2-203.42

2164

Water Management Plan for Lime Sludge Ponds

FDF Project No. 20205
Document No. 20205-PL-0001

April 1999
Revision B

Fernald Environmental Management Project
Fernald, Ohio
FDF Subcontract No. 98PC001322
Task Order P-022

PARSONS

4055 Executive Park Drive
Cincinnati, Ohio 45241

2164

Water Management Plan for Lime Sludge Ponds

FDF Project No. 20205
Document No. 20205-PL-0001

April 1999
Revision B

Fernald Environmental Management Project
Fernald, Ohio
FDF Subcontract No. 98PC001322
Task Order P-022

PARSONS

4055 Executive Park Drive
Cincinnati, Ohio 45241

2

Water Management Plan
for
Lime Sludge Ponds

2164

CONTENTS

SECTION

Executive Summary ES-1

1.0 Introduction 1
- 1.1 Introduction 1
- 1.2 Purpose 3
- 1.3 Project Overview 3

2.0 Remediation of Lime Sludge Ponds 4
- 2.1 Existing Conditions 4
- 2.2 Site Preparation 4
- 2.3 Excavation Phase 5

3.0 Conversion to Water Management Facility 7
- 3.1 Overall Concept 7
- 3.2 Liner System 9
- 3.3 Perimeter Drain System 11
- 3.4 Outlet Structures 14

4.0 Water Management During Excavation 18
- 4.1 Inspection 18
- 4.2 Operation 18
- 4.3 Maintenance 19

5.0 WMF Operation 20

FIGURES

2164

Figure 1-1 Project Location

Figure 2-1 Lime Sludge Ponds During Excavation

Figure 3-1 Conversion to Water Management Facility

Figure 3-2 LSP Groundwater Contours

Figure 3-3 LSP Groundwater Recovery Rates

Figure 3-4 Water Management Facility Plan

Figure 3-5 Typical Section Water Management Facility

LIST OF ACRONYMS AND ABBREVIATIONS

2164

AWRRP	Aquatic Restoration Wastewater Project
AWWT	Advanced Wastewater Treatment Facility
BSL	Biodenitrification-Surge Lagoon (Bio-Surge Lagoon)
CGU	Coarse-Grain Unit
FDF	Fluor Daniel Fernald, Inc.
FEMP	Fernald Environmental Management Project
FPA	Former Production Area
ft	feet
GCL	Geocomposite Liner
GL	Geomembrane Liner
gpm	gallons-per-minute
HDPE	High Density Polyethylene
LSP	Lime Sludge Ponds
OSDF	On-Site Disposal Facility
PD	Perimeter Drain
sec	seconds
SWRB	Surface Water Retention Basin
UV	Ultra-Violet Light
VOCs	Volatile Organic Chemicals
WMF	Water Management Facility
WMP	Water Management Plan

5

EXECUTIVE SUMMARY

2164

This Water Management Plan (WMP) addresses control and management of stormwater, and accumulations of groundwater during excavation of the Lime Sludge Ponds (LSP). It also addresses conversion of the LSP excavation area into a Water Management Facility (WMF) for use during remediation activities of the Former Production Area (FPA).

The LSP Project will consist of two major phases; LSP Excavation and Conversion to a WMF. The LSP excavation phase includes: installation of stormwater runon controls and contractor laydown areas, vegetation removal, excavation of the lime sludge, removal of associated berms and other impacted materials, and disposal of excavated materials at the On-Site Disposal Facility (OSDF). Water encountered during excavation of the lime sludge will be collected in localized sumps within the excavation area and pumped to the Storm Water Retention Basin (SWRB) via the existing storm sewer system. During the excavation phase approximately 30,000 cubic yards of material will be removed. This shall include approximately 20,000 cubic yards of lime sludge and 10,000 cubic yards of soil and other impacted material. Conversion to a WMF will consist of installation of a groundwater perimeter drain (PD) system underneath the geomembrane liner (GL), installation of a flexible GL, and installation of a discharge outlet structure and discharge pump. The WMF will have a water holding capacity of approximately 4,000,000 gallons (20,000 cubic yards).

The WMF will have valved outlet piping to allow discharge of the collected water to either the SWRB (storm water collected within the facility, or from other remediation activities that require Advanced Waste Water Treatment [AWWT] Phase I treatment), or to the Biodenitrification-Surge Lagoon (BSL) (water collected during remediation activities that require AWWT Phase II treatment).

The overall operation of the WMF is planned and designed to minimize impact to the environment and provide means to collect and control runoff from remediation areas. Upon completion of the WMF, disturbed areas that are not lined with a GL will be re-vegetated.

1.0 INTRODUCTION

1.1 Introduction

The Fernald Environmental Management Project (FEMP) is a 1,050-acre facility located in southwestern Ohio approximately 18 miles northwest of downtown Cincinnati. The mission of the facility was to provide high-purity uranium metal products to support United States defense programs. Production operations were discontinued in 1989. Subsequently, the United States Department of Energy decided to decontaminate and dismantle the facility and began environmental remediation of the site.

To facilitate management of the environmental remediation activities, the site was divided into ten remediation areas. The LSP are a part of Remediation Area 3. The LSP project area encompasses approximately 2 acres and is located in the western part of the FEMP (Figure 1-1). It is bordered on the east by the Former Production Area (FPA); on the north by Second Street; on the west by a railroad track and the Southern Waste Units Haul Road; and on the south by the K-65 Trench. The remediation activities within the LSP project will include removal of subsurface utility lines, excavation of the LSP, and conversion of the excavation to a WMF.

