecological communities may potentially occur at isolated locations from exposure to sediment. This potential risk would be eliminated by the removal of impacted sediment.

Remedial action objectives are media-specific goals for protecting human health and the environment. Remedial action objectives were developed to address site contaminants and to address the identified potential site risks by preventing or minimizing exposure to contaminants potentially present in groundwater, leachate, and sediment. Compliance with remedial action objectives is discussed in the following paragraphs, on a media-specific basis.

6.6.2.1 Groundwater

The remedial action objectives developed to address site groundwater include preventing off-site migration and/or ingestion of groundwater containing leachate constituents at concentrations that present an unacceptable health risk. Alternative 5 would meet these remedial action objectives.

The groundwater/leachate collection system enhancement component of Alternative 5 would prevent future migration of groundwater containing contaminants from the site that represents an unacceptable health risk. Under this alternative, the groundwater/leachate collection system would be cleaned periodically to maintain its efficiency of operation. This cleaning would enhance the system's ability to maintain an inward gradient toward the landfill in all areas. An inward gradient would prevent the migration of contaminants in the landfill to the surrounding groundwater.

Ingestion is a concern under a potential future residential land use scenario involving the consumption of water from a contaminated water supply well. Ingestion would be prevented by both the institutional controls and groundwater/leachate collection system enhancement components of Alternative 5. Groundwater/leachate collection system enhancement would increase the ability of the system to prevent migration of leachate constituents to groundwater at the site. In combination with natural attenuation and dilution, this component would, over time, reduce the risk associated with ingestion to groundwater to acceptable levels. Alternative 5 would also prevent ingestion of groundwater through the establishment of institutional controls. Institutional controls would prevent residential development of the site, and prevent installation of water supply wells.

Data from the RI indicates that the existence of the landfill causes reducing conditions in the upper zone of the aquifer. The resulting anoxic conditions in the groundwater could cause the mobilization of metal ions that are naturally occurring in the aquifer matrix. The placement of a RCRA Subtitle D Cap could further decrease the entry of oxygen into the aquifer, creating a stronger reducing environment. The result could be an increased mobilization of naturally occurring heavy metals in the aquifer.

6.6.2.2 Leachate

The remedial action objective for leachate at the site consists of minimizing the release of leachate constituents with the potential to cause unacceptable health risks to groundwater. Alternative 5 would meet this objective, through installation of a RCRA Subtitle D cap, and maintenance of the cap, the groundwater/leachate collection system, and the surface water collection system.

6.6.2.3 Sediment

The remedial action objective developed to address potential risks associated with sediment includes preventing exposure to sediment impacted by arsenic, Aroclor 1248, and chromium. Alternative 5 meets this objective through the excavation and off-site disposal of the impacted sediment.

6.6.3 Compliance with ARARs

This criterion describes the chemical-specific location-specific, and action-specific ARARs potentially applicable to Alternative 5. Potential ARARs are summarized in Tables 6-1 through 6-3.

6.6.3.1 Chemical-Specific ARARs

Potential chemical-specific ARARs relate to groundwater, surface water, and leachate disposal.

Groundwater - The *Pennsylvania Groundwater Quality Protection Strategy* is a consideration when evaluating site groundwater. This document is not an ARAR, but it states a Commonwealth goal of remediating groundwater to background standards. Although an active leachate collection system is in place at the site, vinyl chloride was detected in one well, on one of two sampling events at a concentration at the of 2 ug/L. This is the detection limit and also the MCL for vinyl chloride. Although it results in a health risk which exceeds the $1x10^{-6}$ carcinogenic point of departure, this concentration is not evidence of significant groundwater contamination. It is typical of residual contamination in the immediate vicinity of an active remedial system. Natural attenuation is preventing migration of the contaminants any significant distance from the leachate collection system. The groundwater quality at the downgradient property boundary is equivalent to background quality. Therefore, it not necessary to focus remediation toward groundwater extraction or treatment.

The federal and state *Safe Drinking Water Acts* are not ARARs for this site, since site groundwater is not and will not likely be considered a drinking water supply.

Leachate - Leachate discharged from the groundwater/leachate collection system is subject to the maximum concentrations and loading rates specified in the current permit from the USVWPCA. Quarterly monitoring, as described in Section 6.6.1.5 would document that compliance with these permit conditions is being maintained.

Surface Water - Water quality standards specified in 25 PA Code, Section 93, the water quality criteria specified in 25 PA Code, Section 16, and state NPDES regulations are applicable to the surface water discharge from the on-site sedimentation basins. Section 93 presents specific water quality criteria and designated water use protection for each stream in Pennsylvania. Section 16 presents criteria for toxic substances which are to be used in developing effluent limits for NPDES permits. NPDES regulations establish permitting and discharge limits applicable for storm water discharges to a surface water body.

Surface water analyses collected during the RI indicate that water quality criteria for may be exceeded in the discharge from the sedimentation basins. The on-site surface water sources include both runoff of surface water and discharge of groundwater. Runoff occurs from the 40 acre landfill as well as the surrounding acreage. Discharge from groundwater is exclusively natural groundwater from upgradient and side gradient to the landfill (since the groundwater/leachate collection system lowers the water table and collects the leachate within the boundaries of the landfill). Therefore, the surface water quality is not representative of leachate leaking from the landfill. The surface water quality in samples collected from the surface water system are consistent with water discharging from springs in the natural soil upgradient from the landfill. Therefore, it is likely that the exceedances of water quality criteria are natural for the area, and not related to the landfill.

Landfill Gas - The *Pennsylvania Air Pollution Control regulations* (25 PA Code, Sections 121-143) are applicable to landfill gas discharge from the passive landfill gas system. These regulations would specify permitting and effluent limitations for the venting system.

6.6.3.2 Location-Specific ARARs

Potential location-specific ARARs relate to construction activities involving the excavation of sediments in potential wetlands, within the 100 year floodplain, and in habitats of endangered species. Prior to the removal of sediment, a joint permit from PADER and the U.S. Army Corps of Engineers (Joint Application for U.S. Army Corps of Engineers Section 404 Permit and Pennsylvania Water Obstruction and Encroachment Permit) would be required. This joint permit requires information concerning the dredging operation, disturbance of aquatic habitat, wetlands destruction, disturbance of endangered species, changes to flow rates to the river, and erosion and sedimentation control. Removal of sediment would have to be conducted in accordance with the permit requirements.

6.6.3.3 Action-Specific ARARs

Potential action-specific ARARs relate to landfill closure design standards, monitoring, surface water discharge, erosion and sedimentation control, and OSHA construction requirements.

Design Standards - The *Residual Waste Landfill* regulations 25 PA Code, Section 288 are the applicable regulations under which a new landfill cap with an integral passive landfill gas system would be installed. The *U.S. EPA RCRA Design Guidelines* would also be considered when designing and installing the new cap.

Monitoring - Monitoring of the site is required by the site's *Post Closure Plan*. The site is in compliance with the current plan that requires monitoring of groundwater, leachate, and landfill gas.

Surface Water Discharge - The *Clean Streams Law* prohibits discharge to surface water in violation of applicable limits. Surface water analyses collected during the RI indicate that water quality criteria may be exceeded in the discharge from the sedimentation basins. The on-site surface water sources include both runoff of surface water and discharge of groundwater. The surface water quality in samples collected from the surface water system are consistent with water discharging from springs in the natural soil upgradient from the landfill. Therefore, it is likely that the exceedances of water quality criteria are natural for the area, and not related to the landfill.

Erosion Control - An Erosion and Sedimentation Control Plan is required for the proposed construction activities (25 PA Code, Section 102.4). Construction activities would have to be conducted in compliance with this requirement.

OSHA - The *OSHA Occupational Safety and Health Standards* (29 CFR 1910) and the *Health and Safety Standards for Construction* (29 CFR 1926) are relevant and appropriate to the construction activities proposed under Alternative 5. Threshold limit values would be monitored in the breathing zone during construction and monitoring activities.

Based on the discussions above, Alternative 5 would comply with the chemical-, location-, and action-specific ARARs identified.

6.6.4 Long-Term Effectiveness and Permanence

This criterion describes factors including: 1) the magnitude of residual risk, 2) the remaining source of residual risk following implementation of the remedy, 3) the need for a five-year review, and 4) the adequacy and reliability of controls. This latter factor considers the long-term management of treatment residuals, long-term reliability of engineering and institutional controls, and the potential need for the replacement of the alternative. These four factors are discussed below.

6.6.4.1 Magnitude of Residual Risk

Alternative 5 would eliminate risk to human health and the environment discussed in the Baseline Risk Assessment and the Ecological Assessment, through installation of a RCRA Subtitle D cap, enhancement of the groundwater/leachate collection system, implementation of institutional controls, and sediment removal. The Risk Assessment indicates that unacceptable risks to human health would result from in the future land use scenarios of drinking contaminated groundwater and ingestion of sediment while wading in the sedimentation basins. The Ecological Assessment indicates that unacceptable risk to ecological communities is limited to sediments found in sedimentation Basin B and its discharge channel.

The potential future risk from groundwater would be mitigated through: installation of a RCRA Subtitle D cap to further minimize infiltration and leachate generation; enhancement of the groundwater/leachate collection system to improve collection performance; and by establishing institutional controls which prohibit residential development and the installation of drinking water wells. The potential human health or ecological risk from sediment would be mitigated through excavation and off-site disposal of the contaminated sediment.

<u>Remaining Sources of Residual Risk</u>

Following implementation of Alternative 5, remaining sources of residual risk would be present from refuse. Groundwater contaminants would be removed through attenuation and dilution. Leachate generation would be further minimized through installation of the RCRA Subtitle D cap. Contaminated sediment would be removed from the site.

The refuse present beneath the cap would represent the primary remaining source of residual risk. The refuse would continue to anaerobically degrade releasing contaminants. Rain water would continue to percolate through the landfill and continue to carry these contaminants to groundwater beneath the landfill, to be collected by the groundwater leachate collection system.

<u>Five-Year Review</u>

The accumulated database of groundwater and landfill gas monitoring would be evaluated after five years to assess the continued effectiveness of enhanced remedial systems.

Groundwater monitoring results would be evaluated to assess groundwater quality downgradient of the landfill. This program would address the remedial action objectives of preventing off-site migration and/or ingestion of leachate constituents that present an unacceptable risk to human health.

The landfill gas monitoring results would be reviewed for continued documentation that off-site migration and on-site build-up of landfill gas is not occurring.

6.6.4.2 Adequacy and Reliability of Controls

The existing and proposed remedial systems would adequately and reliably control site risk. Potential risk from sediment and potential additional future risk from groundwater would be addressed by sediment removal, RCRA Subtitle D cap installation, groundwater/leachate collection system enhancement, and institutional controls.

Engineering controls implemented under this alternative would consist of long-term management, monitoring, operation and maintenance of the existing landfill components by WMPA, and system replacement. There are not expected to be any difficulties or uncertainties associated with operation and maintenance activities. Operation and maintenance would include: cap maintenance, vegetation maintenance, groundwater/leachate collection system maintenance, and continued off-site treatment of extracted groundwater/leachate. It is anticipated that the groundwater/leachate collection system transfer pumps would require replacement every five years.

Alternative 5 would include on-site treatment activities in sedimentation Basins A and B. Residual sediments would settle in the basins and be removed as necessary. Site vegetative maintenance would minimize sediment production.

6.6.5 Reduction of Toxicity, Mobility, and Volume Through Treatment

This criterion considers such factors as: 1) the treatment process used and the material treated, 2) the amount of hazardous material destroyed or treated, 3) the reduction in toxicity, mobility, or volume through treatment, 4) the degree to which treatment is irreversible, 5) the type and quantity of treatment residuals, and 6) the reduction of inherent hazards. These factors are considered where appropriate.

6.6.5.1 Treatment Processes Used and Materials Treated

This alternative would include two off-site treatment processes: off-site treatment of leachate contaminants at the Sharon Sewage Treatment Plant (Sharon STP), and collection and off-site disposal of sediment.

The Sharon STP would utilize biological treatment for the digestion of organic material. The treatment plant would consist of two treatment systems: sedimentation, which would be used to remove suspended solids; and aerobic and anaerobic digestion, to breaks down organic matter into methane gas, carbon dioxide, and water. Effluent from the biological treatment system would flow through a clarifier and be discharged to the Shenango River. Solids would

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be thickened, dewatered, and disposed of in a secure landfill.

Sedimentation Basins A and B would remove residual sediment from site storm water. Treatment would be accomplished through gravitational settling, and off-site disposal in a secure landfill.

6.6.5.2 Amount of Hazardous Material Destroyed or Treated

Leachate and sediment contaminants would be destroyed or treated in Alternative 5.

Currently, the average volume of groundwater/leachate collected and treated from the River Road Landfill site is 1.17 million gallon per month, based on records of liquid transfer to the sewer interceptor line. This volume varies considerably due to seasonal changes in soil moisture content and precipitation patterns. Collection volume typically peaks in the early spring, when saturated soils and heavy rains yield flows as high as 1.8 million gallons per month. Minimum flow volume is typically experienced in the winter, when soils are dry or frozen, and precipitation is absorbed by surface soils or falls as snow. Flow through the system during this period can be as low as 0.7 million gallons per month. The groundwater/leachate collection system would continue to remove similar volumes of leachate for off-site treatment.

The current sediment deposition has been estimated to be approximately 130 cubic yards per year, resulting in approximately 2000 cubic yards of sediment accumulation in the basins since their construction.

6.6.5.3 Degree of Expected Reductions in Toxicity, Mobility, or Volume Through Treatment

Under Alternative 5, the toxicity, mobility, and volume of contaminants produced by degradation of the site refuse and those identified in site sediment would be reduced. The following is a description of how these reductions would be obtained.

Toxicity

The toxicity of contaminated leachate and sediment would be reduced through off-site treatment and landfilling.

The contaminants released by the landfill as leachate would be collected by the groundwater/ leachate collection system, and treated at the Sharon STP. Treatment at the Sharon STP would directly reduce leachate toxicity to levels at or below the plant's NPDES effluent standards.

The toxicity of site sediments containing arsenic, Aroclor 1248, and chromium would be controlled through excavation and off-site disposal in a secure landfill.

Mobility

The mobility of contaminated leachate and sediment would be reduced through off-site treatment and settling.

The mobility of leachate contaminants would be decreased, following a short term increase while being conveyed to the Sharon STP. However, this short term mobility would be contained and controlled within the USVWPCA sewer interceptor line. Ultimately, contaminant mobility would be eliminated through biological digestion, or dewatering and placing contaminants in a secure landfill.

The mobility of site sediment contaminants would be minimized through settling, excavation, and placement of this material in a secure landfill.

Volume

The volume of contaminants present at the site would be reduced through off-site treatment of leachate, and excavation, and off-site disposal of sediment.

The volume of leachate contaminants would be reduced to a negligible amount. The Sharon STP would reduce the volume of contaminants through digestion to water, carbon dioxide, and biomass.

The on-site volume of contaminated sediment would be eliminated through excavation, and off-site disposal in a secure landfill.

6.6.5.4 Degree to which Treatment is Irreversible

Leachate collection and treatment and sediment settling, excavation, and landfilling, would irreversibly treat these materials.

Leachate collection and treatment would irreversibly reduce the toxicity of landfill leachate contaminants. The toxicity of the contaminants would be reduced by digesting organic contaminants and removing suspended solids. Treatment of organics would be irreversible due to the digestion of the treated organic compounds which forms water, carbon dioxide, methane, and biomass. Suspended solids and biomass would be dewatered, and placed in a secure landfill.

Sediment would be collected in the sedimentation basins by gravitational settling would be excavated and transported off-site to be placed in a secure landfill.

6.6.5.5 Type and Quantity of Residuals Remaining After Treatment

For Alternative 5, treatment would be limited to leachate and sediment contaminants.

The Sharon STP would convert organic contaminants into carbon dioxide, water, and biomass. The quantity of residuals remaining after treatment would be negligible since VOCs would be easily digested by the treatment system process. Residual contaminant concentrations would likely be present in some sediment trapped by the basins. However, these concentrations have historically been low.

6.6.5.6 Reduction of Inherent Hazards

Alternative 5 would reduce the inherent hazards posed to groundwater through leachate migration, and to surface water through sediment migration. The principle threat to groundwater would be mitigated through continued collection and treatment of contaminated groundwater/leachate present beneath the landfill. The potential risk from sediment would be removed from the site through excavation, and off-site disposal.

6.6.6 Short Term Effectiveness

This criterion addresses the effects of the alternative during the construction and implementation phase until remedial response objectives are met. There is particular emphasis on protection of the community during remedial actions, protection of workers during remedial actions, environmental impacts occurring during construction. It contains an estimate of the time required to achieve remedial response objectives. These factors are discussed below.

6.6.6.1 Risks to Community During Remedial Actions

Implementation of Alternative 5 would pose an additional risk to the community. A RCRA Subtitle D Cap with integral passive landfill gas system, the groundwater/leachate collection system enhancement, the off-site disposal of sediment, and the habitat enhancement would potentially generate dust, release volatile organic compounds into the air, and generate significant local truck traffic. Potential dust and chemical releases would be controlled through the use of engineering controls. Additional area truck traffic would be a continued risk to the community during the entire construction period.

6.6.6.2 Risk to Workers During Remedial Action

Risk to workers would include chemical exposure and heavy equipment operation during construction activities, and chemical exposure during continued monitoring of groundwater, leachate, sediment, and landfill gas.

The landfill cap construction, groundwater/leachate system enhancement, off-site disposal of sediment, and habitat enhancement might expose remediation workers to chemicals through direct contact, ingestion, or inhalation. Workers could also incur risk of injury or death while performing construction activities and operating heavy equipment. These risks could be minimized by use of dust control measures, and personal protective equipment, and safety procedures.

Workers performing sampling activities as part of the monitoring program could incur potential risk through exposure to chemicals in groundwater, leachate, sediment, and landfill gas. These risks could be minimized by use of personal protective equipment, and safety procedures.

6.6.6.3 Environmental Impacts

Environmental impact resulting from the proposed remedial actions could result from both recapping of the landfill and sediment removal activities. Capping would disturb the habitat of animals nesting on the landfill surface. Sediment removal would disturb the habitat of aquatic and vegetative species living in sedimentation Basins A and B and the discharge channel from Basin B. Following installation of the cap, and removal of the sediment, the cap, and the sedimentation basin and discharge channel would be replanted to restore these areas to their present condition.

6.6.6.4 Time Until Remedial Action Objectives are Achieved

Remedial action objectives associated with groundwater, leachate, and sediment are addressed by construction activities included in this alternative. Time frames associated with achieving remedial action objectives associated with each media of concern are discussed below.

The remedial action objective for groundwater would be met upon completion of the system enhancement construction activities, which would require approximately 12 months. This time frame would include installation of manholes, removal of sediments from piping, characterization of the sediments, and off-site disposal of the sediments in an approved landfill.

The remedial action objective for leachate would be met upon completion of the RCRA Subtitle D cap, which is estimated to be 12 months. This time frame would include installation of the various geosynthetic layers, soil layer, and revegetation.

The time frame for completion of the sediment removal response action would be approximately six months. This time frame would include excavation, loading, off-site disposal, sampling and analysis of sediment removal areas, and charracterization of excavated sediments.

6.6.7 Implementability

This criterion considers factors, where appropriate, such as technical feasibility, administrative feasibility, and availability of services and materials.

6.6.7.1 Technical Feasibility

Alternative 5 would be technically feasible. Habitat enhancement would be readily implementable and a beneficial use of the property. Landfill cap and passive landfill gas system installation, cleaning sediment from the groundwater/leachate collection system, and removing contaminated sediment from site discharge channels would be readily implementable, well developed, and reliable methods of preventing on-site exposure to and off-site migration of contaminants. These remedial components would not inhibit implementation of further remedial components, if they should become required or appropriate. Monitoring of groundwater, leachate, sediment, and landfill gas would be a reliable technology, and is an adequate method to document the success or failure of the remedial systems.

6.6.7.2 Administrative Feasibility

Alternative 5 would be administratively feasible. Habitat enhancement and enhancing the groundwater/leachate collection system might require permits. It might be necessary to obtain conventional construction permits, land disturbance permits, grading permits, etc. for the construction of the cap. An air discharge permit might be required for the on-site discharge of landfill gas to the atmosphere. Zoning restrictions would require the assistance of City of Hermitage and South Pymatuning Township zoning board officials. Restrictions would be added to the property deed by counsel. A PADER Form U might be required for off-site disposal of sediment.

6.6.7.3 Availability of Services and Materials

Materials, services, and equipment required to implement this alternative would be readily available. The construction of the RCRA Subtitle D cap and landfill gas venting system would utilize common construction materials and employ experienced contractors available locally. Sewer cleaning contractors would be readily available for enhancement of the groundwater/ leachate system. Local contractors would be utilized to construct specific elements of the habitat enhancement, remove contaminated sediment, and maintain the remedial components. Sampling and analytical services to perform monitoring would be available in house, and by a local laboratory, respectively.

6.6.8 Cost

This criterion addresses the cost of implementing Alternative 5. The cost includes both direct and indirect capital costs, annual operations and maintenance costs, and net present worth costs. Direct costs include expenditures for equipment, labor, and materials required to install the remedial systems. Indirect costs include expenditures for engineering and financial, and other services that are not part of the actual installation activities, but necessary for successful completion of the project. Operation and maintenance costs are post-construction costs necessary to ensure the continued effectiveness of the remedial systems. The present worth analysis is a calculation of the total project cost projected over 30 years assuming a five percent discount rate.

The capital costs for Remedial Action 5 would be $4,858,000. These costs include construction of the Fence, PADER solid waste cap, surface water collection system, groundwater dam, groundwater/leachate collection system, institutional controls, off-site disposal of sediment, habitat enhancement, groundwater/leachate system enhancement, and RCRA Subtitle D cap/passive landfill gas system. Operation and maintenance costs would range from $189,000 to $318,000, and would include operation of the groundwater/leachate collection system, monitoring, and maintenance of the remedial systems. The present worth for Alternative 5 would be $12,957,000. A summary of the Alternative 5 project costs is included as Table 6-4. The cost detail for Remedial Action Alternative 5 is presented in Appendix A.

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Comparison of Alternatives

7.1 INTRODUCTION

In Section 6, five alternatives were individually assessed against the nine evaluation criteria. In this section, a comparative analysis is conducted to evaluate the relative performance of each alternative in relation to the nine criteria. The purpose of this comparative analysis is to identify the advantages and disadvantages of the alternatives relative to each other, so the relative strengths can be identified. These strengths, combined with risk management decisions made by the Agencies, will serve as the rationale for selecting a preferred alternative and provide a transition from the RI/FS to the ROD.

7.2 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Criterion 1 addresses the adequacy with which the alternatives can provide protection of human health and the environment by controlling exposures to contaminants. Three evaluation criteria are necessary to evaluate the alternatives in this area. These are the ability of each alternative to address: 1) risk to human health, 2) the environment, and 3) meet remedial action objectives.