The LSP were built around 1952 and contain approximately 20,000 cubic yards of lime sludge. Sludge depth varies from 12-feet deep in the south pond to 8-feet deep in the north pond. The lime sludge was generated from the softening of fresh water and contains radioactive and/or other hazardous contaminants in concentrations below the respective Final Remediation Levels.

To facilitate remediation of the LSP and their conversion to a WMF, the project work is included in one package to be executed by one contractor. This WMP describes how stormwater will be handled during excavation of the LSP and measures to be implemented to convert the excavation area to a WMF for use by future projects associated with the FPA.

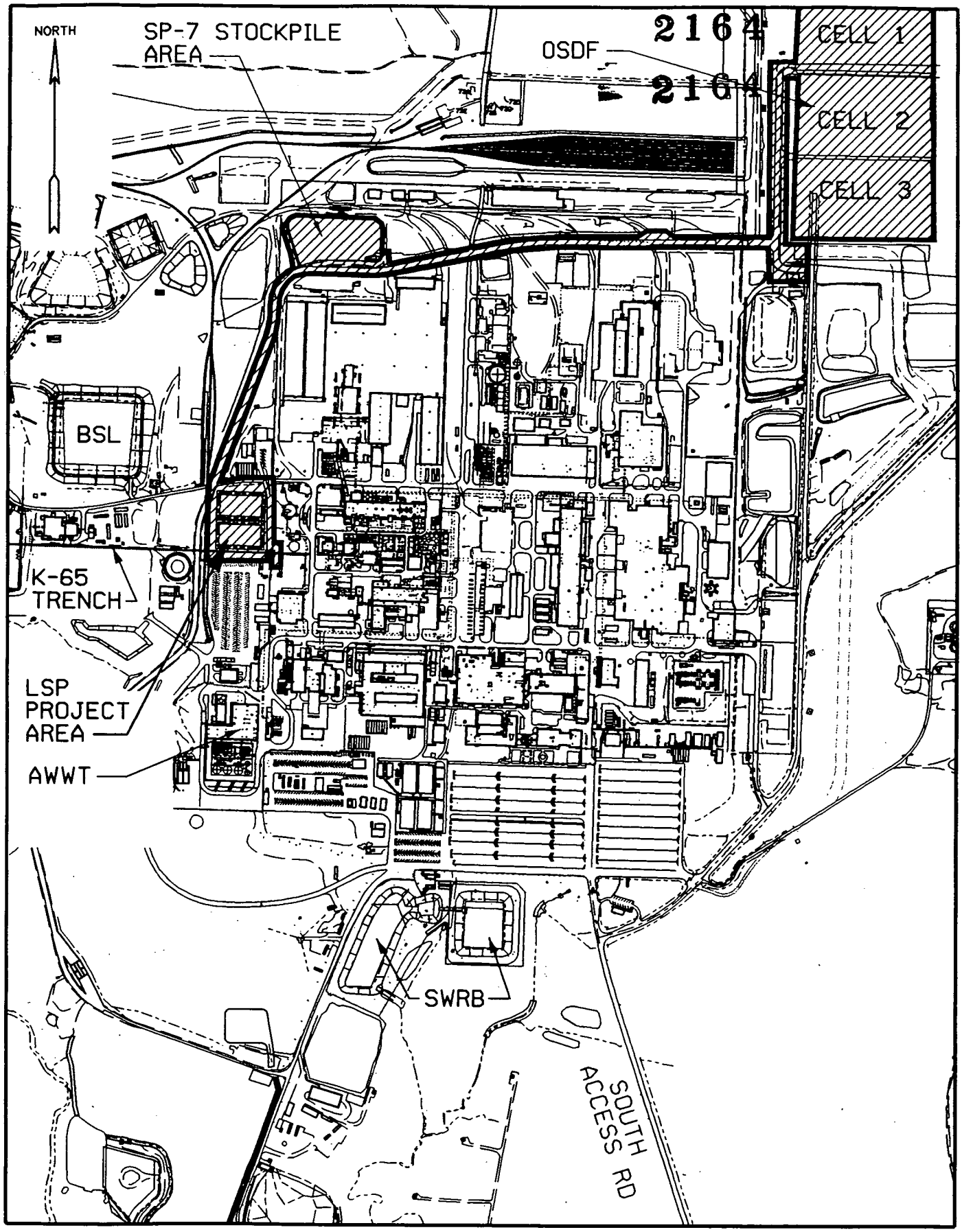

Figure 1-1 – Project Location

8

1.2 Purpose

2164

The overall objectives for this project are to excavate all impacted material from the LSP, and convert the LSP into a WMF to manage stormwater and contaminated water generated during remediation of the FPA. This WMP outlines the water management practices to be used during the LSP remediation activities and subsequent conversion of the LSP into a WMF.

The LSP design will address the management of stormwater during the following construction phases:

- LSP remediation activities,
- Conversion of LSP into a WMF.

The measures outlined in this WMP will be further defined as shown on the Construction Drawings and Technical Specifications.