Calculations in the Baseline Risk Assessment indicate that unacceptable risk to human health might occur under a potential future land use scenario through ingestion of contaminated groundwater. This risk is addressed in an increasingly aggressive fashion through the five alternatives. Alternative 1 includes the existing PADER solid waste cap, which would limit percolation and promote runoff from the landfill surface. Alternative 2 would add an operating groundwater/leachate collection system which would prevent groundwater impact. Alternative 3 would add institutional controls, which would prohibit residential development and prevent installation of drinking water wells, and thus eliminate the potential future land use scenario and the potential future risk. Alternatives 4 and 5 would introduce additional remedial components that limit groundwater contamination. These would include enhancement of the groundwater/leachate collection system in Alternative 4, and installation of a RCRA Subtitle D cap in Alternative 5. These additional components, while effective, would not reduce site

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risk to levels below those achieved by Alternative 3.

The Ecological Assessment indicates that unacceptable risk to ecological communities might potentially occur at isolated locations from exposure to sediment. This potential risk would not be addressed by Alternatives 1 and 2. Alternatives 3 through 5 would equally address this risk, through removal of the contaminated sediment.

Remedial action objectives were developed for groundwater, leachate, and sediment, and are presented in Section 4.2. The following summarizes how each of the five alternatives would meet or fail to meet each of the remedial action objectives.

7.2.1 Groundwater

The remedial action objectives developed to address groundwater include 1) preventing off-site migration and 2), preventing ingestion of groundwater containing leachate constituents at concentrations creating an unacceptable health risk. These objectives would be met by Alternatives 3 through 5, but would not be met by Alternatives 1 and 2. Alternatives 3 through 5 would meet the remedial action objectives through continued operation of the groundwater/leachate collection system, monitoring, and institutional controls. Alternatives 4 and 5 would offer further performance enhancement not necessary to meet the remedial action objectives.

7.2.2 Leachate

The remedial action objective developed for leachate is to minimize the release of leachate constituents to groundwater that present unacceptable health risks. Alternatives 2 through 5 would meet this objective through on-going maintenance of the current cap, and the surface water collection system which would minimize erosion. Alternative 5 would offers a further performance enhancement which would not be necessary to meet the remedial action objective.

7.2.3 Sediment

The remedial action objective developed for sediment includes preventing exposure to sediment contaminated by arsenic, Aroclor 1248, and chromium. Alternatives 3 through 5 would meet this objective, through excavation and off-site disposal of the contaminated sediment.

Based on the discussions above, Alternatives 3 through 5 would adequately protect human health and the environment by 1) eliminating unacceptable risk to human health, 2) eliminating unacceptable risk to the environment, and 3) by meeting the remedial action objectives.

7.3 COMPLIANCE WITH ARARS

Criterion 2 considers the chemical-specific, location-specific, and action-specific ARARs that are potentially applicable to the five alternatives. Alternative 1 is the No Action alternative and does not trigger ARARs. Therefore, the following discussions are limited to Alternatives 2 through 5.

7.3.1 Chemical-Specific ARARs

Groundwater - There are no ARARs for groundwater. However, the *Pennsylvania Groundwater Quality Protection Strategy* is a consideration when evaluating site groundwater. Although it is not an ARAR, it states a Commonwealth goal of remediating groundwater to background standards. For reasons discussed in Section 6, it is not technically practical to focus remediation toward groundwater extraction and treatment, so none of the alternatives offer such a component.

Leachate - The chemical specific ARAR for leachate is the current permit from the Upper Shenango Valley Water Pollution Control Authority. Alternatives 2 through 5, for which this alternative is applicable, would meet the requirements of this permit.

Surface Water - Surface water analyses collected during the RI indicate that water quality criteria may be exceeded in the discharge from the sedimentation basins. However, the exceedances are representative of the natural surface water quality for the site. Therefore remediation is not necessary. However, surface water quality would be monitored in Alternatives 2 through 5, to indicate any future changes.

7.3.2 Location-Specific ARARs

Potential location-specific ARARs relate to construction activities required for the excavation of sediments in potential wetlands, within the 100 year floodplain, and in habitats of endangered species. A joint application from PADER and the U.S. Army Corps of Engineers would be required to complete the sediment removal component of Alternatives 3 through 5.

7.3.3 Action-Specific ARARs

Potential action-specific ARARs relate to landfill closure design standards, monitoring, surface water discharge, sedimentation and erosion control, and OSHA construction requirements. ARAR requirements associated with these activities would have to be met.

Based on this comparison, it is apparent that action-specific ARARs will not play a significant role in the selection of a final remedial alternative since each alternative complies equally with ARARs.

7.4 LONG-TERM EFFECTIVENESS AND PERMANENCE

Criterion 3 addresses 1) the magnitude of residual risk, 2) the remaining source of residual risk following implementation of the remedy, 3) the need for a five year review, and 4) the adequacy and reliability of controls. An evaluation of the alternatives with respect to this criterion is described below.

7.4.1 Magnitude of Residual Risk

The magnitude of residual risk would be mitigated by Alternatives 3 through 5, and the calculated risk would remain if Alternatives 1 or 2 were implemented. Alternatives 3 through 5 would mitigate risk to human health and the environment through implementation of institutional controls and removal of contaminated sediment, respectively. Alternatives 4 and 5 would include groundwater/leachate system enhancement and a RCRA Subtitle D cap, which would enhance the current system's ability to minimize leachate mobilization.

7.4.1.1 Remaining Sources of Residual Risk

Sources of residual risk include refuse, groundwater, leachate, and sediment. The presence of refuse at the site is not addressed. Since the site is a landfill, this residual risk will remain on site. Groundwater residual risk would be mitigated by Alternatives 4 and 5, since enhancement of the groundwater/leachate collection system would eliminate the remaining groundwater contaminant sources. Alternatives 2 and 3 would remove all except residual contamination in the immediate vicinity of the landfill. Leachate residual risk would be addressed by Alternatives 2 through 5 through continued maintenance of the PADER solid waste cap and the surface water collection system. Alternative 5, which would include installation of a RCRA Subtitle D cap, would further limit leachate mobilization. Sediment residual risk would be eliminated by Alternatives 3 through 5 through removal and disposal of contaminated sediment.

7.4.1.2 Five Year Review

A five year review would be conducted through implementation of Alternatives 2 through 5. The five year review would be conducted to assess the continued effectiveness of the remedial systems for which ever alternative is selected.

7.4.1.3 Adequacy and Reliability of Controls

Site risk would be adequately and reliably controlled through implementation of Alternatives 3 through 5. Potential future risk and potential ecological risk would be addressed by institutional controls, and sediment removal, respectively. Alternatives 4 and 5 would provide further enhancement of the leachate reduction, but would not provide increased protection to human health and the environment over Alternative 3.

Alternatives 2 through 5 would include engineering controls consisting of long-term management, monitoring, operation and maintenance, and system component replacement.

Alternatives 3 through 5 would present on-site treatment activities in sedimentation Basins A and B. Residual sediments would settle in the basins and be removed as necessary. Site vegetative maintenance would minimize sediment production.

Based on this comparison, the long term effectiveness criterion would be satisfied by Alternatives 4 and 5. These alternatives 1) mitigate residual risk, 2) eliminate the remaining sources of residual risk with the exception of refuse, which would remain at the site, 3) conduct a five year review, and 4) adequately and reliably control site risk.

7.5 REDUCTION OF TOXICITY, MOBILITY, AND VOLUME THROUGH TREATMENT

Criterion 4 addresses: 1) the treatment process used and the material treated, 2) the amount of hazardous materials destroyed or treated, 3) the reduction of toxicity, mobility, and volume through treatment, 4) the degree to which treatment is irreversible, 5) the type and quantity of treatment residuals, and 6) the reduction of inherent hazards. The following summarizes how each of the five alternatives would meet or fail to meet each of these sub-criteria.

7.5.1 Treatment Process Used and Materials Treated

The treatments considered in the alternatives include: off-site treatment of leachate contaminants at the Sharon STP and settlement of sediment in sedimentation Basins A and B. Leachate treatment would be conducted in Alternatives 2 through 5. Sediment settlement would be conducted in Alternatives 3 through 5.

7.5.2 Amount of Hazardous Material Destroyed or Treated

Hazardous materials destroyed or treated consist of leachate and sediment. Leachate constituents are treated at the Sharon STP in alternatives 2 through 5. Sediment is excavated and landfilled in Alternatives 3 through 5.

7.5.3 Degree of Expected Reductions in Toxicity, Mobility, and Volume Through Treatment

7.5.3.1 Toxicity

The toxicity of leachate and contaminated sediment would be reduced through off-site treatment and landfilling. Leachate would be treated at the Sharon STP in Alternatives 2 through 5. Sediment would be excavated and landfilled off-site in Alternatives 3 through 5.

7.5.3.2 Mobility

The mobility of contaminated leachate and sediment would be reduced through off-site treatment and stabilization/landfilling. Leachate mobility would be reduced in Alternatives 2 through 5. Sediment mobility would be reduced in Alternatives 3 through 5.

7.5.3.3 Volume

In Alternatives 2 through 5, the volume of leachate contaminants would be reduced to a negligible amount. The Sharon STP would reduce the volume of contaminants by digestion to

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water, carbon dioxide, and biomass. In Alternatives 3 through 5, the on-site volume of contaminated sediment present on-site would be eliminated through excavation and off-site disposal in a secure landfill.

7.5.4 Degree to which Treatment is Irreversible

Leachate treatment at Sharon STP, after collection and transport by the on-site interceptor line, would irreversibly reduce the toxicity of landfill leachate contaminants in Alternatives 2 through 5. Treatment of organics would be irreversible due to the digestion of the treated organic compounds which forms water, carbon dioxide, methane, and biomass. Suspended solids and biomass would be dewatered, and placed in a secure landfill. In Alternatives 3 through 5, sediment that has collected in the sedimentation basins by gravitational settling would be transported off-site for disposal at a secure landfill.

7.5.5 Type and Quantity of Residuals Remaining After Treatment

Treatment is limited to leachate and sediment contaminants. Alternatives 2 through 5 would treat leachate at the Sharon STP where organic contaminants would be converted into carbon dioxide, water, and biomass. The quantity of residuals remaining after treatment would be negligible since VOCs would be easily digested by the treatment system process.

All sediments would remain on site for Alternative 2. After sediment removal in Alternatives 3 through 5, there would likely remain some sediment trapped by the basins.

7.5.6 Reduction of Inherent Hazards

Inherent hazards consist of groundwater contamination through leachate migration, and of sediment containing arsenic, Aroclor, and chromium. Alternatives 2 through 5 would mitigate the hazard from groundwater through continued collection and treatment of leachate. Human health and ecological hazards would be mitigated in Alternatives 3 through 5 by the excavation and off-site disposal of sediments.

Based on this comparison, Alternatives 3 through 5 would satisfy the requirements of this criterion. These alternatives would address 1) the treatment process used and the material treated, 2) the amount of hazardous materials destroyed or treated, 3) the reduction of toxicity, mobility, and volume through treatment, 4) the degree to which treatment is irreversible, 5) the type and quantity of treatment residuals, and 6) the reduction of inherent hazards.

7.6 SHORT TERM EFFECTIVENESS

Criterion 5 evaluates the effects of each alternative during the construction and implementation phase until remedial response objectives are met. There is particular emphasis on protection of the community during remedial actions, protection of workers during remedial actions, and environmental impacts occurring during construction. An estimate of the time required to achieve remedial response objectives is also provided.

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7.6.1 Risks to Community During Remedial Actions

Risk to the community associated with Alternatives 1 through 5 would increase with increasing construction activity. Alternatives 1 and 2 would not pose risk to the community, since no construction related activities are involved. Alternative 3 would involve sediment removal, which would involve some minimal construction related activities. Alternative 4, which would include enhancement of the groundwater/leachate collection system, would potentially generate dust, and release volatile organic compounds to the air. The installation of a RCRA Subtitle D Cap (Alternative 5) would potentially generate a large quantity of dust, and generate significant local truck traffic. Potential dust and chemical releases could be controlled through the use of engineering controls. Additional area truck traffic would be a continued risk to the community during the entire construction period.

7.6.2 Risk to Workers During Remedial Action

There would be no risk to workers for Alternative 1, since there would be no construction or sampling. However, there would be risks to workers in the implementation of Alternatives 2 through 5. The cap installation (Alternative 5), groundwater/leachate system enhancement (Alternatives 4 and 5), off-site disposal of sediment, and habitat enhancement (Alternatives 3 through 5) would expose remediation workers to chemicals through direct contact, ingestion, or inhalation. Workers would also incur risk of injury or death while performing construction activities due to operation of heavy equipment. These risks could be minimized by use of dust control measures, personal protective equipment, and safety procedures.

Workers performing sampling activities as part of a monitoring program (Alternatives 2 through 5) would incur potential risk through exposure to chemicals in groundwater, leachate, and sediment. These risks could be minimized by use of personal protective equipment and safety procedures.

7.6.3 Environmental Impacts

Environmental impact resulting from the proposed remedial actions would result from both recapping of the landfill and sediment removal. Capping (Alternative 5) would disturb the habitat of animals nesting on the landfill surface. Sediment removal (Alternatives 3 through 5) would disturb the habitat of aquatic and vegetative species living in sedimentation Basins A and B and the discharge channel from Basin B. Following installation of the cap and removal of the sediment, the construction areas would be replanted to restore these areas to their present condition.

7.6.4 Time Until Remedial Action Objectives are Achieved

Remedial action objectives associated with groundwater, leachate, and sediment are addressed by the construction activities. Time frames for achieving remedial action objectives for each media of concern are discussed below.

The remedial action objective for groundwater would be met upon completion of the system enhancement construction activities (Alternatives 4 and 5). It is estimated that installing manholes, removal of sediments from piping, characterizing the sediments, and off-site disposal of the sediments in an approved landfill, would take approximately 12 months.

The remedial action objective for leachate in Alternative 5 would be met upon completion of the RCRA Subtitle D cap, which would take 12 months. This time frame would include installation of the passive landfill gas system, various geosynthetic layers, soil layer, and revegetation.

The time frame for completion of the sediment removal response action (Alternatives 3 through 5) would be approximately six months. This time frame would include excavation, loading, off-site disposal, sampling and analysis of sediment from Basins A and B and the discharge channel from Basin B.

Based on this comparison, the short term effectiveness criterion would be satisfied by each of the five alternatives. In general, short term effectiveness would decrease with increasing alternative numbers, due to the increasing construction aspects of each subsequent alternative.

7.7 IMPLEMENTABILITY

This criterion considers factors, where appropriate, such as technical feasibility, administrative feasibility, and availability of services and materials.

7.7.1 Technical Feasibility

The components of each alternative would be technically feasible. Habitat enhancement (Alternatives 3 through 5) would be readily implementable and a beneficial use of the property. RCRA Subtitle D landfill cap installation (Alternative 5), cleaning sediment from the groundwater/leachate collection system (Alternatives 4 and 5), and removing contaminated sediment (Alternatives 3 through 5) would be readily implementable. The technologies are well developed and reliable methods of preventing on-site exposure to and off-site migration of contaminants. These remedial components would not inhibit implementation of further remedial components, if they should become required or appropriate. Monitoring of groundwater, leachate, landfill gas, and sediment (Alternatives 3 through 5) would be a reliable technology and be an adequate method to document successful performance of the remedial systems.

7.7.2 Administrative Feasibility

The components of each alternative would be administratively feasible. It might be necessary to obtain conventional construction permits, land disturbance permits, grading permits, etc. for the construction of the cap (Alternative 5), and enhancement of the groundwater/leachate collection system (Alternatives 4 and 5). It would be necessary to obtain a joint Corps of Engineers Section 404 and Pennsylvania Water Obstruction and Encroachment Permit for sediment removal (Alternatives 3 through 5). Institutional controls would require the assistance of City of Hermitage and South Pymatuning Township zoning board officials, and the services of attorneys (Alternatives 3 through 5).

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7.7.3 Availability of Services and Materials

Materials, services, and equipment required to implement all of the remedial activities in the five alternatives are readily available. The construction of the RCRA Subtitle D cap (Alternative 5) would utilize common construction materials and employ experienced contractors available locally. Sewer cleaning contractors would be readily available for enhancement of the groundwater/leachate system (Alternatives 4 and 5). Local contractors would be utilized to construct specific elements of the habitat enhancement program (Alternatives 3 through 5), remove contaminated sediment (Alternatives 3 through 5), and maintain the remedial components. Sampling and analytical services to perform monitoring (Alternatives 2 through 5) would be available in house, and from a local laboratory, respectively.

Based on this comparison, the implementability criterion would be satisfied by each of the five alternatives. All alternatives are 1) technically feasible, 2) administratively feasible, and 3) services and materials are readily available to implement the alternatives.

7.8 COST

This criterion addresses the cost of implementing each of the five alternatives. The cost of each alternative includes both direct and indirect capital costs, annual operations and maintenance costs, and net present worth calculation. Direct costs include expenditures for equipment, labor, and materials required to install the remedial systems. Indirect costs include expenditures for engineering and financial, and other services that are not part of the actual installation activities, but necessary for successful completion of the project. Operation and maintenance costs are post-construction costs necessary to ensure the continued effectiveness of the remedial systems. The present worth analysis is a calculation of the total project cost projected over 30 years assuming a five percent discount rate.

In general, alternative present net worth (PNW) costs increase with alternative number ranging from a low of $1,950,000 to a high of $12,957,000. Alternative 1 is significantly less than alternative 2. The cost range between alternative 2 through 4 is approximately $2 million. Alternative 5 adds an additional approximately $4 million, of which approximately $2.5 million is from capital costs associated with the substantial construction activities. A summary of the project costs for each alternative is included as Table 6-4. The cost detail is presented in Appendix A.

7.9 STATE ACCEPTANCE

Criterion 8 will be addressed in the Proposed Plan and the ROD after agency review of the Feasibility Study report.

7.10 COMMUNITY ACCEPTANCE

Criterion 9 will be addressed in the Responsiveness Summary following public comment on the Proposed Plan.

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Identification and Screening of Re[illegible]l Technologies and Process Options
River Road Landfill
Feasibility Study
Hermitage, Pennsylvania

Media	General Response Action	Remedial Technology	Process Option	Description	Applicability
Groundwater	No Action		None	No action.	NCP requires no action to be carried through to detailed analysis of alternatives.
	Groundwater Use Restrictions		Deed Restrictions	All deeds for property within potentially contaminated areas would include restrictions on property use.	Potentially applicable.
			Well Closure	Closure of drinking water wells and replacement as necessary within the affected area of influence.	Potentially applicable.
			Zoning Restrictions	Zoning restrictions would be established by local agencies for the groundwater pathway.	Potentially applicable.
	Monitoring		Monitoring	Long-term monitoring of site conditions and contaminant levels.	Currently in place.
	Gradient Controls	Vertical Barriers	Slurry Wall	Trench is excavated while filled with a bentonite water slurry. Trench is backfilled with a soil-bentonite or cement-bentonite mix.	Potentially applicable.
			Grout Curtain	Pressure injection of grout in a regular overlapping pattern of drilled holes.	Potentially applicable.
			Sheet Piles	Driven steel sheet piling.	Potentially applicable.
			Vibrating Beam Wall	Vibratory force used to advance steel beam into ground and injection of relatively thin wall of cement or bentonite as beam is withdrawn.	Potentially applicable.
			Soil Dam	In-situ placement of low permeability soil fill to cut off groundwater flow.	Currently in place.
		Horizontal Barriers	Grout Injection	Pressure injection of grout through closely spaced drilled holes.	Potentially applicable.
		Extraction and/or Recharge	Trenches	Trenches used to intercept migration of contaminated groundwater to receptors.	Potentially applicable.
			Drains	System of perforated pipe laid in trenches and backfilled with permeable media to intercept and collect contaminated groundwater.	Currently in place.
			Drain Enhancement	Cleanout of existing groundwater/ leachate collection system using high pressure water jets to remove fouling within the piping.	Potentially applicable.
			Extraction Wells	Wells installed to intercept contaminated groundwater and prevent migration to receptors.	Potentially applicable.
			Injection Wells (not carried forward)	Wells installed to inject uncontaminated water and limit contaminant migration.	Groundwater dam and collection system are effectively preventing downgradient contaminant migration.

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Identification and Screening of Re[illegible]al Technologies and Process Options
River Road Landfill
Feasibility Study
Hermitage, Pennsylvania

Media	General Response Action	Remedial Technology	Process Option	Description	Applicability
Groundwater	Direct Treatment On-site	Biological Treatment	Aerobic	Use microorganisms in an aerobic environment to degrade organics.	Potentially applicable.
			Anaerobic	Use microorganisms in an anaerobic environment to degrade organics.	Potentially applicable.
		Chemical Treatment	Precipitation	Alteration of chemical equilibrium to reduce contaminant solubility.	Potentially applicable.
			Oxidation	Chemical oxidation of groundwater contaminants using an oxidizing agent such as peroxide hypochlorite, chlorine gas, or ozone.	Potentially applicable.
			Photolysis	Photodegradation of contaminants using UV radiation or addition of polar solvents.	Potentially applicable.
			Reduction	Reduction of chlorinated organics and hexavalent chromium.	Potentially applicable.
		Physical Treatment	Air Stripping	Contact of large volumes of air with water in a packed column or through diffused aeration to promote transfer of VOCs to air.	Potentially applicable.
			Steam Stripping	Similar to air stripping except steam is pumped into stripping column to add heat in the volatilization of VOCs from liquid to air.	Potentially applicable.
			Carbon Adsorption	Passage of contaminated water over columns of activated carbon where contaminants adsorb onto the carbon surface.	Potentially applicable.
			Reverse Osmosis	Use of high pressure to force clean water through a membrane leaving contaminants behind.	Potentially applicable.
			Ion Exchange	Contaminated water is passed through a bed of resin material where exchange of ions occurs between the bed and the water.	Potentially applicable.
			Spray Evaporation	Contaminated water sprayed into the air where VOCs are transferred from the water. Large collection ponds receive spray water.	Potentially applicable.
		Thermal Destruction	Incineration	Thermal destruction of organic contaminants using any one of many reactor types suited to handle aqueous wastes.	Not applicable due to destruction of a primarily aqueous liquid.
			Wet Air Oxidation	Oxidation of organic contaminants at elevated temperatures and pressures.	Not applicable due to destruction of a primarily aqueous liquid.

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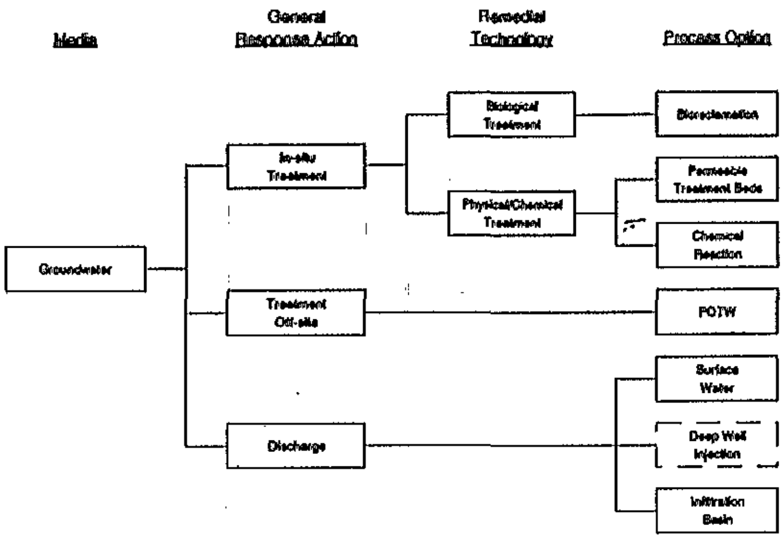
Identification and Screening of Re... al Technologies and Process Options
River Road Landfill
Feasibility Study
Hermitage, Pennsylvania



Process Option	Description	Applicability
Bioreclamation	System of injection and extraction wells used to inject aerated water possibly seeded with bacteria and/or nutrients to biodegrade contaminants.	Potentially applicable.
Permeable Treatment Beds	Trenches downgradient of site backfilled with activated carbon, lime, or ion exchange resins to remove contaminants as groundwater passes through.	Potentially applicable.
Chemical Reaction	System of injection wells used to inject oxidizers such as ozone, permanganate, or hydrogen peroxide for degradation of organics.	Potentially applicable.
POTW	Transport groundwater to POTW for treatment.	Currently in-place.
Surface Water	Discharge groundwater to local surface water.	Potentially applicable.
Deep Well Injection	Discharge groundwater to an on-site/off-site regulated deep well injection system.	Not generally accepted by regulatory authorities.
Infiltration Basin	Discharge allowed to infiltrate into soil through a basin.	Potentially applicable.

LEGEND
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Identification and Screening of Ren... Technologies and Process Options
River Road Landfill
Feasibility Study
Hermitage, Pennsylvania

Media	General Response Action	Remedial Technology	Process Option	Description	Applicability
Leachate	No Action		None	No action.	NCP requires no action to be carried through to detailed analysis of alternatives.
	Leachate Use Restrictions		Deed Restrictions	All deeds for property within landfill area would include restrictions on property use.	Potentially applicable.
			Well Closure	Closure of drinking water wells and replacement as necessary within the affected area of influence.	Potentially applicable.
			Zoning Restrictions	Zoning restrictions would be established by local agencies for leachate use.	Potentially applicable.
	Monitoring		Monitoring	Long-term monitoring of site conditions and contamination levels.	Currently in place.
	Containment	Cap	Pavement	Application of a layer of asphalt or asphaltic concrete.	Potentially applicable.
			PA Solid Waste-Type Cap	Cap which complies with 25 PA Section 75, which includes two feet of suitable fill material.	Currently in place.
			RCRA Subtitle D Cap	Placement of a clay or synthetic liner over the landfill to reduce rainwater infiltration and leachate generation.	Potentially applicable.
			RCRA Subtitle C Cap (not carried forward)	Flexible membrane liner followed by a drainage/filter layer and cover soil to provide erosion and moisture control.	Not applicable. Facility is a solid waste landfill.
		Surface Stabilization	Grading	Mechanically reshape site to manage surface water.	Currently in place.
			Revegetation	Establish vegetative cover to stabilize surface soils.	Currently in place.
			Habitat Enhancement	Establish vegetative cover over the landfill that will attract rare species of birds and stabilize surface soils.	Potentially applicable.

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Identification and Screening of Re... al Technologies and Process Options
River Road Landfill
Feasibility Study
Hermitage, Pennsylvania

Media	General Response Action	Remedial Technology	Process Option	Description	Applicability
Leachate	Gradient Controls	Vertical Barriers	Slurry Wall	Trench is excavated while filled with a bentonite water slurry. Trench is backfilled with a soil-bentonite or cement-bentonite mix.	Potentially applicable.
			Grout Curtain	Pressure injection of grout in a regular overlapping pattern of drilled holes.	Potentially applicable.
			Sheet Piles	Driven steel sheetpiling.	Potentially applicable.
			Vibrating Beam Wall	Vibratory force used to advance steel beam into ground and injection of relatively thin wall of cement or bentonite as beam is withdrawn.	Potentially applicable.
			Soil Dam	In-situ placement of low permeability soil fill to promote leachate collection in the adjacent groundwater/ leachate collection system.	Currently in place.
		Horizontal Barriers (not carried forward)	Grout Injection (not carried forward)	Pressure injection of grout through closely spaced drilled holes.	Technology effectively repairs existing barriers, but can not create a new barrier to leachate flow.
		Extraction and/or Recharge	Trenches	Trenches used to intercept migration of contaminated leachate to receptors.	Potentially applicable.
			Drains	System of perforated pipe laid in trenches and backfilled with permeable media to intercept and collect contaminated leachate.	Currently in place.
			Drain Enhancement	Cleanout of existing groundwater/ leachate collection system using high pressure water jets to remove fouling within the piping.	Potentially applicable.
			Extraction Wells	Wells installed to intercept contaminated leachate and prevent migration to receptors.	Potentially applicable.
			Injection Wells (not carried forward)	Wells installed to inject uncontaminated water and limit contaminant migration.	Groundwater dam and groundwater/leachate collection system control water level on groundwater side of landfill.

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Identification and Screening of Rem... Technologies and Process Options
River Road Landfill
Feasibility Study
Hermitage, Pennsylvania

Media	General Response Action	Remedial Technology	Process Option	Description	Applicability
Leachate	Direct Treatment On-site	Biological Treatment	Aerobic	Use microorganisms in an aerobic environment to degrade organics.	Potentially applicable.
			Anaerobic	Use microorganisms in an anaerobic environment to degrade organics.	Potentially applicable.
		Chemical Treatment	Precipitation	Alteration of chemical equilibrium to reduce contaminant solubility.	Potentially applicable.
			Oxidation	Chemical oxidation of groundwater contaminants using an oxidizing agent such as peroxide hypochlorite, chlorine gas, or ozone.	Potentially applicable.
			Photolysis	Photodegradation of contaminants using UV radiation or addition of polar solvents.	Potentially applicable.
			Reduction	Reduction of chlorinated organics and hexavalent chromium.	Potentially applicable.
		Physical Treatment	Air Stripping	Contact of large volumes of air with water in a packed column or through diffused aeration to promote transfer of VOCs to air.	Potentially applicable.
			Steam Stripping	Similar to air stripping except steam is pumped into stripping column to add heat in the volatilization of VOCs from liquid to air.	Potentially applicable.
			Carbon Adsorption	Passage of contaminated water over columns of activated carbon where contaminants adsorb onto the carbon surface.	Potentially applicable.
			Reverse Osmosis	Use of high pressure to force clean water through a membrane leaving contaminants behind.	Potentially applicable.
			Ion Exchange	Contaminated water is passed through a bed of resin material where exchange of ions occurs between the bed and the water.	Potentially applicable.
			Spray Evaporation	Contaminated water sprayed into the air where VOCs are transferred from the water. Large collection ponds receive spray water.	Potentially applicable.
		Thermal Destruction	Incineration	Thermal destruction of organic contaminants using any one of many reactor types suited to handle aqueous wastes.	Not applicable due to high aqueous content of leachate.
			Wet Air Oxidation	Oxidation of organic contaminants at elevated temperatures and pressures.	Not applicable due to high aqueous content of leachate.

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Identification and Screening of Re... Technologies and Process Options
River Road Landfill
Feasibility Study
Hermitage, Pennsylvania

Media	General Response Action	Remedial Technology	Process Option	Description	Applicability
Leachate	In-situ Treatment	Biological Treatment	Bioreclamation	System of injection and extraction wells used to inject aerated water possibly seeded with bacteria and/or nutrients to biodegrade contaminants.	Potentially applicable.
		Physical/Chemical Treatment	Permeable Treatment Beds	Trenches downgradient of landfill backfilled with activated carbon, lime, or ion exchange resins to remove contaminants as leachate passes through.	Potentially applicable.
			Chemical Reaction	System of injection wells used to inject oxidizers such as ozone, permanganate, or hydrogen peroxide for degradation of organics.	Potentially applicable.
	Treatment Off-site		POTW	Transport leachate to POTW for treatment.	Currently in place.
	Discharge		Surface Water	Discharge treated leachate to local surface water.	Potentially applicable.
			Deep Well Injection	Discharge treated leachate to an on-site/off-site regulated deep well injection system.	Not generally accepted by regulatory authorities.
			Infiltration Basin	Discharge allowed to infiltrate into soil through a basin.	Potentially applicable.

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Table 4-1

Identification and Screening of Re[illegible]chnologies and Process Options
River Road Landfill
Feasibility Study
Hermitage, Pennsylvania

Media	General Response Action	Remedial Technology	Process Option	Description	Applicability
Sediment	No Action		None	No action.	NCP requires no action to be carried through to detailed analysis of alternatives.
	Access Restrictions		Deed Restrictions	All deeds for property within potentially contaminated areas would include restrictions on use of property.	Potentially applicable.
			Fence	Fence would be installed around contaminated area and repaired as necessary.	Currently in place.
			Zoning Restrictions	Zoning restrictions would be established by local agencies for potentially contaminated areas.	Potentially applicable.
	Monitoring		Monitoring	Long-term monitoring of site conditions and contamination levels.	Currently in place.
	Surface Stabilization		Grading	Mechanically reshape site grades to manage surface water.	Potentially applicable.
			Revegetation	Establish vegetative cover to stabilize sediment.	Potentially applicable.
	Removal and Disposal	Excavate and Landfill	Off-site Landfill	Permanent storage of contaminated sediments at an approved landfill.	Potentially applicable.
			On-site Disposal	Consolidation of contaminated sediments on-site.	Potentially applicable.
	Treatment Off-site	Thermal Destruction	Off-site Incinerator	Thermal destruction of contaminated solids and liquids in approved RCRA-permitted incinerator.	Not applicable due to low organic contaminant concentrations.
		Biological Treatment	Licensed Landfarm	Sediment spread over land in a licensed landfarm. Biological degradation occurs in aerated and nutrient-rich sediment.	Not applicable due to low organic contaminant concentrations.

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Identification and Screening of R[illegible] [illegible]l Technologies and Process Options
River Road Landfill
Feasibility Study
Hermitage, Pennsylvania

Media	General Response Action	Remedial Technology	Process Option	Description	Applicability
Sediment	In-situ Control/Treatment	Biological Treatment	Biodegradation	Nutrients, oxygen, and microorganisms are added to the subsurface environment to promote biological degradation.	Not applicable due to low concentration of organic contaminants.
			Bioharvesting	Use of plant and animal species to accumulate contaminants in their tissues. Species are harvested and disposed.	Not applicable due to low concentration of organic contaminants.
		Chemical Treatment	Oxidation	Underground injection of chemicals such as ozone, hydrogen peroxide, or permanganate for degradation of organics.	Not applicable due to low concentration of organic contaminants.
			Reduction	Underground injection of reducing chemicals in which the oxidation state of the compound is reduced.	Not applicable due to low concentration of organic contaminants.
			Soil Aeration	Aeration of sediment via injection wells. Used to promote microbial biodegradation and to strip VOCs from the sediment.	Not applicable due to low concentration of organic contaminants.
			Vapor Extraction	Removal of VOCs by application of vacuum on sediment through a system of wells.	Not applicable due to low concentration of organic contaminants.
		Physical Treatment	Fixation	Sediment mixed or injected with sorbent material which can fix contaminants and stabilize sediment mass.	Not applicable due to low concentration of organic contaminants.
			Vitrification	Contaminated material is fused into glassy stable material by heating it in place with an electric current.	Not applicable due to low concentration of organic contaminants.
			Solvent Extraction	Application of solvent either via surface flooding or injection and collection of extract at wells followed by treatment.	Not applicable due to low concentration of organic contaminants.

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Identification and Screening of Re. chnologies and Process Options
River Road Landfill
Feasibility Study
Hermitage, Pennsylvania

Media	General Response Action	Remedial Technology	Process Option	Description	Applicability
Sediment	Direct Treatment On-site	Biological Treatment	Composting	Materials placed in controlled environment with addition of heat and air to aid microbial degradation of organics.	Not applicable due to low concentration of organic contaminants.
		Chemical Treatment	Oxidation	Oxidizer such as ozone, hydrogen peroxide, or permanganate is introduced into a reactor where it mixes with sediment and oxidation occurs.	Not applicable due to low concentration of organic contaminants.
			Dechlorination Process	Sodium reagent used to strip chlorine atoms from chlorinated hydrocarbons.	Not applicable due to low concentration of organic contaminants.
			Wet Air Oxidation	Oxidation of organics in a reactor under high temperature and pressure.	Not applicable due to low concentration of organic contaminants.
			Reduction	Reduction of chlorinated organics and hexavalent chromium.	Not applicable due to low concentration of organic contaminants.
		Physical Treatment	Solvent Extraction	Solvent is introduced into reactor where it mixes with solids. Extract is collected and later treated.	Not applicable due to low concentration of organic contaminants.
			Retrievable Sorbants	Absorbent materials with ability to concentrate contaminants are mixed with sediment. Use of magnetic particles in sorbents allows their collection and removal.	Not applicable due to low concentration of organic contaminants.
			Sediment Washing	Use of water or steam to wash contaminants from sediment.	Not applicable due to low concentration of organic contaminants.
			Thermal Volatilization	VOC volatilization in a sediment drying unit.	Not applicable due to low concentration of organic contaminants.
			Fixation	Solidification or stabilization of wastes using sulfide, lime, cement, molten glass, or various proprietary or patented products.	Not applicable due to low concentration of organic contaminants.
		Thermal Destruction	Pyrolysis	Solids are burned in an oxygen deficient atmosphere to produce char residue and VOC gases which are then incinerated.	Not applicable due to low concentration of organic contaminants.
			Rotary Kiln	Solids are fed into a horizontally rotating cylinder designed for uniform heat transfer.	Not applicable due to low concentration of organic contaminants.
			Multiple Hearth	Solids are burned in a reactor consisting of a rotating central shaft and a series of flat hearths.	Not applicable due to low concentration of organic contaminants.
			Fluidized Bed	Solids are added to a hot agitated bed of sand where heat transfer and combustion occur.	Not applicable due to low concentration of organic contaminants.
			Molten Salt	Solids are fed into a furnace with a molten salt bed acting as a catalyst and dispersing medium for incinerating wastes.	Not applicable due to low concentration of organic contaminants.
			Infrared	Combustion of solids in a horizontal rectangular chamber using electric infrared heat.	Not applicable due to low concentration of organic contaminants.

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TABLE 4-2

Evaluation and Selection of Process Options (1)
River Road Landfill
Feasibility Study
Hermitage, Pennsylvania

Media	General Response Action	Remedial Technology	Process Option	Effectiveness	Implementability	Cost
Groundwater	No Action		None	Does not achieve remedial action objectives.	Not acceptable.	None.
	Groundwater Use Restrictions		Deed Restrictions	Effective for limiting potential exposure to contaminants.	Readily implementable.	Negligible.
			Well Closure	Effective for limiting potential exposure to contaminants.	Readily implementable.	Negligible.
			Zoning Restrictions	Effective for limiting potential exposure to contaminants.	Readily implementable.	Negligible.
	Monitoring		Monitoring	Effective for documenting groundwater quality and collection system effectiveness.	Currently in place.	Low capital, low O&M.
	Gradient Controls	Vertical Barriers	Slurry Wall (c)	Effective for controlling downgradient groundwater impact.	Readily implementable.	Moderate capital, low O&M.
			Grout Curtain (c)	Effective for controlling downgradient groundwater impact.	Readily implementable.	High capital, low O&M.
			Sheet Piles (c)	Effective for controlling downgradient groundwater impact.	Readily implementable.	High capital, low O&M.
			Vibrating Beam Wall (c)	Effective for controlling downgradient groundwater impact.	Readily implementable.	High capital, low O&M.
			Soil Dam	Effective for controlling downgradient groundwater impact.	Currently in place.	Low capital, low O&M.
		Horizontal Barriers	Grout Injection (a)	Uncertain effectiveness for controlling downgradient groundwater impact.	Difficult to implement.	High capital, low O&M.
		Extraction and/or Recharge	Trenches (c)	Effective for directing groundwater flow.	Readily implementable.	High capital, low O&M.
			Drains	Effective for the collection of contaminated groundwater.	Currently in place.	Low capital, moderate O&M.
			Drain Enhancement	Effective for enhancing the collection of contaminated groundwater.	Readily implementable.	Low capital, moderate O&M.
			Extraction Wells (c)	Effective for the collection of contaminated groundwater.	Readily implementable.	Moderate capital, moderate O&M.

LEGEND
[dashed box] Not carried forward

Notes:
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TABLE 4-2

Evaluation and Selection of Process Options (1)
River Road Landfill
Feasibility Study
Hermitage, Pennsylvania

Media	General Response Action	Remedial Technology	Process Option	Effectiveness	Implementability	Cost
Groundwater	Direct Treatment On-site	Biological Treatment	Aerobic (a)	Existing POTW discharge and treatment system more effective than smaller scale on-site treatment.	Readily implementable.	Moderate capital, moderate O&M.
			Anaerobic (a)	Existing POTW discharge and treatment system more effective than smaller scale on-site treatment.	Readily implementable.	Moderate capital, moderate O&M.
		Chemical Treatment	Precipitation (a)	Existing POTW discharge and treatment system more effective than smaller scale on-site treatment.	Readily implementable.	Moderate capital, moderate O&M.
			Oxidation (a)	Existing POTW discharge and treatment system more effective than smaller scale on-site treatment.	Readily implementable.	Moderate capital, moderate O&M.
			Photolysis (a)	Existing POTW discharge and treatment system more effective than smaller scale on-site treatment.	Readily implementable.	Moderate capital, moderate O&M.
			Reduction (a)	Existing POTW discharge and treatment system more effective than smaller scale on-site treatment.	Readily implementable.	Moderate capital, moderate O&M.
		Physical Treatment	Air Stripping (a)	Existing POTW discharge and treatment system more effective than smaller scale on-site treatment.	Readily implementable.	Moderate capital, moderate O&M.
			Steam Stripping (a)	Existing POTW discharge and treatment system more effective than smaller scale on-site treatment.	Readily implementable.	Moderate capital, moderate O&M.
			Carbon Adsorption (a)	Existing POTW discharge and treatment system more effective than smaller scale on-site treatment.	Readily implementable.	Moderate capital, high O&M.
			Reverse Osmosis (a)	Existing POTW discharge and treatment system more effective than smaller scale on-site treatment.	Readily implementable.	High capital, moderate O&M.
			Ion Exchange (a)	Existing POTW discharge and treatment system more effective than smaller scale on-site treatment.	Readily implementable.	Moderate capital, high O&M.
			Spray Evaporation (a)	Existing POTW discharge and treatment system more effective than smaller scale on-site treatment.	Readily implementable.	Moderate capital, moderate O&M.

LEGEND
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TABLE 4-2

Evaluation and Selection of Process Options (1)
River Road Landfill
Feasibility Study
Hermitage, Pennsylvania

Media	General Response Action	Remedial Technology	Process Option	Effectiveness	Implementability	Cost
Groundwater	In-situ Treatment	Biological Treatment	Bioreclamation (a)	Uncertain effectiveness. Pilot study would be required to determine effectiveness.	Readily implementable.	Moderate capital, moderate O&M.
		Physical/Chemical Treatment	Permeable Treatment Beds (a)	Uncertain effectiveness. Pilot study would be required to determine effectiveness.	Readily implementable.	High capital, moderate O&M.
			Chemical Reaction (a)	Uncertain effectiveness. Pilot study would be required to determine effectiveness.	Readily implementable.	High capital, moderate O&M.
	Treatment Off-site		POTW	Effective for removing contamination from the site.	Currently in place.	Low capital, moderate O&M.
	Discharge		Surface Water (a)	Existing POTW discharge and treatment system more effective than smaller scale on-site treatment.	Readily implementable.	Moderate capital, moderate O&M.
			Infiltration Basin (a)	Existing POTW discharge and treatment system more effective than smaller scale on-site treatment.	Readily implementable.	High capital, moderate O&M.

LEGEND
Not carried forward

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(c) Not carried forward due to cost limitations.

TABLE 4-2

Evaluation and Selection of Process Options (1)
River Road Landfill
Feasibility Study
Hermitage, Pennsylvania

Media	General Response Action	Remedial Technology	Process Option	Effectiveness	Implementability	Cost
Leachate	No Action		None	Does not achieve remedial action objectives.	Not acceptable.	None.
	Leachate Use Restrictions		Deed Restrictions	Effective for limiting potential access to contaminants.	Readily implementable.	Negligible.
			Well Closure	Effective for eliminating potential access to contaminants.	Readily implementable.	Negligible.
			Zoning Restrictions	Effective for limiting potential access to contaminants.	Readily implementable.	Negligible.
	Monitoring		Monitoring	Effective for documenting leachate quality and contaminant concentrations.	Currently in place.	Low capital, low O&M.
	Containment	Cap	Pavement (b)	Effective for reducing leachate generation and promoting surface runoff.	Difficult to implement over entire landfill.	Moderate capital, low O&M.
			PA Solid Waste-Type Cap	Effective for reducing leachate generation and promoting surface runoff.	Currently in place.	Moderate capital, low O&M.
			RCRA Subtitle D Cap	Effective for reducing leachate generation and promoting surface water runoff.	Readily implementable.	High capital, low O&M.
		Surface Stabilization	Grading	Effective for promoting surface water runoff.	Readily implementable.	Low capital, low O&M.
			Revegetation	Effective for preventing erosion.	Readily implementable.	Low capital, low O&M.
			Habitat Enhancement	Effective for preventing erosion.	Readily implementable.	Low capital, low O&M.

LEGEND
[dashed box] Not carried forward

Notes:
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TABLE 4-2

Evaluation and Selection of Process Options (1)
River Road Landfill
Feasibility Study
Hermitage, Pennsylvania

Media	General Response Action	Remedial Technology	Process Option	Effectiveness	Implementability	Cost
Leachate	Gradient Controls	Vertical Barriers	Slurry Wall (c)	Effective for controlling leachate flow.	Readily implementable.	Moderate capital, low O&M.
			Grout Curtain (c)	Effective for controlling leachate flow.	Readily implementable.	High capital, low O&M.
			Sheet Piles (c)	Effective for controlling leachate flow.	Readily implementable.	High capital, low O&M.
			Vibrating Beam Wall (c)	Effective for controlling leachate flow.	Readily implementable.	High capital, low O&M.
			Soil Dam	Effective for controlling leachate flow.	Currently in place.	Low capital, low O&M.
		Extraction and/or Recharge	Trenches (c)	Effective for directing leachate flow.	Readily implementable.	High capital, low O&M.
			Drains	Effective for the collection of leachate.	Currently in place.	Low capital, moderate O&M.
			Drain Enhancement	Effective for the collection of leachate.	Readily implementable.	Low capital, moderate O&M.
			Extraction Wells (c)	Effective for the removal of leachate.	Readily implementable.	Moderate capital, moderate O&M.