1.3 Project Overview

This project will require excavation of approximately 30,000 cubic yards of impacted materials from the LSP. At this time it is anticipated that all of the impacted material will be disposed in the OSDF. After removal of the impacted material from the LSP, the open excavation will be converted into a facility to manage stormwater and contaminated water generated during remediation of the FPA. This conversion includes installation of a geosynthetic liner, PD, and an outlet structure with a transfer pump which will transfer the collected water to either the SWRB, or the Biodenitrification Surge Lagoon (BSL), depending upon the origin of the water and the type of treatment required. It is anticipated that this WMF will be used for a period of approximately five years to accommodate future remediation activities within the FPA; at which time the WMF will be removed.

2.0 Remediation of Lime Sludge Ponds

2.1 Existing Conditions

Presently, the LSP is comprised of two individual ponds, each of which was designed to be approximately 100 ft x 200 ft at the bottom, with 2H:1V side slopes and a depth of 8.5 feet. Approximately 30,000 cubic yards of impacted material are expected to be removed from the LSP. To ensure removal of all impacted material, the proposed excavation limits will extend a minimum of one (1) foot beyond the original pond design. The proposed excavation will also remove the existing berm separating the northern pond from the southern pond.

Management of stormwater runon from upstream areas should not be a problem as the current drainage patterns indicate that the existing berm and/or ditch combination effectively divert runoff from entering the existing ponds. Therefore, control of surface water will only be needed at the small, isolated construction areas (i.e., laydown area, loading area, etc.,) to minimize erosion and prevent silt from leaving the site. Silt fence, berms, ditches, etc., are some of the methods that may be used to control surface water.

2.2 Site Preparation

During site preparation the contractor's laydown areas and loading area will be installed. Demolition activities which include miscellaneous fencing, an abandoned storm drain (ST-6") and effluent piping (FT-3") (See Construction Drawings for extent and location of site preparation activities).

Also during site preparation, modifications will be made to facilitate handling of stormwater and groundwater. These modifications are as follows:

1) A new manhole will be installed over an existing 10-inch storm drain (ST-10"), located east of the LSP. After installation of the manhole the top of the ST-10" pipe will be removed. A 6-inch diameter steel pipe and a 2-inch diameter steel pipe will be installed underneath an existing asphalt road and connect to the new manhole. The 2-inch pipe will be sealed for future perimeter drain discharge during WMF operation by installing a blind flange. A

temporary hose connection will be constructed at-grade on the 6-inch pipe for temporary stormwater discharge during excavation activities.

2164

2) Also during site preparation modifications will be made to an existing 6-inch pipe to facilitate handling of future stormwater runoff from the FPA. This pipe is an abandoned 6-inch steel pipe, located inside the K-65 trench, which was previously used to convey discharge to the BSL. This project will utilize one section of the 6-inch pipe to convey water to the BSL during the operational phase of the WMF. Flow will be directed to the BSL by installing a tap (an inlet tie-in point) in the 6-inch line. The inlet tap will be located adjacent to the south LSP. This tap will be fitted with a 6-inch stub-out and blind flange, which will remain during the excavation activities.

3) During the conversion to a WMF, the blind flange will be removed from the 6-inch stub-out and a hard (pipe) connection will be made with the stormwater lift station. Similarly, the blind flange on the 2-inch stub-out will be removed and a hard-pipe connection made to the perimeter drain lift station.

2.3 Excavation Phase

During the LSP excavation phase, the only water encountered will result from direct precipitation into the excavation and/or groundwater. To the extent practical, the excavation area will be graded to drain to field-located collection points within the excavation area. Sumps will be excavated at these collection points to temporarily hold "excavation water". The excavation sumps will provide some detention time for deposition of sediments prior to pumping. A screened pump intake hose will be used to minimize disturbance of sediments during pumping activities. Sediment collected in the sumps will be removed periodically and mixed with the impacted material for disposal.

Portable sump pumps will be used to transfer the excavation water from the sumps to an existing 10-inch diameter storm sewer (refer to Construction Drawings for location) for conveyance to the SWRB (AWWT Phase I treatment). Multiple sumps/pumps may be used for dewatering the excavation area at the discretion of the Contractor. As previously described in Section 2.2, a temporary hose connection will be constructed to facilitate connection and transfer of water from the sump pump to the existing ST-10" for use during the excavation phase. The transfer pipe to be installed during site preparation will tie the temporary hose connection to the existing storm sewer. During conversion to a WMF, the temporary hose connection will be removed and a permanent discharge pipe will tie into the transfer pipe (See Figure 2-1).