LEGEND
[dashed box] Not carried forward

Notes:
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TABLE 4-2

Evaluation and Selection of Process Options (1)
River Road Landfill
Feasibility Study
Hermitage, Pennsylvania

Media	General Response Action	Remedial Technology	Process Option	Effectiveness	Implementability	Cost
Leachate	Direct Treatment On-site	Biological Treatment	Aerobic (a)	Existing POTW discharge and treatment system more effective than smaller scale on-site treatment.	Readily implementable.	Moderate capital, moderate O&M.
			Anaerobic (a)	Existing POTW discharge and treatment system more effective than smaller scale on-site treatment.	Readily implementable.	Moderate capital, moderate O&M.
		Chemical Treatment	Precipitation (a)	Existing POTW discharge and treatment system more effective than smaller scale on-site treatment.	Readily implementable.	Moderate capital, moderate O&M.
			Oxidation (a)	Existing POTW discharge and treatment system more effective than smaller scale on-site treatment.	Readily implementable.	Moderate capital, moderate O&M.
			Photolysis (a)	Existing POTW discharge and treatment system more effective than smaller scale on-site treatment.	Readily implementable.	Moderate capital, moderate O&M.
			Reduction (a)	Existing POTW discharge and treatment system more effective than smaller scale on-site treatment.	Readily implementable.	Moderate capital, moderate O&M.
		Physical Treatment	Air Stripping (a)	Existing POTW discharge and treatment system more effective than smaller scale on-site treatment.	Readily implementable.	Moderate capital, moderate O&M.
			Steam Stripping (a)	Existing POTW discharge and treatment system more effective than smaller scale on-site treatment.	Readily implementable.	Moderate capital, moderate O&M.
			Carbon Adsorption (a)	Existing POTW discharge and treatment system more effective than smaller scale on-site treatment.	Readily implementable.	Moderate capital, high O&M.
			Reverse Osmosis (a)	Existing POTW discharge and treatment system more effective than smaller scale on-site treatment.	Readily implementable.	High capital, moderate O&M.
			Ion Exchange (a)	Existing POTW discharge and treatment system more effective than smaller scale on-site treatment.	Readily implementable.	Moderate capital, high O&M.
			Spray Evaporation (a)	Existing POTW discharge and treatment system more effective than smaller scale on-site treatment.	Readily implementable.	Moderate capital, moderate O&M.

LEGEND

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TABLE 4-2

Evaluation and Selection of Process Options (1)
River Road Landfill
Feasibility Study
Hermitage, Pennsylvania

Media	General Response Action	Remedial Technology	Process Option	Effectiveness	Implementability	Cost
Leachate	In-Situ Treatment	Biological Treatment	Bioreclamation (a)	Uncertain effectiveness. Pilot study would be required to determine effectiveness.	Readily implementable.	Moderate capital, moderate O&M.
		Physical/Chemical Treatment	Permeable Treatment Beds (a)	Uncertain effectiveness. Pilot study would be required to determine effectiveness.	Readily implementable.	High capital, moderate O&M.
			Chemical Reaction (a)	Uncertain effectiveness. Pilot study would be required to determine effectiveness.	Readily implementable.	High capital, moderate O&M.
	Treatment Off-site		POTW	Effective for removal of contamination from the site.	Currently in place.	Low capital, moderate O&M.
	Discharge		Surface Water (a)	Existing POTW discharge and treatment system more effective than smaller scale on-site treatment.	Readily implementable.	Moderate capital, moderate O&M.
			Infiltration Basin (a)	Existing POTW discharge and treatment system more effective than smaller scale on-site treatment.	Readily implementable.	High capital, moderate O&M.

LEGEND

Not carried forward

Notes:

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2 Process options were not carried forward for the reasons listed below.
(a) Not carried forward due to effectiveness limitations.
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TABLE 4-2

Evaluation and Selection of Process Options (1)
River Road Landfill
Feasibility Study
Hermitage, Pennsylvania

Media	General Response Action	Remedial Technology	Process Option	Effectiveness	Implementability	Cost
Sediment	No Action		None	Does not achieve remedial action objectives.	Not acceptable.	None.
	Access Restrictions		Deed Restrictions	Effective for eliminating potential exposure to contaminants.	Readily implementable.	Negligible.
			Fence	Effective for limiting potential exposure to contaminants.	Currently in place.	Negligible.
			Zoning Restrictions	Effective for limiting potential exposure to contaminants.	Readily implementable.	Negligible.
	Monitoring		Monitoring	Effective for documenting the performance of on-site remedial actions.	Currently in place.	Low capital, low O&M.
	Surface Stabilization		Grading (a)	Does not eliminate potential exposure to site sediments.	Readily implementable.	Moderate capital, low O&M.
			Revegetation (a)	Does not eliminate potential exposure to site sediments.	Readily implementable.	Moderate capital, low O&M.
	Removal and Disposal	Excavate and Landfill	Off-site Landfill	Effective for disposal of contaminated site sediment.	Readily implementable.	Low capital, low O&M.
			On-site Disposal (c)	Effective for limiting potential exposure to contaminants.	Readily implementable.	Moderate capital, low O&M.

LEGEND
[dashed box] Not carried forward

Notes:
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(c) Not carried forward due to cost limitations.

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Table 6-1
Chemical Specific ARARs and Criteria, Advisories, and Guidance to be Considered

Medium/ Authority	Requirement	Status	Requirement/Applicability	Alternatives 1	2	3	4	5	Consideration in FS
Groundwater									
Federal Regulatory Requirement	Safe Drinking Water Act of 1974 (42 U.S.C. 300(l)) Maximum Contaminant Levels (40 CFR 141.11 - 141.16), Maximum Contaminant Goals (40 CFR 141.50 - 141.51), and Secondary Maximum Contaminant Levels (40 CFR 143.3)	ARAR	Enforceable numerical standards for public water supplies. Site groundwater is not and will not be used for drinking water purposes.						Will be considered when selecting groundwater remedial actions.
Federal Criteria, Advisories, and Guidance	*Clean Water Act* (33 U.S.C. 1251) Section 304 - Water Quality Criteria (WQC)	TBC	Federal WQC are health-based criteria that have been developed for numerous compounds		X	X	X	X	WQC will be considered in characterizing human health risks associated with consumption of possibly contaminated groundwater
Federal Criteria, Advisories, and Guidance	Health Effects Assessments for (Specific Chemicals)., ECAO, U.S. EPA, 1985	TBC	Health effect assessments (HEA) and proposed HEA published by U.S. EPA		X	X	X	X	Groundwater monitoring programs will consider relevant items discussed in this guidance manual
Federal Criteria, Advisories, and Guidance	*Verified Reference Doses of U.S. EPA* ECAO-CIN 475, January 1986	TBC	Federal Advisory Document		X	X	X	X	Groundwater monitoring programs will consider relevant items discussed in this guidance manual.
Federal Criteria, Advisories, and Guidance	Health Advisories, U.S. EPA Office of Water	TBC	Federal advisories established to protect consumers from unhealthful water		X	X	X	X	These advisory levels will be considered when evaluating levels of contaminants found in groundwater.

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Table 6-1
Chemical Specific ARARs and Criteria, Advisories, and Guidance to be Considered

Medium/ Authority	Requirement	Status	Requirement/Applicability	Alternatives 1	2	3	4	5	Consideration in FS
Groundwater (Cont.)									
Federal Criteria, Advisories, and Guidance	Water Quality Advisories, U.S. EPA Office of Water, Criteria, and Standards Division.	TBC	Federal Advisory Document		X	X	X	X	These advisory levels will be considered when evaluating levels of contaminants found in groundwater.
Federal Criteria, Advisories, and Guidance	U.S. EPA Office of Water Guidance Documents, including: Groundwater/UIC Guidance Documents; Groundwater Protection Strategy; Clean Water Act Guidance Document	TBC	Federal Advisory Documents		X	X	X	X	These advisory levels will be considered when evaluating levels of contaminants found in groundwater.
State Regulatory Requirement	Pennsylvania (PA) Safe Drinking Water Act of 1984	ARAR	State standards for drinking water quality. Site groundwater is not and will not be used for drinking water purposes						Will be considered when selecting groundwater remedial actions
State Regulatory Requirement	PA Groundwater Protection Strategy (February 1992)	TBC	Describes PA's strategy for groundwater protection and remediation		X	X	X	X	Will be considered when selecting groundwater remedial actions

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Table 6-1

Chemical Specific ARARs and Criteria, Advisories, and Guidance to be Considered

Medium/ Authority	Requirement	Status	Requirement/Applicability	Alternatives 1	2	3	4	5	Consideration in FS
Discharge to Surface Water									
State Regulatory Requirement	PA Water Quality Standards Title 25, Section 93 of PA Code	ARAR	State standards for quality of water discharged to streams		X	X	X	X	Will be considered in evaluating any remedial actions involving sedimentation basin discharge
State Regulatory Requirement	PA National Pollutant Discharge *Elimination System* Title 25, Section 92, 102, 111 of PA Code	ARAR	State requirements for limitations on stormwater discharges		X	X	X	X	Will be considered in evaluating any remedial actions involving sedimentation basin discharge
State Regulatory Requirement	PA Water Quality Criteria Title 25, Section 16 of PA Code	ARAR	State requirements for specific chemicals in surface water discharges		X	X	X	X	Will be considered in evaluating any remedial actions involving sedimentation basin discharge
Leachate									
Local Regulatory Requirement	USVPCA Industrial Waste Discharge Permit	ARAR	Established maximum concentrations and loading rates for leachate constituents in effluent discharged to POTW		X	X	X	X	Will be considered in implementation of remedial actions involving leachate collection and discharge

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Table 6-1

Chemical Specific ARARs and Criteria, Advisories, and Guidance to be Considered

Medium/ Authority	Requirement	Status	Requirement/Applicability	Alternatives					Consideration in FS
				1	2	3	4	5	
Air									
State Regulatory Requirement	PA Air Pollution Control Regulations Title 25, Section 121-143	ARAR	Prohibits air pollution in the state of PA; establishes rules for sources, including sampling and testing requirements; establishes emission standards					X	Will be considered when evaluating site landfill gas emissions from a passive landfill gas venting system.

Table 6-2
Action Specific ARARs and Criteria, Advisories, and Guidance to be Considered

Authority	Requirement	Status	Requirement Synopsis	Alternatives 1	2	3	4	5	Consideration in FS
Design Standards									
State Regulatory Requirement	Solid Waste Management Title 25, Chapter 75.24 of PA Code Dated May 24, 1977	ARAR	Specifies requirements for landfill closure in 1986, 1987		X	X	X		Represents legally applicable requirements for landfill cap design
State Regulatory Requirement	PA Residual Waste Landfill Rules Title 25, Chapter 288 of PA Code	ARAR	Establishes requirements for final cover, and landfill gas system					X	Will be considered if selected remedial action includes capping
Federal Guidance Documents	EPA's RCRA Design Guidelines Permitting Guidance Manuals Technical Resource Documents	TBC	Design of remedial systems Performance of rem. systems Technical guidance			X	X	X	These documents will be cosidered when evaluating potential remedial systems.
Monitoring									
State Regulatory Requirement	Closure and Post-Closure Plan September 1987	ARAR	Established basis for current monitoring plan		X	X	X	X	Will be considered in developing groundwater monitoring program
State criteria, advisories, and guidance	Guidance Manual for Landfill Gas Management	TBC	Describes landfill gas management practices and procedures		X	X	X	X	Will be considered if landfill gas management is a component of selected remedial actions
Local Regulatory Requirement	USVPCA Industrial Waste Discharge Permit	ARAR	Established monitoring requirements for effluent discharges from leachate collection system to POTW		X	X	X	X	Will be considered in any monitoring program established for discharge of leachate to POTW
Surface Water Discharge									
State Regulatory Requirement	PA Clean Streams Law Title 25, Act 95 of PA Code	ARAR	Sets forth requirements to protect and ensure integrity of state's streams		X	X	X	X	Will be considered in any remedial actions which may potentially affect the Shenango River

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Table 6-2
Action Specific ARARs and Criteria, Advisories, and Guidance to be Considered

Authority	Requirement	Status	Requirement Synopsis	Alternatives					Consideration in FS
				1	2	3	4	5	
OSHA									
Federal Regulatory Requirement	29 CFR 1910	ARAR	Establishes general industry standards for worker protection			X	X	X	Will be considered in any remedial action which may potentially expose workers to hazardous wastes
Federal Regulatory Requirement	29 CFR 1926	ARAR	Establishes health and safety protocols for construction work			X	X	X	Will be considered in any remedial actions involving construction work
Erosion Control									
State Regulatory Requirement	Title 25, Chapter 102 of PA Code	ARAR	Establishes requirements for sedimentation/erosion controls			X	X	X	Will be considered if excavation and earth moving are a component of selected remedial actions

Table 6-3

Location Specific ARARs and Criteria, Advisories, and Guidance to be Considered

Authority	Requirement	Status	Requirement Synopsis	Alternatives 1	2	3	4	5	Consideration in FS
Federal Regulatory Requirement	Clean Water Act 40 CFR 6	ARAR	Establishes requirements for constructing in floodplains			X	X	X	Will be considered in remedial actions which occur within the 100 yr floodplain of the Shenango River
Federal Regulatory Requirement	U.S. Army Corps of Engineers Permit Program Rules 40 CFR 320	ARAR	Establishes statutory framework for review of permits controlling certain activities			X	X	X	Will be considered in remedial actions affecting discharge from the sedimentation basins
State Regulatory Requirement	Floodplain Management Act of 1978, P.L. 851, No. 166 Dam Safety and Encroachment Act of 1978, P.L. 1375	ARAR	Establishes requirements for construction, earth-moving and filling within 100 yr floodplain			X	X	X	Will be considered if remedial actions occur with the 100 yr. floodplain of the Shenango River
Federal Regulatory Requirement	Clean Water Act 40 CFR 6, Section 404	ARAR	Establishes requirements for construction within wetlands			X	X	X	Will be considered in any remedial actions which may affect on-site wetlands
State Regulatory Requirement	Dam Safety and Encroachment Act of 1978, P.L. 1375	ARAR	Establishes requirements for actions within wetlands			X	X	X	Will be considered if selected remedial actions occur within wetlands
State Regulatory Requirement	Dam Safety and Encroachment Act of 1978, P.L. 1375	ARAR	Establishes requirements for areas affecting streams			X	X	X	Will be considered if selected remedial actions have potential to affect the Shenango River
Federal Criteria, Advisories, and Guidance	Endangered Species Act of 1973 16 U.S.C. 1531	TBC	Establishes requirements for the protection of endangered species			X	X	X	Will be considered if selected remedial actions impact habitat of endangered species.

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TABLE 6-4

Summary of Cost Estimates
Remedial Action Alternatives
River Road Landfill
Hermitage, Pennsylvania

Alternative No.	Backup Information	Estimated Costs		
		Capital	O&M	PNW
1. No Action	Table A-1	$1,345,000	$0	$1,950,000
2. Fence, PADER Solid Waste Cap, Surface Water Collection system, Groundwater Dam, Groundwater/Leachate Collection System, and Monitoring	Table A-2	$1,814,000	$122,000 - $229,000	$6,976,000
3. Fence, PADER Solid Waste Cap, Surface Water Collection System, Groundwater Dam, Groundwater/Leachate Collection System, Monitoring, Institutional Controls, Off-Site Disposal of Sediment and Habitat Enhancement	Table A-3	$2,061,000	$169,000 - $298,000	$8,430,000
4. Fence, PADER Solid Waste Cap, Surface Water Collection System, Groundwater Dam, Groundwater/ Leachate Collection System, Monitoring, Institutional Controls, Off-Site Disposal of Sediment, Groundwater/Leachate Collection System Enhancement, and Habitat Enhancement	Table A-4	$2,389,000	$169,000 - $298,000	$8,904,000
5. Fence, PADER Solid Waste Cap, Surface Water Collection System, Groundwater Dam, Groundwater/ Leachate Collection System, Monitoring, Institutional Controls, Off-Site Disposal of Sediment, Groundwater/Leachate Collection System Enhancement, Solid Waste Cap, and Habitat Enhancement	Table A-5	$4,858,000	$189,000 - $318,000	$12,957,000

Note:

1. Costs are rounded to the nearest $1000.
2. Detailed cost information is provided in Appendix A.

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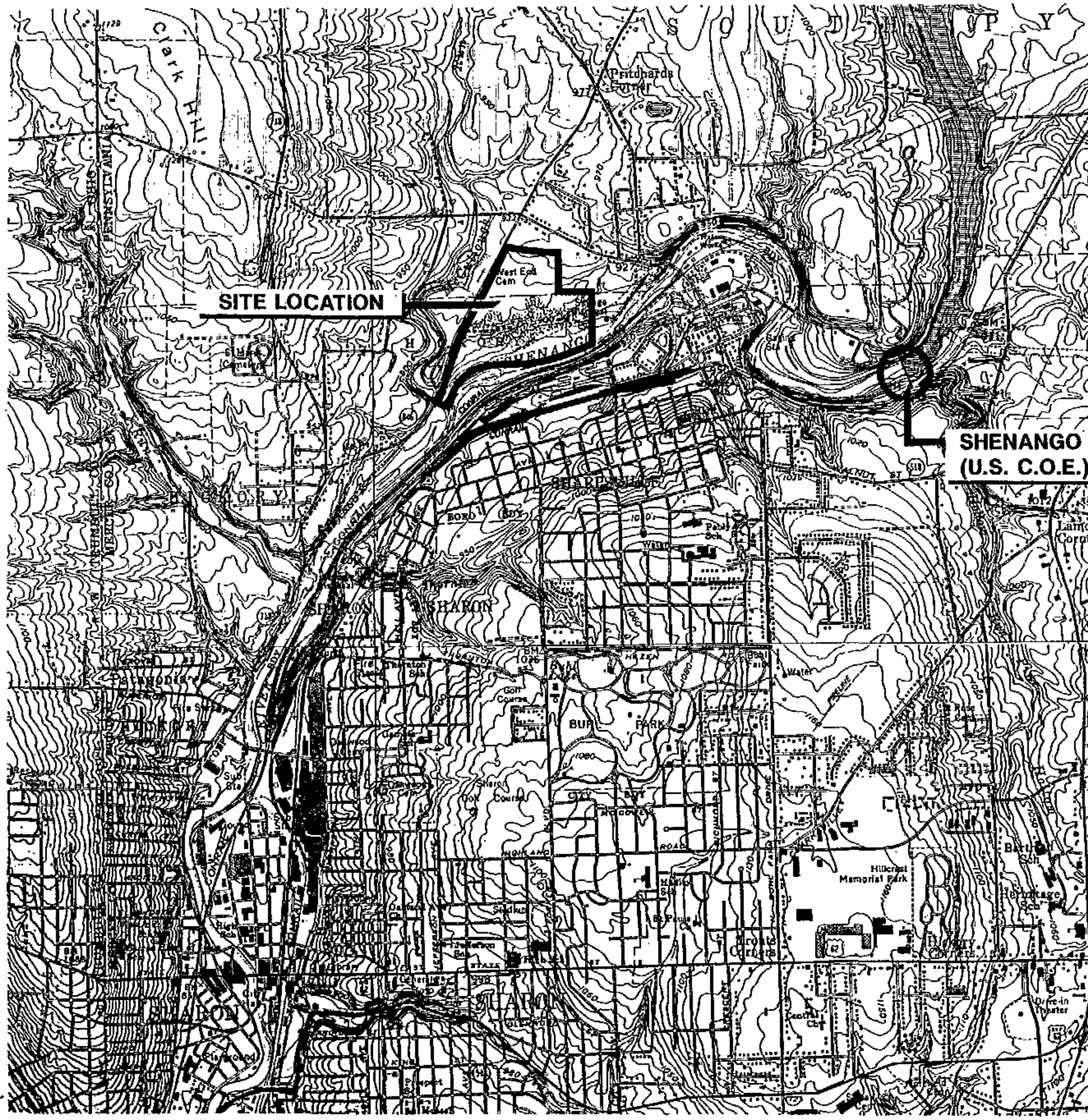
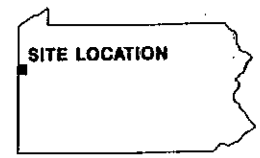


NOTES

1. BASE MAP DEVELOPED FROM THE SHARPSVILLE, PENNSYLVANIA (DATED 1958, PHOTOREVISED 1981), SHARON EAST, PENNSYLVANIA (DATED 1958, PHOTOREVISED 1981), SHARON WEST, OHIO-PENNSYLVANIA (DATED 1962, PHOTOREVISED 1979) AND ORANGEVILLE, OHIO-PENNSYLVANIA (DATED 1961, PHOTOREVISED 1979, PHOTOINSPECTED 1982) 7.5 MINUTE U.S.G.S. TOPOGRAPHIC QUADRANGLE MAPS.



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SCALE IN FEET

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FIGURE 2-1

QUALITY CONTROL	Graphic Standards
	Land Professional
	Technical Review
	Project Manager
	Management Review
	Other

This document has been developed for a specific application and may not be used without the written approval of Montgomery Watson.

Developed By	Drawn By JLH
Approved By	Date
Reference	
Revisions	

SITE LOCATION MAP

FEASIBILITY STUDY REPORT
RIVER ROAD LANDFILL RI/FS
HERMITAGE, PENNSYLVANIA

Drawing Number 5203360 B1

MONTGOMERY WATSON

EPA REGION III
SUPERFUND DOCUMENT MANAGEMENT SYSTEM

DOC ID 132808
PAGE # AR 204678

IMAGERY COVER SHEET
UNSCANNABLE ITEM

SITE NAME River Road Landfill

OPERABLE UNIT ______

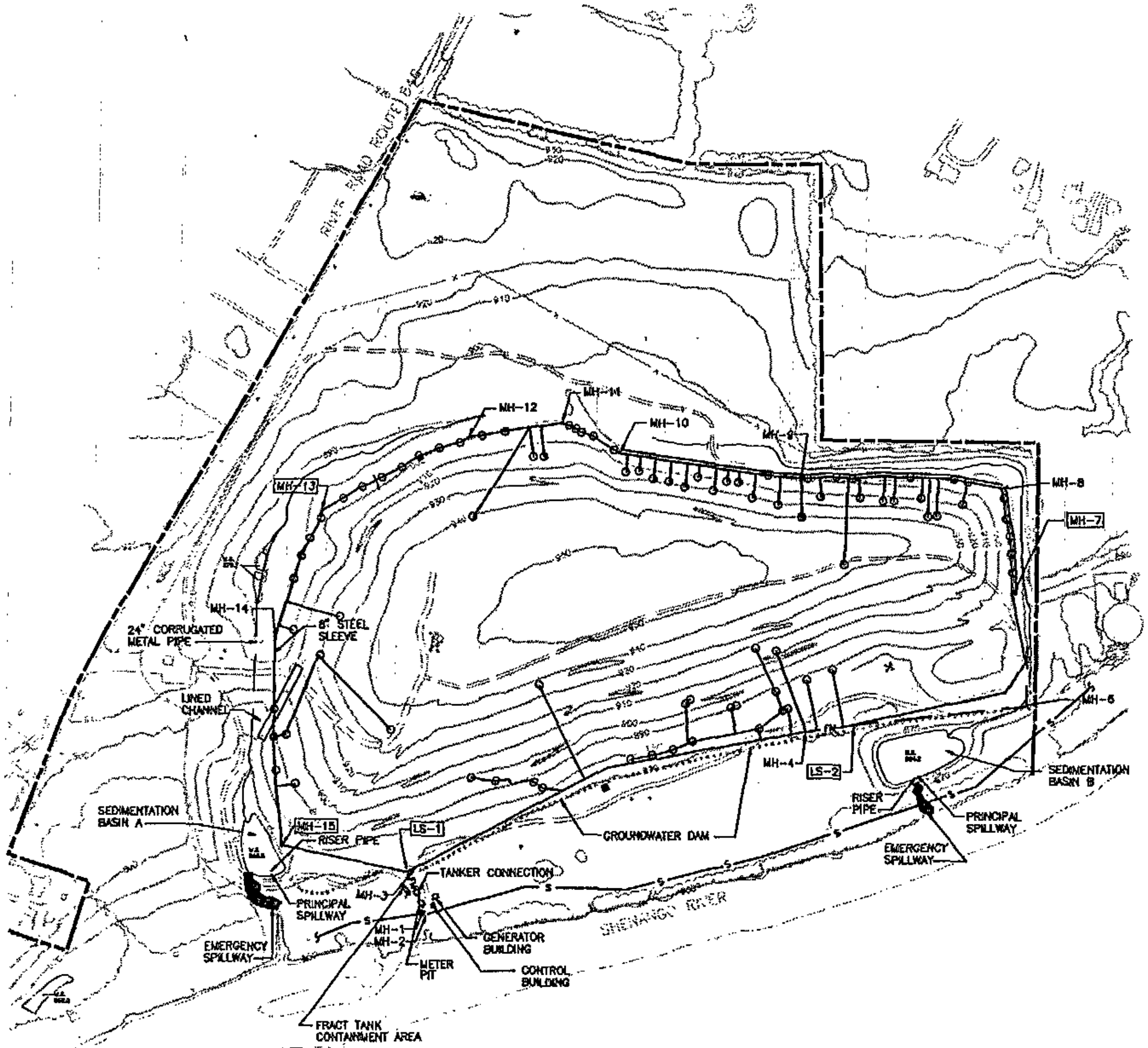
ADMINISTRATIVE RECORDS- SECTION III **VOLUME** H

REPORT OR DOCUMENT TITLE Draft Feasibility Study Report

DATE OF DOCUMENT 01--April--95

DESCRIPTON OF IMAGERY Site Features Map

NUMBER AND TYPE OF IMAGERY ITEM(S) 1 oversized map



LEGEND

- GROUND CONTOUR
- BUILDING
- TREES/SHRUBS
- FENCE LINE
- ACCESS ROAD
- EDGE OF WATER
- GROUNDWATER DAM
- FM — FORCEMAIN
- ADDITIONAL LEACHATE COLLECTION LINE
- LEACHATE COLLECTION RISER AND PIPE
- LS-2 — LIFT STATION LOCATION AND NUMBER
- MH-1 — MANHOLE LOCATION AND NUMBER
- MH-7 — LOCATION MONITORED FOR FLOW
- S — U.S.V.W.P.C.A. SEWER INTERCEPTOR
- APPROXIMATE PROPERTY LINE
- UTILITY POLE
- ELECTRICAL TOWER
- EMERGENCY SPILLWAY RIP-RAP

NOTES

1. BASE MAP PROVIDED BY WASTE MANAGEMENT OF PENNSYLVANIA AND IS FROM AN AERIAL SURVEY PERFORMED BY KUCERA INTERNATIONAL, INC., FLOWN 1989.
2. TOPOGRAPHIC CONTOUR INTERVAL IS 10 FEET (U.S.G.S. DATUM).

north

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SCALE IN FEET

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FIGURE 2-3

LEACHATE COLLECTION SYSTEM DIAGRAM
FEASIBILITY STUDY REPORT
RIVER ROAD LANDFILL RI/FS
HERMITAGE, PENNSYLVANIA

Developed By | Drawn By JLH | Approved By | Date | Reference | Revisions

Drawing Number 5203360 B3

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QUALITY CONTROL	Graphic Standards	Technical Review	Management Review
	Lead Professional	Project Manager	Other

EXPLANATION

PENNSYLVANIAN — Pottsville Group

HOMEWOOD FORMATION

MERCER FORMATION

CONNOQUENESSING FORMATION

SHARON FORMATION

POTTSVILLE UNDIFFERENTIATED

DEVONIAN — Cuyahoga Group

SHENANGO FORMATION

MEADVILLE SHALE

SHARPSVILLE SANDSTONE

ORANGEVILLE SHALE

BEREA SANDSTONE

BEDFORD SHALE

CUSSEWAGO SANDSTONE

DEVONIAN UNDIFFERENTIATED

SYMBOLS

NOTES

1. BEDROCK GEOLOGY MAP OF THE FREDONIA AND SHARPSVILLE QUADRANGLES AND PART OF THE ORANGEVILLE QUADRANGLE, NORTHERN MERCER COUNTY, PENNSYLVANIA FROM SCHINER AND KIMMEL (1976).
2. TABLE 1 REFERENCE UNDER SYMBOLS LEGEND IS A REFERENCE TO ORIGINAL REPORT.

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SCALE IN FEET

FIGURE 2-4

AR304680

REGIONAL BEDROCK GEOLOGY MAP	Developed By / Drawn By JLH
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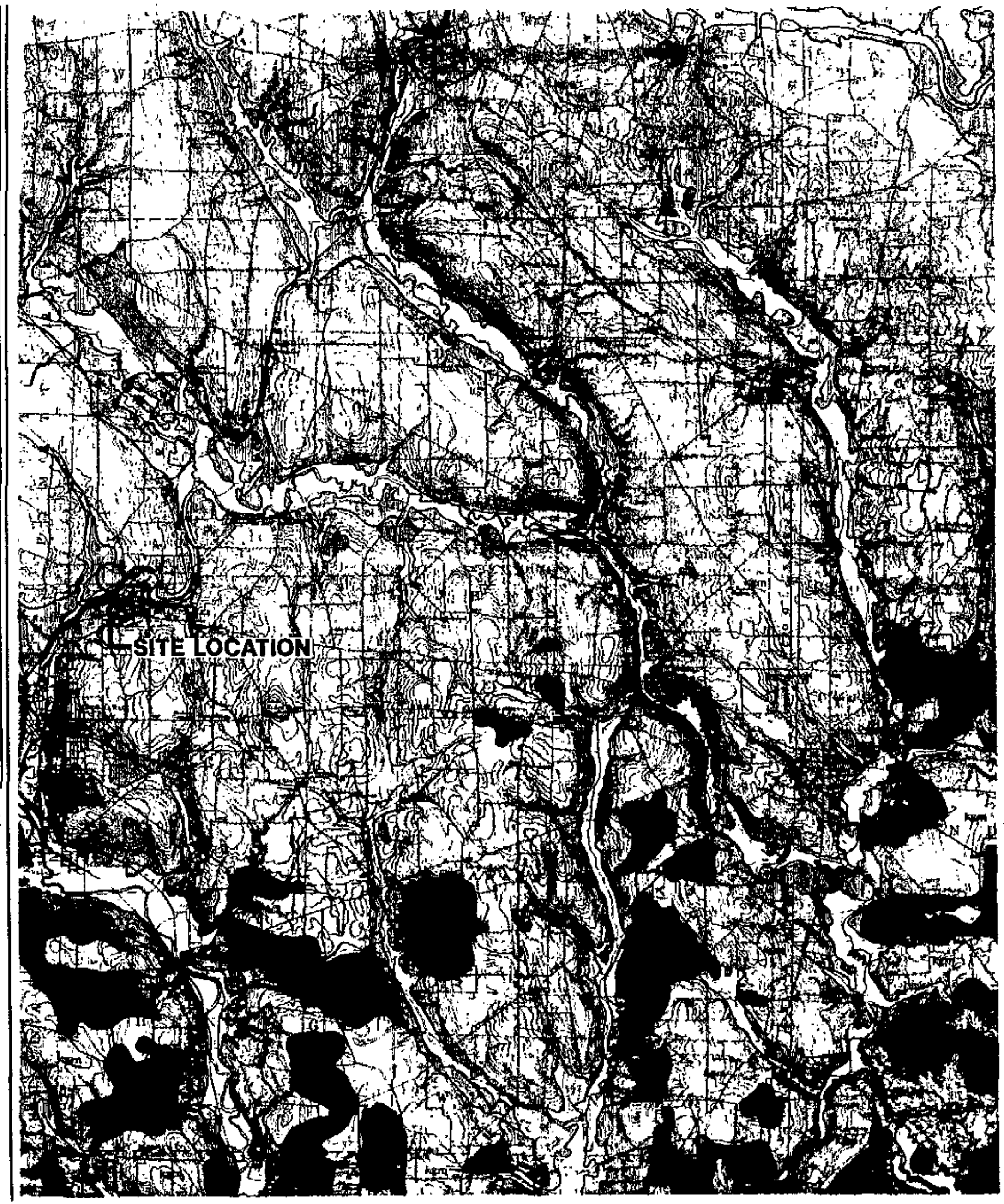
Drawing Number 5203360 B4	Reference
MONTGOMERY WATSON	Revisions

QUALITY CONTROL	Graphic Standards / Lead Professional	Technical Review / Project Manager	Management Review / Other



EXPLANATION

Unit	Topographic Features	Character of Material	Topography
Ashtabula Till	Ashtabula morainic system (end moraines)	Till (silt)	Strongly constructional, knob and kettle topography; numerous undrained depressions
	Ashtabula moraine under thin beach sands		
Hiram Till	Defiance end moraine	Till (silty clay to clay)	Undulating, locally constructional, scattered undrained depressions, very weak at places
	ground moraine	Till (silty clay)	Flat to gently undulating, local poorly drained areas
Lavery Till	Lavery end moraine	Till (silt)	Somewhat undulating, locally constructional, undrained areas rare
	ground moraine	Till (silt)	Level to gently undulating
Kent Till	Kent end moraine	Till (sandy loam)	Strongly constructional, knob and kettle topography, numerous undrained depressions
	Findley Lake recessional moraine	Till (loam)	
	Clymer recessional moraine	Till (loam)	
	ground moraine	Till (loam becoming sandy loam toward the east and south east)	Smooth to gently undulating, undrained areas very rare
Inner phase	ground (?) moraine	Thin, discontinuous, weathered till blanket	Erosional, similar to non-glaciated area, but less "rugged", rare slightly constructional patches
Outer phase	ground moraine (?)	Rare patches of thin weathered till over bedrock, scattered erratics	Erosional, similar to non-glaciated area, but slightly less "rugged"
Undifferentiated members of units above	kames, kame terraces, kame moraines, and eskers	Sand and gravel	Distinctly constructional; erosional in dissected areas. Knobby, commonly in the form of ridges, terraces, or isolated mounds. Kame moraines intimately mixed with end moraines.
Undifferentiated members of units above	outwash valley trains, river terraces, lake deposits including beaches of former high levels of Lake Erie	Bedded sand, silt, and clay; sand and gravel	Laterally smooth to gently undulating, commonly nearly level or gently sloping downstream
Undifferentiated	stream alluvium and bedrock		

NOTE – The symbols above are normally prefixed by the letter "Q" for Quaternary. The letter has been omitted since all units having symbols are of Quaternary age. Glacial deposits outside the glacial border are only partially mapped.

PLEISTOCENE — WISCONSIN — CARY; ILLINOIAN; ILLINOIAN OR WISCONSIN; RECENT OR PRE PLEISTOCENE

NOTE

1. MAP OF THE GLACIAL DEPOSITS OF NORTHWESTERN PENNSYLVANIA FROM SCHEPPS, DROSTE AND SITLER (1959).

north

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SCALE IN FEET

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FIGURE 2-5

REGIONAL GLACIAL GEOLOGY MAP	Developed By / Drawn By JLH
FEASIBILITY STUDY REPORT	Approved By / Date
RIVER ROAD LANDFILL RI/FS	Reference
HERMITAGE, PENNSYLVANIA	Revisions
Drawing Number 5203360	B5

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QUALITY CONTROL: Graphic Standards ___ Lead Professional ___ Technical Review ___ Project Manager ___ Management Review ___ Other ___

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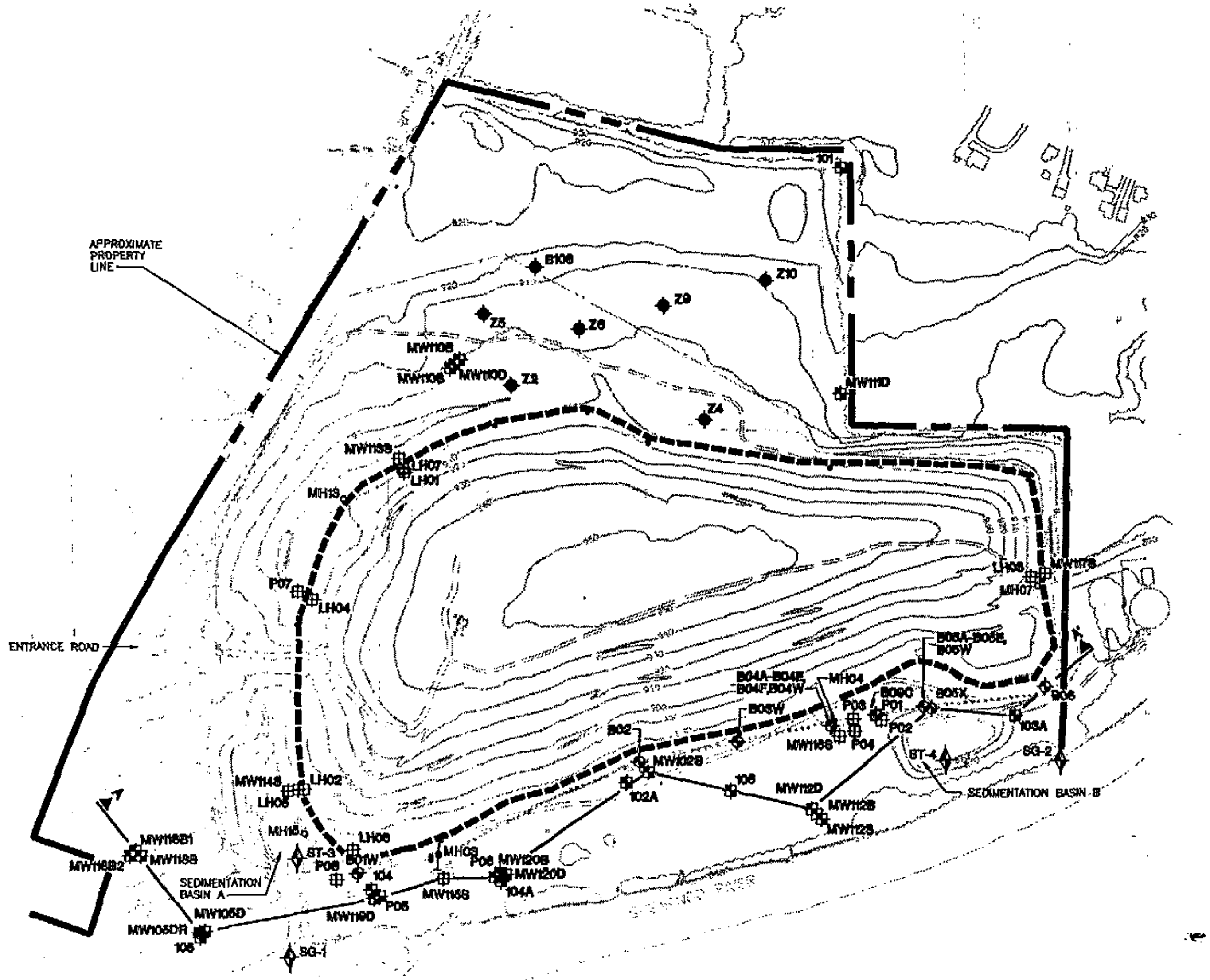
QUALITY CONTROL	Graphic Standards	Technical Review	Management Review
	Lead Professional	Project Manager	Other



LEGEND

- GROUND CONTOUR
- BUILDING
- TREES/SHRUBS
- FENCE LINE
- ACCESS ROAD
- EDGE OF WATER
- GROUNDWATER DAM
- 106 — MONITORING WELL INSTALLED PRIOR TO RI
- SG-1 / ST-3 — STAFF GAGE LOCATIONS
- MW110S, MW110D, MW110B — MONITORING WELL INSTALLED FOR RI S-SHALLOW, D-DEEP, B-BEDROCK (11661 – SHALLOW BEDROCK) (11682 – DEEPER BEDROCK)
- P04 — PIEZOMETER
- LH-08, MW107S — LEACHATE COLLECTION SYSTEM EFFECTIVENESS WELLS AND PIEZOMETERS. WELLS IN WASTE ARE LABELED LH (LEACHATE HEADWELL).
- MH07 — LEACHATE COLLECTION SYSTEM MANHOLE
- LIMITS OF LANDFILL
- A — A' CROSS-SECTION LOCATION
- B05X — SOIL BORING LOCATION AND NUMBER
- Z10 — PREVIOUS SOIL BORING LOCATION AND NUMBER

NOTES

1. BASE MAP PROVIDED BY WASTE MANAGEMENT OF PENNSYLVANIA AND IS BASED ON AN AERIAL SURVEY PERFORMED BY KUCERA INTERNATIONAL, INC., FLOWN 1989.
2. TOPOGRAPHIC CONTOUR INTERVAL IS 10 FEET (U.S.G.S. DATUM).
3. DUE TO INADEQUATE OR CONFLICTING LOCATION DATA FROM PREVIOUS SOURCES, THE Z WELLS AND BORING B106 ARE PLOTTED WITH LESS CERTAINTY THAN OTHER DATA POINTS.

north

0 300 600

SCALE IN FEET

FIGURE 2-6

AR304682

CROSS SECTION LOCATION MAP

FEASIBILITY STUDY REPORT
RIVER ROAD LANDFILL RI/FS
HERMITAGE, PENNSYLVANIA

Drawing Number 5203360 B6

MONTGOMERY WATSON

Developed By

Drawn By JLH

Approved By

Date

Reference

Revisions

EPA REGION III
SUPERFUND DOCUMENT MANAGEMENT SYSTEM

DOC ID 132808
PAGE # AR 304683

IMAGERY COVER SHEET
UNSCANNABLE ITEM

SITE NAME River Road Landfill

OPERABLE UNIT

ADMINISTRATIVE RECORDS- SECTION III **VOLUME** H

REPORT OR DOCUMENT TITLE Draft Feasibility Study Report

DATE OF DOCUMENT 01-April-95

DESCRIPTON OF IMAGERY Cross-Section A-A'