11

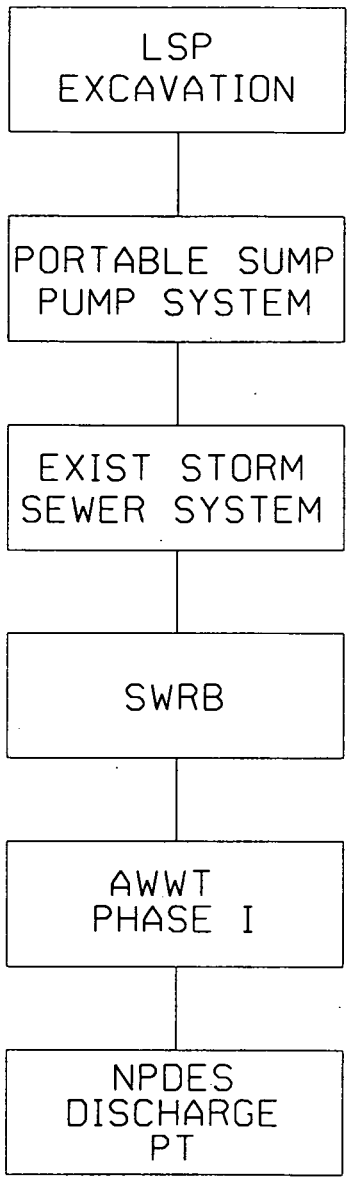

Figure 2-1 – Lime Sludge Ponds During Excavation

SECTION 3

3.0 Conversion to Water Management Facility

3.1 Overall Concept

Previous remediation projects at the FEMP have proven that management of water is one of the most difficult tasks associated with any project. Given the size and complexity of remediation of the FPA, the management of water will prove to be especially difficult. Therefore, a primary goal of this LSP project is to utilize the excavation area (after removal of the impacted material) by converting the excavation area to a WMF. This WMF will be sized based on the excavation area and provide a readily accessible facility that can be used as one part of a system, if needed, to help in the management of water encountered during remediation of the FPA. Therefore, some of the criteria used in converting the LSP into a WMF are fundamentally related to the primary goal. The following is a listing of functional criteria for the conversion of the LSP into a WMF:

1. Convert excavation area into a WMF (basin) which can be used as part of a water management system for future FPA remediation projects,

2. Provide a method (outlet structure and pumping system) to empty the WMF after each storm event. The outlet structure shall be manually controlled, and shall be capable of discharge to either the SWRB or BSL, depending on the origin of the water (i.e., Volatile Organic Chemicals [VOCs] or non-VOC water).

After excavation is completed, the LSP will be converted into a WMF. This facility will handle both stormwater and ground water potentially contaminated with VOCs that are generated from remediation activities within the FPA. Depending upon the origin of the water to be discharged from the WMF, the collected water will be processed through the AWWT Phase I treatment (SWRB) if no VOCs are present, or the AWWT Phase II treatment (BSL) if VOCs are present. (See Figure 3-1).