NUMBER AND TYPE OF IMAGERY ITEM(S) 1 oversized map

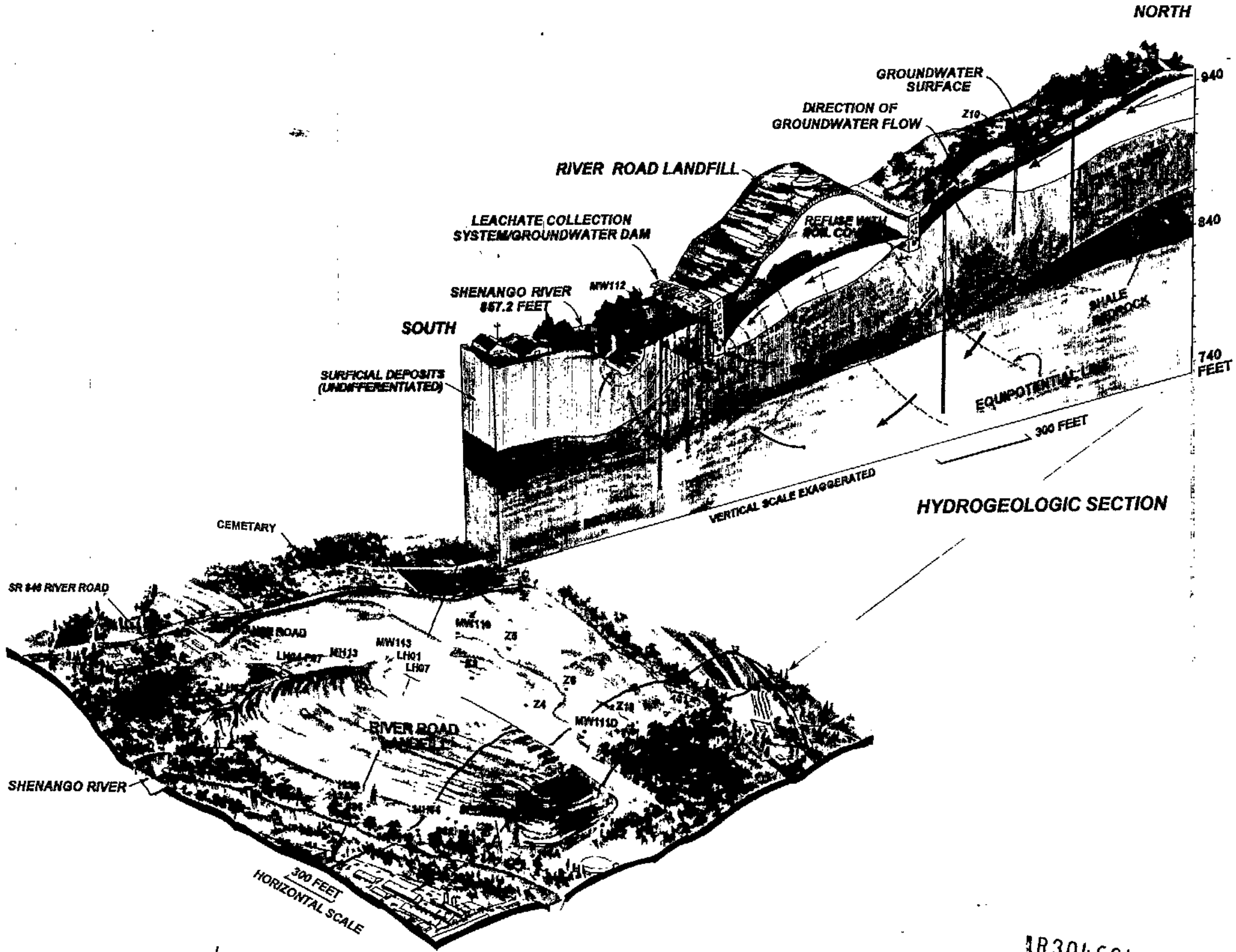


FIGURE 2-8

AR304684

CONCEPTUAL MODEL OF SITE HYDROGEOLOGY

FEASIBILITY STUDY REPORT
RIVER ROAD LANDFILL RI/FS
HERMITAGE, PENNSYLVANIA

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Drawn By	JLH
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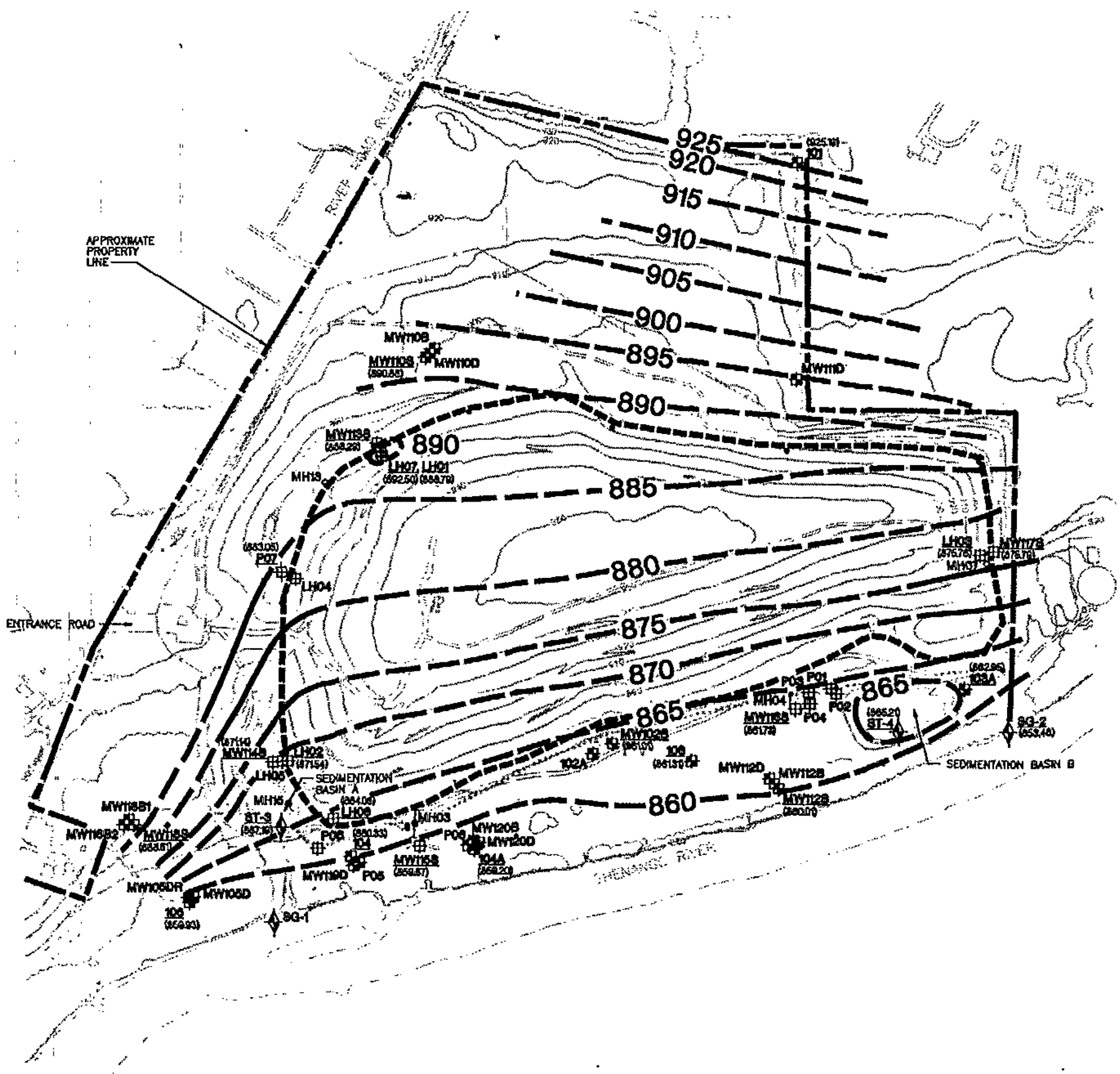
Date	
Reference	
Revisions	
Drawing Number	5203360 B8

MONTGOMERY WATSON

QUALITY CONTROL	Graphic Standards	Technical Review	Management Review
	Lead Professional	Project Manager	Other



LEGEND

	GROUND CONTOUR
	BUILDING
	TREES/SHRUBS
	FENCE LINE
	ACCESS ROAD
	EDGE OF WATER
	GROUNDWATER DAM
106	MONITORING WELL INSTALLED PRIOR TO RI
SG-1 ST-5	STAFF GAGE LOCATIONS
MW110S MW110D MW110B	MONITORING WELL INSTALLED FOR RI S-SHALLOW, D-DEEP, B-BEDROCK (118B1 - SHALLOW BEDROCK) (118B2 - DEEPER BEDROCK)
P01	PIEZOMETER
LH-09 MW117S	LEACHATE COLLECTION SYSTEM EFFECTIVENESS WELLS AND PIEZOMETERS. WELLS IN WASTE ARE LABELED LH (LEACHATE HEADWELL).
MH07	LEACHATE COLLECTION SYSTEM MANHOLE
	LIMITS OF LANDFILL
(876.79)	WATER TABLE ELEVATION AT UNDERLINED MONITORING WELL OR STAFF GAGE
870	WATER TABLE CONTOUR (CONTOUR INTERVAL: 5', DASHED WHERE INFERRED)

NOTES

1. BASE MAP PROVIDED BY WASTE MANAGEMENT OF PENNSYLVANIA AND IS BASED ON AN AERIAL SURVEY PERFORMED BY KUCERA INTERNATIONAL, INC., FLOWN 1989.
2. TOPOGRAPHIC CONTOUR INTERVAL IS 10 FEET (U.S.G.S. DATUM).

north

0 300 600

SCALE IN FEET

AR304685

FIGURE 2-9

QUALITY CONTROL	Graphic Standards
	Land Professional
	Technical Review
	Project Manager
	Management Review
	Other

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WATER TABLE CONTOUR MAP

FEASIBILITY STUDY REPORT
RIVER ROAD LANDFILL RI/FS
HERMITAGE, PENNSYLVANIA

Developed By	Drawn By JLH
Approved By	Date
Reference	
Revisions	

Drawing Number 5203360 B9

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EPA REGION III
SUPERFUND DOCUMENT MANAGEMENT SYSTEM

DOC ID 132808
PAGE # AR 304686

IMAGERY COVER SHEET
UNSCANNABLE ITEM

SITE NAME River Road Landfill

OPERABLE UNIT ____________

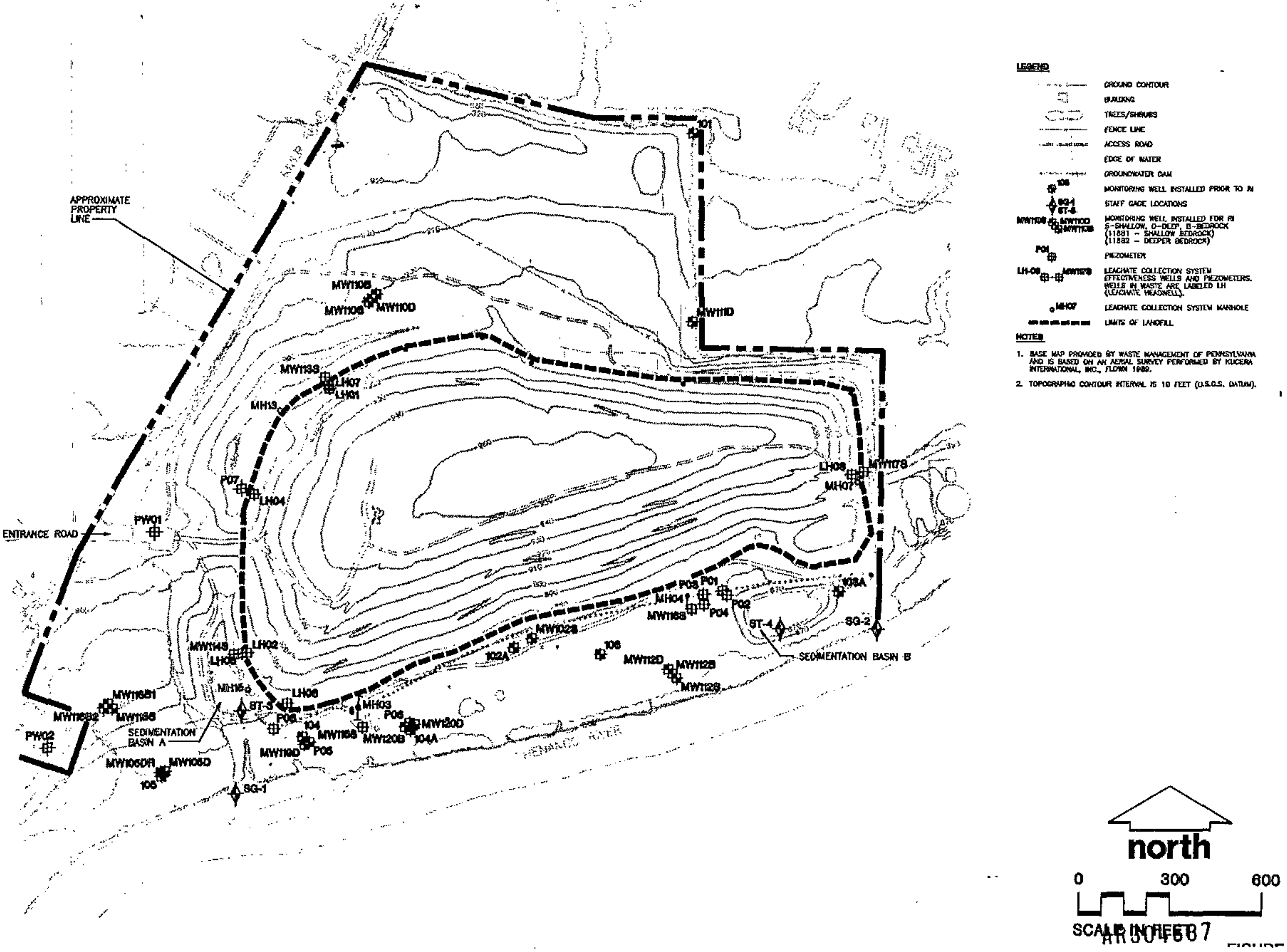
ADMINISTRATIVE RECORDS- SECTION III **VOLUME** #

REPORT OR DOCUMENT TITLE Draft Feasibility Study Report

DATE OF DOCUMENT 01 - April - 95

DESCRIPTON OF IMAGERY Potentiometric cross-section map

NUMBER AND TYPE OF IMAGERY ITEM(S) 1 oversized map



LEGEND

- GROUND CONTOUR
- BUILDING
- TREES/SHRUBS
- FENCE LINE
- ACCESS ROAD
- EDGE OF WATER
- GROUNDWATER DAM
- 106 — MONITORING WELL INSTALLED PRIOR TO RI
- SG-1, ST-5 — STAFF GAGE LOCATIONS
- MW110S, MW110D, MW110B — MONITORING WELL INSTALLED FOR RI S-SHALLOW, D-DEEP, B-BEDROCK (11881 - SHALLOW BEDROCK) (11882 - DEEPER BEDROCK)
- P01 — PIEZOMETER
- LH-08, MW117S — LEACHATE COLLECTION SYSTEM EFFECTIVENESS WELLS AND PIEZOMETERS. WELLS IN WASTE ARE LABELED LH (LEACHATE HEADWELL).
- MH07 — LEACHATE COLLECTION SYSTEM MANHOLE
- LIMITS OF LANDFILL

NOTES

1. BASE MAP PROVIDED BY WASTE MANAGEMENT OF PENNSYLVANIA AND IS BASED ON AN AERIAL SURVEY PERFORMED BY KUCERA INTERNATIONAL, INC., FLOWN 1989.
2. TOPOGRAPHIC CONTOUR INTERVAL IS 10 FEET (U.S.G.S. DATUM).

Developed By	Drawn By JLH
Approved By	Date
Reference	
Revisions	

SAMPLE LOCATION MAP

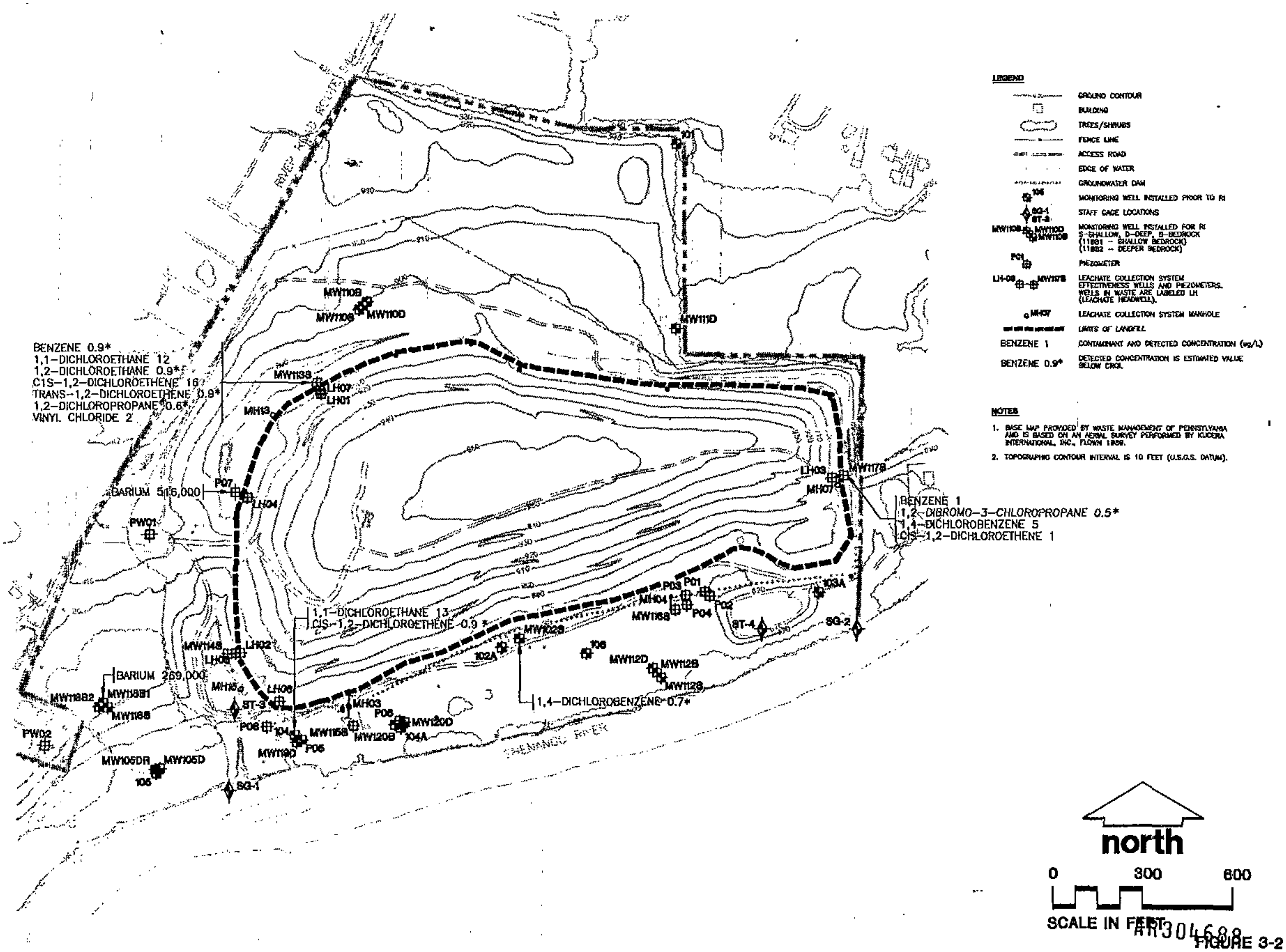
FEASIBILITY STUDY REPORT
RIVER ROAD LANDFILL RI/FS
HERMITAGE, PENNSYLVANIA

Drawing Number 5203360 B10

MONTGOMERY WATSON

AR304687

QUALITY CONTROL	Graphic Standards	Technical Review	Management Review
	Lead Professional	Project Manager	Other



AR304688

FIGURE 3-2

GROUNDWATER QUALITY MAP

FEASIBILITY STUDY REPORT
RIVER ROAD LANDFILL RI/FS
HERMITAGE, PENNSYLVANIA

Drawn By JLH
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Reference
Revisions

Drawing Number 5203360 B11

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QUALITY CONTROL	Graphic Standards	Technical Review	Management Review
	Lead Professional	Project Manager	Other

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APPENDIX A-1

Alternative 1
Summary of Cost Estimates
River Road Landfill
Hermitage, Pennsylvania

Item	Backup Information	Estimated Costs		
		Capital	O&M	PNW
1. Fence	Table A-1-Cap Table A-1-O&M Table A-1-PNW	$188,000	$0	$188,000
2. Monitoring	Table A-2-Cap Table A-2-O&M Table A-2-PNW	$0	$0	$0
3. PADER Solid Waste Cap	Table A-3-Cap Table A-3-O&M Table A-3-PNW	$348,000	$0	$348,000
4. Surface Water Collection System	Table A-4-Cap Table A-4-O&M Table A-4-PNW	$61,000	$0	$61,000
5. Groundwater Dam	Table A-5-Cap Table A-5-O&M Table A-5-PNW	$748,000	$0	$748,000
Subtotals		**$1,345,000**	**$0**	**$1,345,000**
			5% Administration	$67,250
			20% Engineering	$269,000
			20% Contingency	$269,000
			TOTAL	**$1,950,000**

Note:

1. Costs are rounded to the nearest $1000.
2. Detailed Cost backup provide in Appendix A, in referenced Tables

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APPENDIX A-2

Alternative 2
Summary of Cost Estimates
River Road Landfill
Hermitage, Pennsylvania

Item	Backup Information	Estimated Costs		
		Capital	O&M	PNW
1. Fence	Table A-1-Cap Table A-1-O&M Table A-1-PNW	$188,000	$0 to $2,000	$203,000
2. Monitoring	Table A-2-Cap Table A-2-O&M Table A-2-PNW	$0	$72,000 - $121,000	$1,196,000
3. PADER Solid Waste Cap	Table A-3-Cap Table A-3-O&M Table A-3-PNW	$348,000	$7,000 - $17,000	$637,000
4. Surface Water Collection System	Table A-4-Cap Table A-4-O&M Table A-4-PNW	$61,000	$0 - $10,000	$194,000
5. Groundwater Dam	Table A-5-Cap Table A-5-O&M Table A-5-PNW	$748,000	$0	$748,000
6. Groundwater/Leachate Collection System	Table A-6-Cap Table A-6-O&M Table A-6-PNW	$469,000	$43,000 - $79,000	$1,833,000
Subtotals		**$1,814,000**	**$122,000 - $229,000**	**$4,811,000**
			5% Administration	$241,000
			20% Engineering	$962,000
			20% Contingency	$962,000
			TOTAL	**$6,976,000**

Note:

1. Costs are rounded to the nearest $1000.
2. Detailed cost back-up provided in Appendix A, in referenced tables.

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APPENDIX A-3

Alternative 3
Summary of Cost Estimates
River Road Landfill
Hermitage, Pennsylvania

Item	Backup Information	Estimated Costs		
		Capital	O&M	PNW
1. Fence	Table A-1-Cap Table A-1-O&M Table A-1-PNW	$188,000	$0 - $2,000	$203,000
2. Monitoring	Table A-2-Cap Table A-2-O&M Table A-2-NPW	$0	$104,000 - $174,000	$1,724,000
3. PADER Solid Waste Cap	Table A-3-Cap Table A-3-O&M Table A-3-PNW	$348,000	$7,000 - $17,000	$637,000
4. Surface Water Collection System	Table A-4-Cap Table A-4-O&M Table A-4-PNW	$61,000	$0 - $11,000	$194,000
5. Groundwater Dam	Table A-5-Cap Table A-5-O&M Table A-5-PNW	$748,000	$0	$748,000
6. Groundwater/Leachate Collection System	Table A-6-Cap Table A-6-O&M Table A-6-PNW	$469,000	$43,000 - $79,000	$1,833,000
7. Institutional Controls	Table A-7-Cap Table A-7-O&M Table A-7-PNW	$10,000	$0	$10,000
8. Off-site Disposal of Sediment	Table A-8-Cap Table A-8-O&M Table A-8-PNW	$137,000	$0	$137,000
11. Habitat Enhancement	Table A-12-Cap Table A-12-O&M Table A-12-PNW	$100,000	$15,000	$327,000
Subtotals		**$2,061,000**	**$169,000 - $298,000**	**$5,813,000**
			5% Administration	$291,000
			20% Engineering	$1,163,000
			20% Contingency	$1,163,000
			TOTAL	**$8,430,000**

Note:

1. Costs are rounded to the nearest $1000.
2. Detailed cost back-up provided in Appendix A, in referenced tables.

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APPENDIX A-4

Alternative 4
Summary of Cost Estimates
River Road Landfill
Hermitage, Pennsylvania

Item	Backup Information	Estimated Costs Capital	O&M	PNW
1. Fence	Table A-1-Cap Table A-1-O&M Table A-1-PNW	$188,000	$0 - $2,000	$203,000
2. Monitoring	Table A-2-Cap Table A-2-O&M Table A-2-PNW	$0	$104,000 - $174,000	$1,724,000
3. PADER Solid Waste Cap	Table A-3-Cap Table A-3-O&M Table A-3-PNW	$348,000	$7,000 - $17,000	$637,000
4. Surface Water Collection System	Table A-4-Cap Table A-4-O&M Table A-4-PNW	$61,000	$0 - $11,000	$194,000
5. Groundwater Dam	Table A-5-Cap Table A-5-O&M Table A-5-PNW	$748,000	$0	$748,000
6. Groundwater/Leachate Collection System	Table A-6-Cap Table A-6-O&M Table A-6-PNW	$469;000	$43,000 - $79,000	$1,833,000
7. Institutional Controls	Table A-7-Cap Table A-7-O&M Table A-7-PNW	$10,000	$0	$10,000
8. Off-site Disposal of Sediment	Table A-8-Cap Table A-8-O&M Table A-8-PNW	$137,000	$0	$137,000
9. Groundwater/Leachate System Enhancement	Table A-9-Cap Table A-9-O&M Table A-9-PNW	$328,000	$0	$328,000
11. Habitat Enhancement	Table A-12-Cap Table A-12-O&M Table A-12-PNW	$100,000	$15,000	$327,000
Subtotal		**$2,389,000**	**$169,000 - $298,000**	**$6,141,000**
			5% Administration	$307,000
			20% Engineering	$1,228,000
			20% Contingency	$1,228,000
			TOTAL	**$8,904,000**

Note:

1. Costs are rounded to the nearest $1000.
2. Detailed cost back-up provided in Appendix A, in referenced tables.

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APPENDIX A-5

Alternative 5
Summary of Cost Estimates
River Road Landfill
Hermitage, Pennsylvania

Item	Backup Information	Estimated Costs Capital	O&M	PNW
1. Fence	Table A-1-Cap Table A-1-O&M Table A-1-PNW	$188,000	$0 - 2,000	$203,000
2. Monitoring	Table A-2-Cap Table A-2-O&M Table A-2-NPW	$0	$104,000 - $174,000	$1,724,000
3. PADER Solid Waste Cap	Table A-3-Cap Table A-3-O&M Table A-3-PNW	$348,000	$7,000 - $17,000	$637,000
4. Surface Water Collection System	Table A-4-Cap Table A-4-O&M Table A-4-PNW	$61,000	$0 - $11,000	$194,000
5. Groundwater Dam	Table A-5-Cap Table A-5-O&M Table A-5-PNW	$748,000	$0	$748,000
6. Groundwater/Leachate Collection System	Table A-6-Cap Table A-6-O&M Table A-6-PNW	$469,000	$43,000 - $79,000	$1,833,000
7. Institutional Controls	Table A-7-Cap Table A-7-O&M Table A-7-PNW	$10,000	$0	$10,000
8. Off-site Dispoal of Sediment	Table A-8-Cap Table A-8-O&M Table A-8-PNW	$137,000	$0	$137,000
9. Groundwater/Leachate System Enhancement	Table A-9-Cap Table A-9-O&M Table A-9-PNW	$328,000	$0	$328,000
10. Solid Waste Cap	Table A-10-Cap Table A-10-O&M Table A-10-PNW	$2,129,000	$6,000	$2,220,000
10. Passive Landfill Gas System	Table A-11-Cap Table A-11-O&M Table A-11-PNW	$340,000	$14,000	$575,000
11. Habitat Enhancement	Table A-12-Cap Table A-12-O&M Table A-12-PNW	$100,000	$15,000	$327,000
Subtotal		**$4,858,000**	**$189,000 - $318,000**	**$8,936,000**
			5% Administration	$447,000
			20% Engineering	$1,787,000
			20% Contingency	$1,787,000
			TOTAL	**$12,957,000**

Note:

1. Costs are rounded to the nearest $1000.
2. Detailed cost back-up provided in Appendix A, in referenced tables.

DLN/sls/DRH
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APPENDIX A-1-CAP

Estimated Capital Costs, 1995 Dollars
Component 1 - Fence
River Road Landfill
Hermitage, Pennsylvania

	Item	Qty.	Unit	Unit Cost	Extended Cost
1.	Fence Installation	10,000	Ft	$18.75	$187,500
				TOTAL	**$188,000**

Notes:
1. Total capital cost is rounded to the nearest $1,000.
2. Based on Means Building Construction Cost Data, 51 Annual Addition, 1993.
3. Engineering and administration costs are shown on the alternatives summary tables.
4. Actual fence installation date not known.

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APPENDIX A-1-O & M

Operation and Maintenance Costs
Component 1 - Fence
River Road Landfill
Hermitage, Pennsylvania

Annual Costs Item	Qty.	Unit	Unit Cost	Extended Cost
1. Fence Repair	100	Ft	$10	$1,000
			SUB-TOTAL	$1,000
			15 % CONTINGENCY	$150
			TOTAL	$1,000

Intermittent Costs Item	Events	Qty.	Unit	Unit Cost	Extended Cost/Event
1. Signs	3	50	Each	$10	$500
2. Gates	3	1	Gate	$800	$800
				SUB-TOTAL	$1,000
				15 % CONTINGENCY	$150
				TOTAL	$1,000

1. Fence repair scheduled to begin in 1998.
2. Total O&M costs are rounded to the nearest $1,000.
3. Engineering and administration costs are shown on the alternatives summary tables.
4. Based on WMPA Post-Closure Cost Summary.

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APPENDIX A-1-PNW

Present Net Worth
Component 1 - Fence
River Road Landfill
Hermitage, Pennsylvania

Year	Capital Cost	O&M Costs	Total	P/W Factor	Present Net Worth
1	$188,000	$0	$188,000	1.0000	$188,000
2	$0	$0	$0	0.9524	$0
3	$0	$0	$0	0.9070	$0
4	$0	$1,000	$1,000	0.8638	$864
5	$0	$1,000	$1,000	0.8227	$823
6	$0	$1,000	$1,000	0.7835	$784
7	$0	$1,000	$1,000	0.7462	$746
8	$0	$1,000	$1,000	0.7107	$711
9	$0	$1,000	$1,000	0.6768	$677
10	$0	$2,000	$2,000	0.6446	$1,289
11	$0	$1,000	$1,000	0.6139	$614
12	$0	$1,000	$1,000	0.5847	$585
13	$0	$1,000	$1,000	0.5568	$557
14	$0	$1,000	$1,000	0.5303	$530
15	$0	$1,000	$1,000	0.5051	$505
16	$0	$1,000	$1,000	0.4810	$481
17	$0	$1,000	$1,000	0.4581	$458
18	$0	$1,000	$1,000	0.4363	$436
19	$0	$1,000	$1,000	0.4155	$416
20	$0	$2,000	$2,000	0.3957	$791
21	$0	$1,000	$1,000	0.3769	$377
22	$0	$1,000	$1,000	0.3589	$359
23	$0	$1,000	$1,000	0.3418	$342
24	$0	$1,000	$1,000	0.3256	$326
25	$0	$1,000	$1,000	0.3101	$310
26	$0	$1,000	$1,000	0.2953	$295
27	$0	$1,000	$1,000	0.2812	$281
28	$0	$1,000	$1,000	0.2678	$268
29	$0	$1,000	$1,000	0.2551	$255
30	$0	$2,000	$2,000	0.2429	$486
				TOTAL	**$203,000**

Notes:
1. PNW is based on 5% discount rate.
2. Total PNW is rounded to the nearest $1000.

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APPENDIX A-2-CAP

Estimated Capital Costs, 1995 Dollars
Component 2 - Monitoring
River Road Landfill
Hermitage, Pennsylvania

Item	Qty.	Unit	Unit Cost	Extended Cost
1. Monitoring				$0
			TOTAL	$0

Notes:

1. There are no capital costs associated with monitoring.
2. Engineering and administration costs are shown on the alternatives summary tables.

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APPENDIX A-2-O & M

Operation and Maintenance Costs
Component 2 - Monitoring
River Road Landfill
Hermitage, Pennsylvania

For Alternative 2 Item	Event	Qty.	Unit	Unit Cost	Extended Cost	Extended Cost Plus 15% Contingency
1. Well Replacement (Yr. 16)	1	7	Well	$6,000	$42,000	$48,000
2. Decommissioning Wells (Yr. 30)	1	7	Well	$1,400	$9,800	$11,000
3. Well Repair	15	1	Year	$1,000	$1,000	$1,000
4. Sampling Costs	30	1	Year	$7,500	$7,500	$9,000
5. Groundwater Analytical	30	4	Qrtr.	$12,000	$48,000	$55,000
6. Leachate analytical	30	4	Sample	$1,275	$5,100	$6,000
7. Gas Monitoring	30	4	Events	$400	$1,600	$2,000

For Alternatives 3 through 5 Item	Event	Qty.	Unit	Unit Cost	Extended Cost	Extended Cost Plus 15% Contingency
1. Well Replacement (Yr. 16)	1	10	Well	$6,000	$60,000	$69,000
2. Decommissioning Wells (Yr. 30)	1	10	Well	$1,400	$14,000	$16,000
3. Well Repair	15	1	Year	$1,000	$1,000	$1,000
4. Sampling Costs	30	1	Year	$10,725	$10,725	$12,000
5. Groundwater Analytical	30	4	Qrtr.	$17,160	$68,640	$79,000
6. Leachate analytical	30	4	Sample	$1,275	$5,100	$6,000
7. Gas Monitoring	30	4	Events	$400	$1,600	$2,000
8. Site Inspections	30	1	Visit	$3,000	$3,000	$3,000
9. Sediment Sampling/Analysis	30	1	Year	$2,000	$2,000	$2,000

Notes:

1. Total O&M cost is rounded to the nearest $1000.
2. Engineering and administration costs are shown on the alternatives summary tables.
3. Based on WMPA Post-Closure Cost Summary.

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TABLE A-2-PNW

Present Net Worth For Alternative 2
Component 2 - Monitoring
River Road Landfill
Hermitage, Pennsylvania

Year	Capital Cost	O&M Costs	Total	P/W Factor	Present Net Worth
1	$0	$72,000	$72,000	1.0000	$72,000
2	$0	$73,000	$73,000	0.9524	$69,525
3	$0	$72,000	$72,000	0.9070	$65,304
4	$0	$73,000	$73,000	0.8638	$63,057
5	$0	$72,000	$72,000	0.8227	$59,234
6	$0	$73,000	$73,000	0.7835	$57,196
7	$0	$72,000	$72,000	0.7462	$53,726
8	$0	$73,000	$73,000	0.7107	$51,881
9	$0	$72,000	$72,000	0.6768	$48,730
10	$0	$73,000	$73,000	0.6446	$47,056
11	$0	$72,000	$72,000	0.6139	$44,201
12	$0	$73,000	$73,000	0.5847	$42,683
13	$0	$72,000	$72,000	0.5568	$40,090
14	$0	$73,000	$73,000	0.5303	$38,712
15	$0	$72,000	$72,000	0.5051	$36,367
16	$0	$121,000	$121,000	0.4810	$58,201
17	$0	$72,000	$72,000	0.4581	$32,983
18	$0	$73,000	$73,000	0.4363	$31,850
19	$0	$72,000	$72,000	0.4155	$29,916
20	$0	$73,000	$73,000	0.3957	$28,886
21	$0	$72,000	$72,000	0.3769	$27,137
22	$0	$73,000	$73,000	0.3589	$26,200
23	$0	$72,000	$72,000	0.3418	$24,610
24	$0	$73,000	$73,000	0.3256	$23,769
25	$0	$72,000	$72,000	0.3101	$22,327
26	$0	$73,000	$73,000	0.2953	$21,557
27	$0	$72,000	$72,000	0.2812	$20,246
28	$0	$73,000	$73,000	0.2678	$19,549
29	$0	$72,000	$72,000	0.2551	$18,367
30	$0	$84,000	$84,000	0.2429	$20,404
				TOTAL	**$1,196,000**

Notes:
1. PNW is based on 5% discount rate.
2. Total PNW is rounded to the nearest $1000.

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TABLE A-2-PNW

Present Net Worth For Alternatives 3 Through 5
Component 2 - Monitoring
River Road Landfill
Hermitage, Pennsylvania

Year	Capital Cost	O&M Costs	Total	P/W Factor	Present Net Worth
1	$0	$104,000	$104,000	1.0000	$104,000
2	$0	$105,000	$105,000	0.9524	$100,002
3	$0	$104,000	$104,000	0.9070	$94,328
4	$0	$105,000	$105,000	0.8638	$90,699
5	$0	$104,000	$104,000	0.8227	$85,561
6	$0	$105,000	$105,000	0.7835	$82,268
7	$0	$104,000	$104,000	0.7462	$77,605
8	$0	$105,000	$105,000	0.7107	$74,624
9	$0	$104,000	$104,000	0.6768	$70,387
10	$0	$105,000	$105,000	0.6446	$67,683
11	$0	$104,000	$104,000	0.6139	$63,846
12	$0	$105,000	$105,000	0.5847	$61,394
13	$0	$104,000	$104,000	0.5568	$57,907
14	$0	$105,000	$105,000	0.5303	$55,682
15	$0	$104,000	$104,000	0.5051	$52,530
16	$0	$174,000	$174,000	0.4810	$83,694
17	$0	$104,000	$104,000	0.4581	$47,642
18	$0	$105,000	$105,000	0.4363	$45,812
19	$0	$104,000	$104,000	0.4155	$43,212
20	$0	$105,000	$105,000	0.3957	$41,549
21	$0	$104,000	$104,000	0.3769	$39,198
22	$0	$105,000	$105,000	0.3589	$37,685
23	$0	$104,000	$104,000	0.3418	$35,547
24	$0	$105,000	$105,000	0.3256	$34,188
25	$0	$104,000	$104,000	0.3101	$32,250
26	$0	$105,000	$105,000	0.2953	$31,007
27	$0	$104,000	$104,000	0.2812	$29,245
28	$0	$105,000	$105,000	0.2678	$28,119
29	$0	$104,000	$104,000	0.2551	$26,530
30	$0	$121,000	$121,000	0.2429	$29,391
				TOTAL	**$1,724,000**

Notes:
1. PNW is based on 5% discount rate.
2. Total PNW is rounded to the nearest $1000.

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APPENDIX A-3-CAP

Estimated Capital Costs, 1995 Dollars
Component 3 - PADER Solid Waste Cap
River Road Landfill
Hermitage, Pennsylvania

Item	Qty.	Unit	Unit Cost	Extended Cost
1. Cap Installation	38	acres		$348,000
			TOTAL	$348,000

Notes:

1. Based on WMPA records concerning cap construction, 1988.
2. Costs for existing 38 acre, 2-ft thick cap constructed of site material.
   Actual cost for cap construction = $247,000.
   Actual cost carried forward to 1995 dollars using 5 percent discount rate.
3. Engineering and administration costs are shown on the alternatives summary tables.

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APPENDIX A-3-O & M

Operation and Maintenance Costs
Component 3 - PADER Solid Waste Cap
River Road Landfill
Hermitage, Pennsylvania

Item	Qty.	Unit	Unit Cost	Extended Cost	Extended Cost Plus 15% Contingency
1. Cap Maintenance (1995)	1	Cap	$9,600	$9,600	$11,000
2. Cap Maintenance (1998-2002)	1	Cap	$9,000	$9,000	$10,000
3. Cap Maintenance (Post 2002)	1	Cap	$2,500	$2,500	$3,000
4. Mowing	4	Ea	$1,500	$6,000	$7,000

Notes:

1. Total O&M cost is rounded to the nearest $1000.
2. Engineering and administration costs are shown on the alternatives summary tables.
3. Based on WMPA Post-Closure Cost Summary.

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APPENDIX A-3-PNW

Present Net Worth
Component 3 - PADER Solid Waste Cap
River Road Landfill
Hermitage, Pennsylvania

Year	Capital Cost	O&M Costs	Total	P/W Factor	Present Net Worth
1	$348,000	$116,000	$464,000	1.0000	$464,000
2	$0	$7,000	$7,000	0.9524	$6,667
3	$0	$7,000	$7,000	0.9070	$6,349
4	$0	$17,000	$17,000	0.8638	$14,685
5	$0	$17,000	$17,000	0.8227	$13,986
6	$0	$17,000	$17,000	0.7835	$13,320
7	$0	$17,000	$17,000	0.7462	$12,685
8	$0	$17,000	$17,000	0.7107	$12,082
9	$0	$10,000	$10,000	0.6768	$6,768
10	$0	$10,000	$10,000	0.6446	$6,446
11	$0	$10,000	$10,000	0.6139	$6,139
12	$0	$10,000	$10,000	0.5847	$5,847
13	$0	$10,000	$10,000	0.5568	$5,568
14	$0	$10,000	$10,000	0.5303	$5,303
15	$0	$10,000	$10,000	0.5051	$5,051
16	$0	$10,000	$10,000	0.4810	$4,810
17	$0	$10,000	$10,000	0.4581	$4,581
18	$0	$10,000	$10,000	0.4363	$4,363
19	$0	$10,000	$10,000	0.4155	$4,155
20	$0	$10,000	$10,000	0.3957	$3,957
21	$0	$10,000	$10,000	0.3769	$3,769
22	$0	$10,000	$10,000	0.3589	$3,589
23	$0	$10,000	$10,000	0.3418	$3,418
24	$0	$10,000	$10,000	0.3256	$3,256
25	$0	$10,000	$10,000	0.3101	$3,101
26	$0	$10,000	$10,000	0.2953	$2,953
27	$0	$10,000	$10,000	0.2812	$2,812
28	$0	$10,000	$10,000	0.2678	$2,678
29	$0	$10,000	$10,000	0.2551	$2,551
30	$0	$10,000	$10,000	0.2429	$2,429
				TOTAL	**$637,000**

Notes:
1. PNW is based on 5% discount rate.
2. Total PNW is rounded to the nearest $1000.

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APPENDIX A-4-CAP

Estimated Capital Costs, 1995 Dollars
Component 4 - Surface Water Collection System
River Road Landfill
Hermitage, Pennsylvania

Item	Qty.	Unit	Unit Cost	Extended Cost
1. Surface Water Collection System				$61,000
			TOTAL	$61,000

Notes:

1. Based on estimated costs for surface water collection system construction by WMPA personnel in 1987. Actual estimated cost = $41,000.
   Actual cost carried forward to 1995 dollars using 5 percent discount rate.
2. Engineering and administration costs are shown on the alternatives summary tables.

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APPENDIX A-4-O & M

Operation and Maintenance Costs
Component 4 - Surface Water Collection System
River Road Landfill
Hermitage, Pennsylvania

Item	Qty.	Unit	Unit Cost	Extended Cost	Extended Cost Plus 15% Contingency
1. System Repairs (1995)	1	Year	$9,600	$9,600	$11,000
2. Systems Repairs (1998-2002)	1	Year	$9,000	$9,000	$10,000
3. Systems Repairs (Post 2002)	1	Year	$2,500	$2,500	$3,000

Notes:

1. Total O&M cost is rounded to the nearest $1000.
2. Engineering and administration costs are shown on the alternatives summary tables.
3. Based on WMPA Post-Closure Cost Summary.

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APPENDIX A-4-PNW

Present Net Worth
Component 4 - Surface Water Collection System
River Road Landfill
Hermitage, Pennsylvania

Year	Capital Cost	O&M Costs	Total	P/W Factor	Present Net Worth
1	$61,000	$71,000	$132,000	1.0000	$132,000
2	$0	$0	$0	0.9524	$0
3	$0	$0	$0	0.9070	$0
4	$0	$10,000	$10,000	0.8638	$8,638
5	$0	$10,000	$10,000	0.8227	$8,227
6	$0	$10,000	$10,000	0.7835	$7,835
7	$0	$10,000	$10,000	0.7462	$7,462
8	$0	$3,000	$3,000	0.7107	$2,132
9	$0	$3,000	$3,000	0.6768	$2,030
10	$0	$3,000	$3,000	0.6446	$1,934
11	$0	$3,000	$3,000	0.6139	$1,842
12	$0	$3,000	$3,000	0.5847	$1,754
13	$0	$3,000	$3,000	0.5568	$1,670
14	$0	$3,000	$3,000	0.5303	$1,591
15	$0	$3,000	$3,000	0.5051	$1,515
16	$0	$3,000	$3,000	0.4810	$1,443
17	$0	$3,000	$3,000	0.4581	$1,374
18	$0	$3,000	$3,000	0.4363	$1,309
19	$0	$3,000	$3,000	0.4155	$1,247
20	$0	$3,000	$3,000	0.3957	$1,187
21	$0	$3,000	$3,000	0.3769	$1,131
22	$0	$3,000	$3,000	0.3589	$1,077
23	$0	$3,000	$3,000	0.3418	$1,025
24	$0	$3,000	$3,000	0.3256	$977
25	$0	$3,000	$3,000	0.3101	$930
26	$0	$3,000	$3,000	0.2953	$886
27	$0	$3,000	$3,000	0.2812	$844
28	$0	$3,000	$3,000	0.2678	$803
29	$0	$3,000	$3,000	0.2551	$765
30	$0	$3,000	$3,000	0.2429	$729
				TOTAL	**$194,000**

Notes:
1. PNW is based on 5% discount rate.
2. Total PNW is rounded to the nearest $1000.

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APPENDIX A-5-CAP

Estimated Capital Costs, 1995 Dollars
Component 5 - Groundwater Dam
River Road Landfill
Hermitage, Pennsylvania

Item	Qty.	Unit	Unit Cost	Extended Cost
1. Groundwater Dam	2,400	Ft	$311.85	$748,440
			TOTAL	**$748,000**

Notes:

1. Based on estimated costs for groundwater dam construction by WMPA personnel in 1980.
2. Estimated cost based on estimate by WMPA and Montgomery Watson experience.
   Estimated cost = $360,000.
   Actual cost carried forward to 1995 dollars using 5 percent discount rate.
3. Engineering and administration costs are shown on the alternatives summary tables.

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APPENDIX A-5-O & M

Annual Operation and Maintenance Costs
Component 5 - Groundwater Dam
River Road Landfill
Hermitage, Pennsylvania

Item	Qty.	Unit	Unit Cost	Extended Cost
1. Operation and Maintenance				$0
			TOTAL	$0

Notes:
1. Total O&M cost is rounded to the nearest $1000.
2. Engineering and administration costs are shown on the alternatives summary tables.

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APPENDIX A-5-PNW

Present Net Worth
Component 5 - Groundwater Dam
River Road Landfill
Hermitage, Pennsylvania

Year	Capital Cost	O&M Costs	Total	P/W Factor	Present Net Worth
1	$748,000	$0	$748,000	1.0000	$748,000
2	$0	$0	$0	0.9524	$0
3	$0	$0	$0	0.9070	$0
4	$0	$0	$0	0.8638	$0
5	$0	$0	$0	0.8227	$0
6	$0	$0	$0	0.7835	$0
7	$0	$0	$0	0.7462	$0
8	$0	$0	$0	0.7107	$0
9	$0	$0	$0	0.6768	$0
10	$0	$0	$0	0.6446	$0
11	$0	$0	$0	0.6139	$0
12	$0	$0	$0	0.5847	$0
13	$0	$0	$0	0.5568	$0
14	$0	$0	$0	0.5303	$0
15	$0	$0	$0	0.5051	$0
16	$0	$0	$0	0.4810	$0
17	$0	$0	$0	0.4581	$0
18	$0	$0	$0	0.4363	$0
19	$0	$0	$0	0.4155	$0
20	$0	$0	$0	0.3957	$0
21	$0	$0	$0	0.3769	$0
22	$0	$0	$0	0.3589	$0
23	$0	$0	$0	0.3418	$0
24	$0	$0	$0	0.3256	$0
25	$0	$0	$0	0.3101	$0
26	$0	$0	$0	0.2953	$0
27	$0	$0	$0	0.2812	$0
28	$0	$0	$0	0.2678	$0
29	$0	$0	$0	0.2551	$0
30	$0	$0	$0	0.2429	$0
				TOTAL	**$748,000**

Notes:
1. PNW is based on 5% discount rate.
2. Total PNW is rounded to the nearest $1000.

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APPENDIX A-6-CAP

Estimated Capital Costs
Component 6 - Groundwater/Leachate Collection System
River Road Landfill
Hermitage, Pennsylvania

	Item	Qty.	Unit	Unit Cost	Extended Cost
1.	Phase 1 Leachate Collection System (1985)				$171,000
2.	Phase 2 and Phase 3 Leachate Collection System (1987)				$298,000
				TOTAL	$469,000

Notes:

1. Based on estimated costs for leachate collection system construction by WMPA personnel in 1985 and 1987.
2. Engineering and administration costs are shown on the alternatives summary tables.
3. Actual costs based on WMPA records concerning system construction:
   Phase 1 System - $105,000
   Phase 2 System - $202,000
   Actual cost carried forward to 1995 dollars using 5 percent discount rate.