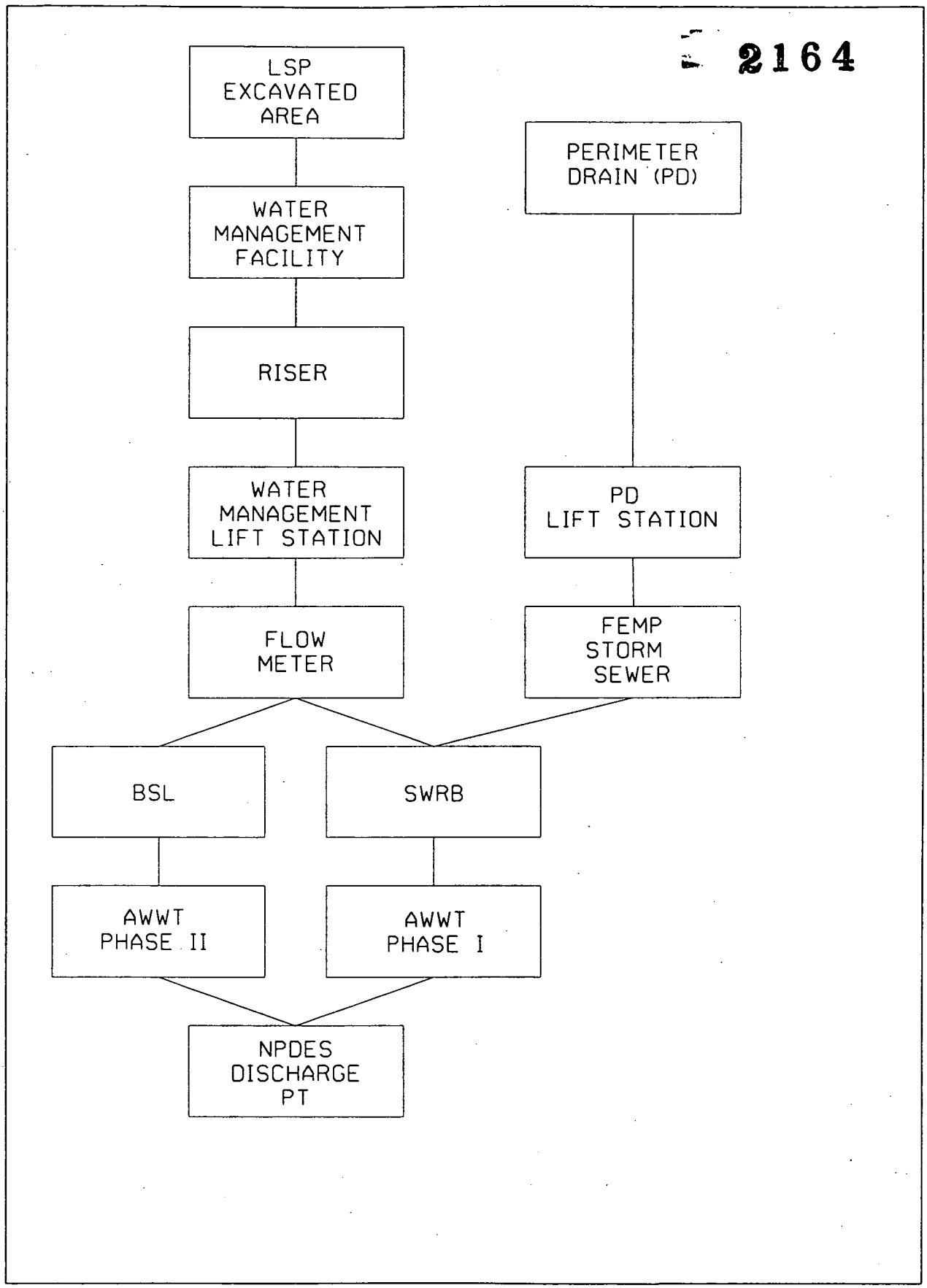

Figure 3-1 Conversion to Water Management Facility

Most stormwater conveyed to the WMF will be transferred to the SWRB via the 6-inch line installed during site preparation and portions of existing plant storm sewer system. VOC-contaminated water will be processed through Phase II treatment and will be pumped from the WMF to the BSL via a portion of existing 6-inch pipe in the K-65 trench. A pump station will be used to pump water out of the WMF. Manually controlled valves, located downstream of the pump station, will direct water either to the SWRB or the BSL. Additionally, a turbine-type flow meter will be located upstream of the valves so that discharge flow from the WMF can be measured.

In order to convert the LSP excavation area into a water management facility, the following must be addressed:

1. Based on sampling data at the LSP, it is anticipated that a portion of the LSP excavation will terminate in a coarse-grain unit (CGU), which extends into the FPA. To prevent migration of storm/VOC-contaminated water into the CGU, some type of liner is needed.

2. The CGU described in Item 1 above will also provide a conduit for hydrostatic head on the liner system should a high groundwater condition occur. A high hydrostatic head condition could compromise the integrity of the liner system. Therefore, some type of PD system must be provided as a means of lowering the hydrostatic head on the bottom and sides of the liner.

3. A means of discharge (i.e., outlet structures) must be provided to manually direct discharge to either the SWRB or the BSL, and to accommodate any water collected by the PD system.

Each of the above are discussed in greater detail in articles 3.2, 3.3, and 3.4 respectively.

3.2 Liner System

As discussed above, the basin will require some type of liner to prevent migration of potentially contaminated water into the CGU. Three (3) general types of liners were considered for the WMF: compacted clay, geocomposite liner (GCL), and flexible geomembrane liner (GL). The compacted clay liner is eliminated due to:

1) Addition of new (bulk) materials into a non-certified area,
2) Wet and dry (empty and full) operating cycles of the WMF.

3.2.1 Geocomposite Liner

GCL, which consist of a bentonite clay core surrounded by a geotextile fabric, have proven to be a very effective alternative to a compacted clay liner for applications where once the bentonite is hydrated, a confining pressure is present to hold the bentonite in place. In the case of this basin, the bentonite would hydrate when the basin received water. However, the requirement to drain the basin after every storm event would effectively remove the confining pressure.

Therefore, the use of a GCL as a basin liner is not considered feasible for this project.

3.2.2 Geomembrane Liners

GL is a generic term covering numerous synthetic materials such as high-density polyethylene (HDPE), very low-density polyethylene, polypropylene, poly-vinyl chloride, etc. Other than clay, a GL is probably used more than any other material for the lining of reservoirs. In determining the suitability of a GL for reservoir applications, the following are some aspects that must be considered:

a) Geometry of basin (i.e., shape, depth, side slopes, etc.), favorable for installation of a GL,
b) Chemical resistance of geomembrane material compatible with liquid to be contained,
c) Geotextile fabric (or other protective layer) required between geomembrane and subgrade for protection,
d) Geomembrane material and thickness compatible with anticipated subgrade deformation/settlement (if any).
e) Geomembrane can be adequately anchored to prevent pullout due to wind uplift, and tension,
f) Susceptibility of geomembrane material to ultra-violet light (UV) degradation,
g) Adequate frictional resistance between subgrade and GL on side slopes,
h) Number of liner penetrations and ease of extrusion welding in field,
i) Possibility of liner damage due to wildlife traffic on top of liner,
j) Increased difficulty modifying the basin for future uses after the GL is installed. Also, should the basin ever need to be cleaned-out, a GL would be more susceptible to damage.

The following recommendations are presented for use of a GL as the basin liner:

- Based on the likely presence of VOC, a HDPE GL is recommended due to the chemical resistance of the HDPE material,

- It is recommended that a geotextile fabric be used as a protective layer between the bottom of the GL and the subgrade. This is a standard practice in the installation of HDPE GL, and may void the GL manufacturer's warranty if not used,
- A minimum 60 mil thickness HDPE should be used,
- During design the effects of wind uplift, frictional resistance on slopes, and anchor trench embedment requirements should be examined during design,
- Due to the expected service life of approximately 5 years, UV degradation should not be a problem,
- Liner penetrations requiring field-extrusion welds should be minimized,
- An inspection program should be implemented to assess effects of wildlife damage on liner.
- Sediment cleanout procedures should be established to minimize potential for damage to the liner.

2164

Based on the information presented in Section 3 above, a GL is the recommended basin liner material.

3.3 Perimeter Drain System

Based on borings in the vicinity of the LSP, a portion of the LSP excavation will terminate in the CGU. High groundwater conditions within the CGU could increase hydrostatic heads and create uplift pressures beneath the liner system. These pressures could compromise the integrity of the liner system. Therefore, some type of drain system must be provided to lower the hydrostatic head on the bottom and sides of the liner.

A groundwater flow analysis of the CGU was performed assuming a hydraulic conductivity of 1.7×10^{-3} cm/sec (4.8 ft/day) and a porosity of 0.35. The water table was set at 575 feet initially and a PD was modeled with the elevation set at 566 feet. The lateral extent and top and bottom elevations of the CGU near the LSP were derived from the Geographical Information System database. Figure 3-2 shows the groundwater contours after 2000 days of collection from the PD system of the LSP. Figure 3-3 shows the groundwater collection rates with time from the PD. For only the first 25 days or so, the recovery rates exceed 5000 ft^3/day (26 gpm). Within 2 years (730 days), the flow has dropped to below 1250 ft^3/day (6.5 gpm). Because of the use of a fixed head boundary condition some distance away at the ends of the CGU body (that is it assumes a continuous water source with no dry periods during the summer months), this analysis tends to overpredict the flow rates into the LSP. Based on this analysis and to proceed with design, a 25 gpm pump was selected (see Figures 3-2 and 3-3).