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APPENDIX A-6-O & M

Annual Operation and Maintenance Costs
Component 6 - Groundwater/Leachate Collection System
River Road Landfill
Hermitage, Pennsylvania

Item	Event	Qty.	Unit	Unit Cost	Extended Cost	Extended Cost Plus 15% Contingency
1. Electricity	30	1	Year	$2,900	$2,900	$3,000
2. Leachate Disposal (Yrs. 0 -10)	10	9,125,000	Gal	$0.003	$27,375	$31,000
3. Leachate Disposal (Yrs. 11-30)	20	3,650,000	Gal	$0.003	$10,950	$13,000
4. Maintenance	30	1	Year	$20,000	$20,000	$23,000
5. Meter/Alarm Maintenance	30	1	Year	$1,200	$1,200	$1,000
6. Pump Replacement	6	4	Pump	$3,200	$12,800	$15,000
7. Flush System	6	1	Event	$2,500	$2,500	$3,000
8. Building Maintenance	30	1	Year	$1,000	$1,000	$1,000
9. Depreciation	30	1	Year	$2,000	$2,000	$2,000

Notes:

1. Total O&M cost is rounded to the nearest $1000.
2. Engineering and administration costs are shown on the alternatives summary tables.

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APPENDIX A-6-PNW

Present Net Worth
Component 6 - Groundwater/Leachate Collection System
River Road Landfill
Hermitage, Pennsylvania

Year	Capital Cost	O&M Costs	Total	P/W Factor	Present Net Worth
1	$469,000	$532,000	$1,001,000	1.0000	$1,001,000
2	$0	$61,000	$61,000	0.9524	$58,096
3	$0	$61,000	$61,000	0.9070	$55,327
4	$0	$61,000	$61,000	0.8638	$52,692
5	$0	$79,000	$79,000	0.8227	$64,993
6	$0	$61,000	$61,000	0.7835	$47,794
7	$0	$61,000	$61,000	0.7462	$45,518
8	$0	$61,000	$61,000	0.7107	$43,353
9	$0	$61,000	$61,000	0.6768	$41,285
10	$0	$79,000	$79,000	0.6446	$50,923
11	$0	$43,000	$43,000	0.6139	$26,398
12	$0	$43,000	$43,000	0.5847	$25,142
13	$0	$43,000	$43,000	0.5568	$23,942
14	$0	$43,000	$43,000	0.5303	$22,803
15	$0	$61,000	$61,000	0.5051	$30,811
16	$0	$43,000	$43,000	0.4810	$20,683
17	$0	$43,000	$43,000	0.4581	$19,698
18	$0	$43,000	$43,000	0.4363	$18,761
19	$0	$43,000	$43,000	0.4155	$17,867
20	$0	$61,000	$61,000	0.3957	$24,138
21	$0	$43,000	$43,000	0.3769	$16,207
22	$0	$43,000	$43,000	0.3589	$15,433
23	$0	$43,000	$43,000	0.3418	$14,697
24	$0	$43,000	$43,000	0.3256	$14,001
25	$0	$61,000	$61,000	0.3101	$18,916
26	$0	$43,000	$43,000	0.2953	$12,698
27	$0	$43,000	$43,000	0.2812	$12,092
28	$0	$43,000	$43,000	0.2678	$11,515
29	$0	$43,000	$43,000	0.2551	$10,969
30	$0	$61,000	$61,000	0.2429	$14,817
				TOTAL	**$1,833,000**

Notes:
1. PNW is based on 5% discount rate.
2. Total PNW is rounded to the nearest $1000.
3. Year one O & M costs reflect years 1985 through 1994.

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APPENDIX A-7-CAP

Estimated Capital Costs
Component 7 - Institutional Controls
River Road Landfill
Hermitage, Pennsylvania

	Item	Qty.	Unit	Unit Cost	Extended Cost
1.	Legal Fees	1	L.S.	$10,000	$10,000
				TOTAL	$10,000

Notes:

1. Based on Montgomery Watson experience with similar projects.
2. Engineering and administration costs are shown on the alternatives summary tables.

DRH/drh
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APPENDIX A-7-O & M

Annual Operation and Maintenance Costs
Component 7 - Institutional Controls
River Road Landfill
Hermitage, Pennsylvania

Item	Qty.	Unit	Unit Cost	Extended Cost
1. Operation and Maintenance				$0
			TOTAL	$0

Notes:

1. *Total O&M cost is rounded to the nearest $1000.*
2. Engineering and administration costs are shown on the alternatives summary tables.

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APPENDIX A-7-PNW

Present Net Worth
Component 7 - Institutional Controls
River Road Landfill
Hermitage, Pennsylvania

Year	Capital Cost	O&M Costs	Total	P/W Factor	Present Net Worth
1	$10,000	$0	$10,000	1.0000	$10,000
2	$0	$0	$0	0.9524	$0
3	$0	$0	$0	0.9070	$0
4	$0	$0	$0	0.8638	$0
5	$0	$0	$0	0.8227	$0
6	$0	$0	$0	0.7835	$0
7	$0	$0	$0	0.7462	$0
8	$0	$0	$0	0.7107	$0
9	$0	$0	$0	0.6768	$0
10	$0	$0	$0	0.6446	$0
11	$0	$0	$0	0.6139	$0
12	$0	$0	$0	0.5847	$0
13	$0	$0	$0	0.5568	$0
14	$0	$0	$0	0.5303	$0
15	$0	$0	$0	0.5051	$0
16	$0	$0	$0	0.4810	$0
17	$0	$0	$0	0.4581	$0
18	$0	$0	$0	0.4363	$0
19	$0	$0	$0	0.4155	$0
20	$0	$0	$0	0.3957	$0
21	$0	$0	$0	0.3769	$0
22	$0	$0	$0	0.3589	$0
23	$0	$0	$0	0.3418	$0
24	$0	$0	$0	0.3256	$0
25	$0	$0	$0	0.3101	$0
26	$0	$0	$0	0.2953	$0
27	$0	$0	$0	0.2812	$0
28	$0	$0	$0	0.2678	$0
29	$0	$0	$0	0.2551	$0
30	$0	$0	$0	0.2429	$0
				TOTAL	$10,000

Notes:

1. PNW is based on 5% discount rate.
2. Total PNW is rounded to the nearest $1000.

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APPENDIX A-8-CAP

Estimated Capital Costs
Component 8 - Off-Site Disposal of Sediment
River Road Landfill
Hermitage, Pennsylvania

Item	Qty.	Unit	Unit Cost	Extended Cost
A. Ditch Sediment Disposal				
1. Characterization Testing	1	Sample	$790	$790
2. Backhoe Excavation	6	CY	$3.85	$23
3. Approval Fee	1	L.S.	$500	$500
4. Haul	240	MI	$4.25	$1,020
5. Treatment & Disposal	6	ton	$185	$1,110
6. State Tax	6	Ton	$27	$162
7. Local Tax (6%)	$1,110		0.06	$67
8. Confirmation Testing (Cr)	4	Sample	$15	$60
			Subtotal	$3,732
B. Pond Sediment Disposal				
1. Characterization Testing	20	Sample	$790	$15,800
2. Drain Pond	6	Day	$500	$3,000
3. Backhoe Excavation	2,000	CY	$3.85	$7,700
4. Haul	2,000	Ton	$20	$40,000
5. Landfill Disposal	2,000	Ton	$30	$60,000
6. Confirmation Testing (PCBs, Arsenic)	90	Sample	$80	$7,200
			Subtotal	$133,700
			TOTAL	$137,000

Notes:
1. Total capital cost is rounded to the nearest $1000.
2. Engineering and administration costs are shown on the alternatives summary tables.

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APPENDIX A-8-O & M

Annual Operation and Maintenance Costs
Component 8 - Off-Site Disposal of Sediment
River Road Landfill
Hermitage, Pennsylvania

Item	Qty.	Unit	Unit Cost	Extended Cost
1. Operation and Maintenance				$0
			TOTAL	$0

Notes:

1. Total O&M cost is rounded to the nearest $1000.
2. Engineering and administration costs are shown on the alternatives summary tables.

DLN/sls/VJR/DRH
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APPENDIX A-8-PNW

Present Net Worth
Component 8 - Off-Site Disposal of Sediment
River Road Landfill
Hermitage, Pennsylvania

Year	Capital Cost	O&M Costs	Total	P/W Factor	Present Net Worth
1	$137,000	$0	$137,000	1.0000	$137,000
2	$0	$0	$0	0.9524	$0
3	$0	$0	$0	0.9070	$0
4	$0	$0	$0	0.8638	$0
5	$0	$0	$0	0.8227	$0
6	$0	$0	$0	0.7835	$0
7	$0	$0	$0	0.7462	$0
8	$0	$0	$0	0.7107	$0
9	$0	$0	$0	0.6768	$0
10	$0	$0	$0	0.6446	$0
11	$0	$0	$0	0.6139	$0
12	$0	$0	$0	0.5847	$0
13	$0	$0	$0	0.5568	$0
14	$0	$0	$0	0.5303	$0
15	$0	$0	$0	0.5051	$0
16	$0	$0	$0	0.4810	$0
17	$0	$0	$0	0.4581	$0
18	$0	$0	$0	0.4363	$0
19	$0	$0	$0	0.4155	$0
20	$0	$0	$0	0.3957	$0
21	$0	$0	$0	0.3769	$0
22	$0	$0	$0	0.3589	$0
23	$0	$0	$0	0.3418	$0
24	$0	$0	$0	0.3256	$0
25	$0	$0	$0	0.3101	$0
26	$0	$0	$0	0.2953	$0
27	$0	$0	$0	0.2812	$0
28	$0	$0	$0	0.2678	$0
29	$0	$0	$0	0.2551	$0
30	$0	$0	$0	0.2429	$0
				TOTAL	$137,000

Notes:
1. *PNW is based on 5% discount rate.*
2. Total PNW is rounded to the nearest $1000.

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APPENDIX A-9-CAP

Estimated Capital Costs
Component 9 - Groundwater/Leachate System Enhancement
River Road Landfill
Hermitage, Pennsylvania

Item	Qty.	Unit	Unit Cost	Extended Cost
1. 14 New Manholes	1	L.S.	$96,700	$96,700
2. Pipe Cleaning	12,325	LF	$4.00	$49,300
3. Sediment Disposal				
a. Characterization Testing	1	Sample	$790	$790
b. Approval Fee	1	L.S.	$1,000	$1,000
c. Haul	600	MI	$8.10	$4,860
d. Incineration	194,400	LB	$0.90	$174,960
e. State Tax	60	CY	$6.06	$364
			TOTAL	$328,000

Notes:

1. Total capital cost is rounded to the nearest $1000.
2. Engineering and administration costs are shown on the alternatives summary tables.

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APPENDIX A-9-O & M

Annual Operation and Maintenance Costs
Component 9 - Groundwater/Leachate System Enhancement
River Road Landfill
Hermitage, Pennsylvania

Item	Qty.	Unit	Unit Cost	Extended Cost
1. Operation and Maintenance				$0
			TOTAL	$0

Notes:

1. Total O&M cost is rounded to the nearest $1000.
2. Engineering and administration costs are shown on the alternatives summary tables.

DLN/sls/VJR/DRH
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APPENDIX A-9-PNW

Present Net Worth
Component 9 - Groundwater/Leachate System Enhancement
River Road Landfill
Hermitage, Pennsylvania

Year	Capital Cost	O&M Costs	Total	P/W Factor	Present Net Worth
1	$328,000	$0	$328,000	1.0000	$328,000
2	$0	$0	$0	0.9524	$0
3	$0	$0	$0	0.9070	$0
4	$0	$0	$0	0.8638	$0
5	$0	$0	$0	0.8227	$0
6	$0	$0	$0	0.7835	$0
7	$0	$0	$0	0.7462	$0
8	$0	$0	$0	0.7107	$0
9	$0	$0	$0	0.6768	$0
10	$0	$0	$0	0.6446	$0
11	$0	$0	$0	0.6139	$0
12	$0	$0	$0	0.5847	$0
13	$0	$0	$0	0.5568	$0
14	$0	$0	$0	0.5303	$0
15	$0	$0	$0	0.5051	$0
16	$0	$0	$0	0.4810	$0
17	$0	$0	$0	0.4581	$0
18	$0	$0	$0	0.4363	$0
19	$0	$0	$0	0.4155	$0
20	$0	$0	$0	0.3957	$0
21	$0	$0	$0	0.3769	$0
22	$0	$0	$0	0.3589	$0
23	$0	$0	$0	0.3418	$0
24	$0	$0	$0	0.3256	$0
25	$0	$0	$0	0.3101	$0
26	$0	$0	$0	0.2953	$0
27	$0	$0	$0	0.2812	$0
28	$0	$0	$0	0.2678	$0
29	$0	$0	$0	0.2551	$0
30	$0	$0	$0	0.2429	$0
				TOTAL	$328,000

Notes:
1. PNW is based on 5% discount rate.
2. Total PNW is rounded to the nearest $1000.

DLN/sls/DRH
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APPENDIX A-10-CAP

Estimated Capital Costs
Component 10 - Solid Waste Cap
River Road Landfill
Hermitage, Pennsylvania

Item	Qty.	Unit	Unit Cost	Extended Cost
1. Strip Topsoil	181,500	SY	$0.40	$72,600
2. Place Grading Layer	10,000	CY	$1.25	$12,500
3. Geocomposite Venting Layer	181,500	SY	$3.40	$617,100
4. 40 Mil Geomembrane	181,500	SY	$3.12	$566,280
5. Geocomposite Drainage Layer	181,500	SY	$3.40	$617,100
6. Place 18" Rooting Layer	181,500	SY	$0.85	$154,275
7. Place 6" Topsoil	181,500	SY	$0.30	$54,450
8. Install Pipe Boots	231	EA	$150	$34,650
			TOTAL	$2,129,000

Notes:

1. Total capital cost is rounded to the nearest $1000.
2. Engineering and administration costs are shown on the alternatives summary tables.

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APPENDIX A-10-PNW

Present Net Worth
Component 10 - Solid Waste Cap
River Road Landfill
Hermitage, Pennsylvania

Year	Capital Cost	O&M Costs	Total	P/W Factor	Present Net Worth
1	$2,129,000	$0	$2,129,000	1.0000	$2,129,000
2	$0	$6,000	$6,000	0.9524	$5,714
3	$0	$6,000	$6,000	0.9070	$5,442
4	$0	$6,000	$6,000	0.8638	$5,183
5	$0	$6,000	$6,000	0.8227	$4,936
6	$0	$6,000	$6,000	0.7835	$4,701
7	$0	$6,000	$6,000	0.7462	$4,477
8	$0	$6,000	$6,000	0.7107	$4,264
9	$0	$6,000	$6,000	0.6768	$4,061
10	$0	$6,000	$6,000	0.6446	$3,868
11	$0	$6,000	$6,000	0.6139	$3,683
12	$0	$6,000	$6,000	0.5847	$3,508
13	$0	$6,000	$6,000	0.5568	$3,341
14	$0	$6,000	$6,000	0.5303	$3,182
15	$0	$6,000	$6,000	0.5051	$3,031
16	$0	$6,000	$6,000	0.4810	$2,886
17	$0	$6,000	$6,000	0.4581	$2,749
18	$0	$6,000	$6,000	0.4363	$2,618
19	$0	$6,000	$6,000	0.4155	$2,493
20	$0	$6,000	$6,000	0.3957	$2,374
21	$0	$6,000	$6,000	0.3769	$2,261
22	$0	$6,000	$6,000	0.3589	$2,153
23	$0	$6,000	$6,000	0.3418	$2,051
24	$0	$6,000	$6,000	0.3256	$1,954
25	$0	$6,000	$6,000	0.3101	$1,861
26	$0	$6,000	$6,000	0.2953	$1,772
27	$0	$6,000	$6,000	0.2812	$1,687
28	$0	$6,000	$6,000	0.2678	$1,607
29	$0	$6,000	$6,000	0.2551	$1,531
30	$0	$6,000	$6,000	0.2429	$1,457
				TOTAL	$2,220,000

Notes:

1. PNW is based on 5% discount rate.
2. Total PNW is rounded to the nearest $1000.

DLN/sls/DRH
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APPENDIX A-10-CAP

Estimated Capital Costs
Component 10 - Solid Waste Cap Passive Landfill Gas System
River Road Landfill
Hermitage, Pennsylvania

Item	Qty.	Unit	Unit Cost	Extended Cost
1. Mobilization/Demobilization	1	LS	$20,000	$20,000
2. Survey	1	LS	$15,000	$15,000
3. Passive Pipe Trench	9,460	LF	$20	$189,200
4. Wellhead Header Pipe Riser	29	EA	$300	$8,700
5. Vent Riser Pipe	115	EA	$300	$34,500
6. Header Pipe	4,825	LF	$15	$72,375
			TOTAL	$340,000

Notes:

1. Total capital cost is rounded to the nearest $1000.
2. Engineering and administration costs are shown on the alternatives summary tables.

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TABLE A-10-O & M

Annual Operation and Maintenance Costs
Component 10 - Solid Waste Cap Passive Landfill Gas System
River Road Landfill
Hermitage, Pennsylvania

Item	Qty.	Unit	Unit Cost	Extended Cost
1. Monthly Inspections (16 hr./qtr.)	64	Hrs.	$100	$6,400
2. Quarterly Maintenance (16 hr./qtr.)	64	Hrs.	$100	$6,400
3. Support/Review	1	EA	$1,600	$1,600
			TOTAL	$14,000

Notes:

1. Total O&M cost is rounded to the nearest $1000.
2. Engineering and administration costs are shown on the alternatives summary tables.

DRF/sls/JAL/DRH
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APPENDIX A-10-PNW

Present Net Worth
Component 10 - Solid Waste Cap Passive Landfill Gas System
River Road Landfill
Hermitage, Pennsylvania

Year	Capital Cost	O&M Costs	Total	P/W Factor	Present Net Worth
1	$340,000	$0	$340,000	1.0000	$340,000
2	$0	$14,400	$14,400	0.9524	$13,715
3	$0	$14,400	$14,400	0.9070	$13,061
4	$0	$14,400	$14,400	0.8638	$12,439
5	$0	$14,400	$14,400	0.8227	$11,847
6	$0	$14,400	$14,400	0.7835	$11,282
7	$0	$14,400	$14,400	0.7462	$10,745
8	$0	$14,400	$14,400	0.7107	$10,234
9	$0	$14,400	$14,400	0.6768	$9,746
10	$13,000	$14,400	$27,400	0.6446	$17,662
11	$0	$14,400	$14,400	0.6139	$8,840
12	$0	$14,400	$14,400	0.5847	$8,420
13	$0	$14,400	$14,400	0.5568	$8,018
14	$0	$14,400	$14,400	0.5303	$7,636
15	$0	$14,400	$14,400	0.5051	$7,273
16	$0	$14,400	$14,400	0.4810	$6,926
17	$0	$14,400	$14,400	0.4581	$6,597
18	$0	$14,400	$14,400	0.4363	$6,283
19	$0	$14,400	$14,400	0.4155	$5,983
20	$13,000	$14,400	$27,400	0.3957	$10,842
21	$0	$14,400	$14,400	0.3769	$5,427
22	$0	$14,400	$14,400	0.3589	$5,168
23	$0	$14,400	$14,400	0.3418	$4,922
24	$0	$14,400	$14,400	0.3256	$4,689
25	$0	$14,400	$14,400	0.3101	$4,465
26	$0	$14,400	$14,400	0.2953	$4,252
27	$0	$14,400	$14,400	0.2812	$4,049
28	$0	$14,400	$14,400	0.2678	$3,856
29	$0	$14,400	$14,400	0.2551	$3,673
30	$13,000	$14,400	$27,400	0.2429	$6,655
				TOTAL	**$575,000**

Notes:
1. PNW is based on 5% discount rate.
2. Total PNW is rounded to the nearest $1000.
3. Capital cost of $13,000 at 10-yr intervals is for replacement of vent or header risers

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APPENDIX A-11-CAP

Estimated Capital Costs
Component 11 - Habitat Enhancement
River Road Landfill
Hermitage, Pennsylvania

Item	Qty.	Unit	Unit Cost	Extended Cost
1. Seeding		LS		$24,000
2. Structural Construction	10	Units	$2,000	$20,000
3. Trails (4 ft width)	300	Ft	$20.00	$6,000
4. Parking Lot/Entrance Improvements	10,000	Sq Ft	$5.00	$50,000
			TOTAL	**$100,000**

Notes:

1. Total capital cost is rounded to the nearest $1000.
2. Engineering and administration costs are shown on the alternatives summary tables.

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APPENDIX A-11-O & M

Annual Operation and Maintenance Costs
Component 11 - Habitat Enhancement
River Road Landfill
Hermitage, Pennsylvania

Item	Qty.	Unit	Unit Cost	Extended Cost
1. Reseed	1	Year	$1,000	$1,000
2. Structural Maintenance	10	Units	$100	$1,000
3. Trail Maintenance	300	Ft	$3	$900
4. Parking Lot Maintenance	1,000	Sq. Ft.	$5	$5,000
5. Security	546	Hr.	$12.50	$6,825
6. Telephone	1	Year	$500	$500
			TOTAL	$15,000

Notes:

1. Total O&M cost is rounded to the nearest $1000.
2. Engineering and administration costs are shown on the alternatives summary tables.

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APPENDIX A-11-PNW

Present Net Worth
Component 11 - Habitat Enhancement
River Road Landfill
Hermitage, Pennsylvania

Year	Capital Cost	O&M Costs	Total	P/W Factor	Present Net Worth
1	$100,000	$0	$100,000	1.0000	$100,000
2	$0	$15,000	$15,000	0.9524	$14,286
3	$0	$15,000	$15,000	0.9070	$13,605
4	$0	$15,000	$15,000	0.8638	$12,957
5	$0	$15,000	$15,000	0.8227	$12,341
6	$0	$15,000	$15,000	0.7835	$11,753
7	$0	$15,000	$15,000	0.7462	$11,193
8	$0	$15,000	$15,000	0.7107	$10,661
9	$0	$15,000	$15,000	0.6768	$10,152
10	$0	$15,000	$15,000	0.6446	$9,669
11	$0	$15,000	$15,000	0.6139	$9,209
12	$0	$15,000	$15,000	0.5847	$8,771
13	$0	$15,000	$15,000	0.5568	$8,352
14	$0	$15,000	$15,000	0.5303	$7,955
15	$0	$15,000	$15,000	0.5051	$7,577
16	$0	$15,000	$15,000	0.4810	$7,215
17	$0	$15,000	$15,000	0.4581	$6,872
18	$0	$15,000	$15,000	0.4363	$6,545
19	$0	$15,000	$15,000	0.4155	$6,233
20	$0	$15,000	$15,000	0.3957	$5,936
21	$0	$15,000	$15,000	0.3769	$5,654
22	$0	$15,000	$15,000	0.3589	$5,384
23	$0	$15,000	$15,000	0.3418	$5,127
24	$0	$15,000	$15,000	0.3256	$4,884
25	$0	$15,000	$15,000	0.3101	$4,652
26	$0	$15,000	$15,000	0.2953	$4,430
27	$0	$15,000	$15,000	0.2812	$4,218
28	$0	$15,000	$15,000	0.2678	$4,017
29	$0	$15,000	$15,000	0.2551	$3,827
30	$0	$15,000	$15,000	0.2429	$3,644
				TOTAL	**$327,000**

Notes:
1. PNW is based on 5% discount rate.
2. Total PNW is rounded to the nearest $1000.

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