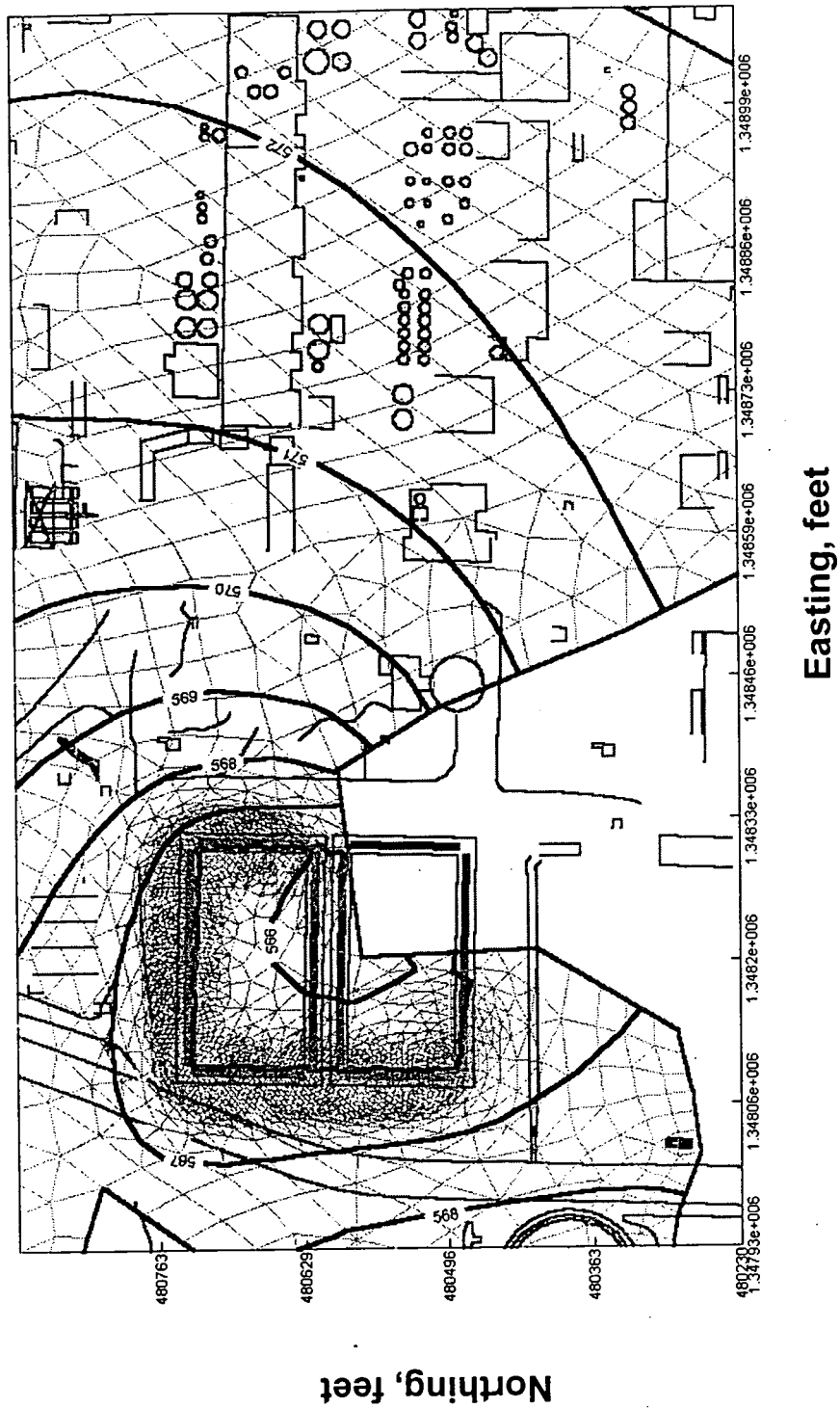

Figure 3-2 – LSP Groundwater Contours

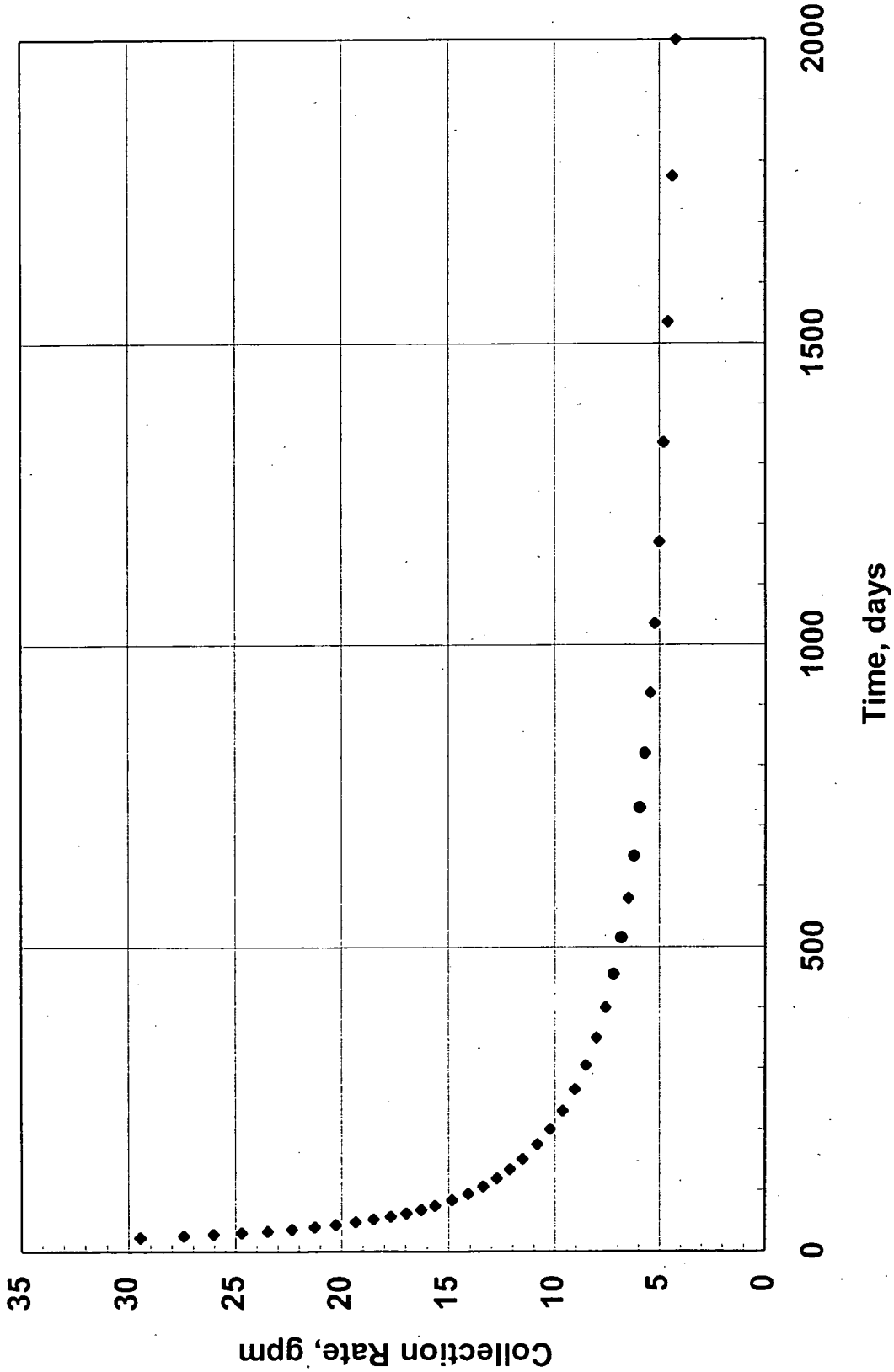

Figure 3-3 - LSP Groundwater Recovery Rates

Based on this groundwater analysis of the CGU and the proposed excavation grading of the LSP, a PD system will be used. The PD system uses a 6-inch perforated, corrugated HDPE pipe with a smooth interior. The PD pipe will be located in a gravel-filled trench surrounded by a geonet/geotextile fabric composite (refer to Construction Drawings for details). The top of the pipe will be located in a perimeter trench with the top-of-pipe a minimum of 6-inches below the liner. The pipe shall be sloped from northwest to southeast on a 1-percent grade (which matches the bottom grade slope). The geonet/geotextile composite will be placed on top of the subgrade (below the GL) and will extend into the PD trench. Any groundwater emitting from the subgrade will be captured and conveyed by the geonet/geotextile composite to the PD. The PD will convey water to a PD lift station located at the southeast corner of the LSP (see Figure 3-4).

3.4 Outlet Structures

The outlet structures include a 400 gpm riser/lift station system to transfer water out of the WMF, and a 25 gpm lift station which will collect seepage from the PD system and pump directly to the existing storm sewer system. The WMF and PD lift stations will be located in the southeast corner of the southern LSP, and installed after excavation activities are completed. Due to the close proximity of the excavation limits to the existing asphalt roadway and K-65 trench, approximately 300 cubic yards of fill material will be placed in the southeast corner of the excavation to provide sufficient room to install the pump stations. This material will be excavated from the west side slopes of the LSP Area after monitoring indicates that all of the impacted material has been removed.

3.4.1 WMF Outlet Structure

The WMF will have a lift station which pumps water to the SWRB or the BSL. The lift station will consist of a manhole, pump, and related piping/wiring/controls, etc., and will be located at the southeast corner of the basin. A high density, polyethylene (HDPE) riser/intake structure will be constructed inside the basin to feed the lift station. The riser will be designed with multiple orifices sized to prevent starvation of the pump. The top of the riser will have a cap-type perforated lid. Discharge from the lift station will be directed to a "tee-wye" fitting. One leg of the fitting will be piped to the SWRB via a new 6-inch pipe and portions of the existing storm sewer system. The other leg of the fitting will be piped to the BSL via a portion of the abandoned 6-inch pipe located in the K-65 trench. Gate valves with post-indicator operators will be installed at the "tee-wye" so that discharge can be manually directed to either the SWRB or BSL, depending on the origin of water being discharged. Additionally, a turbine-type flow meter

will be installed upstream of the "tee-wye" fitting to provide the capability to measure discharge from the WMF (see Figure 3-5).

2164

3.4.2 PD Outlet Structure

A PD lift station will be located at the downstream end of the PD, adjacent to the WMF lift station. Water entering the PD will flow by gravity into the lift station wet well. When sufficient water has been collected in the wet well, it will be pumped directly to the existing storm sewer system for transport to the SWRB (see Figure 3-5).

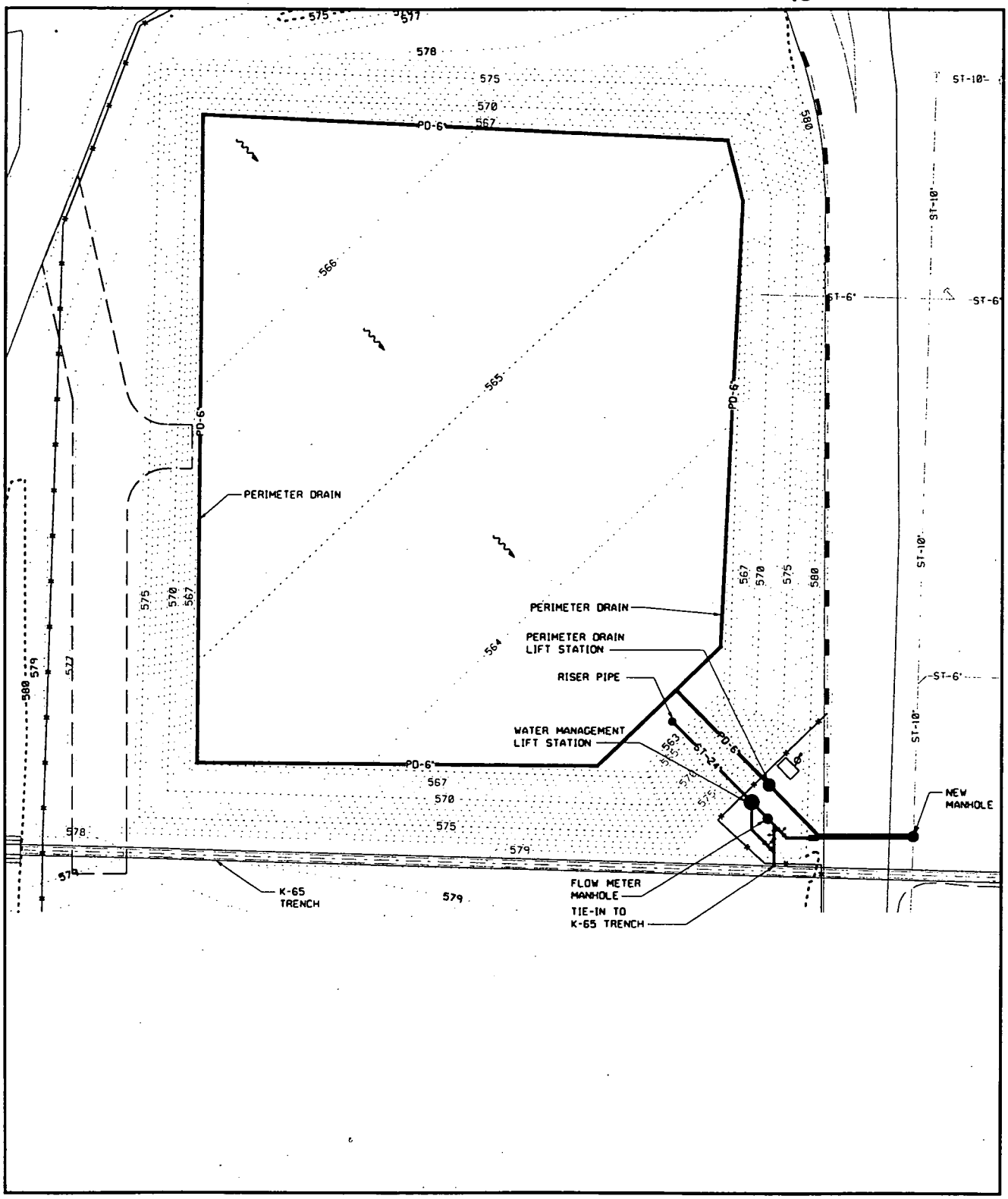

Figure 3-4 – Water Management Facility Plan

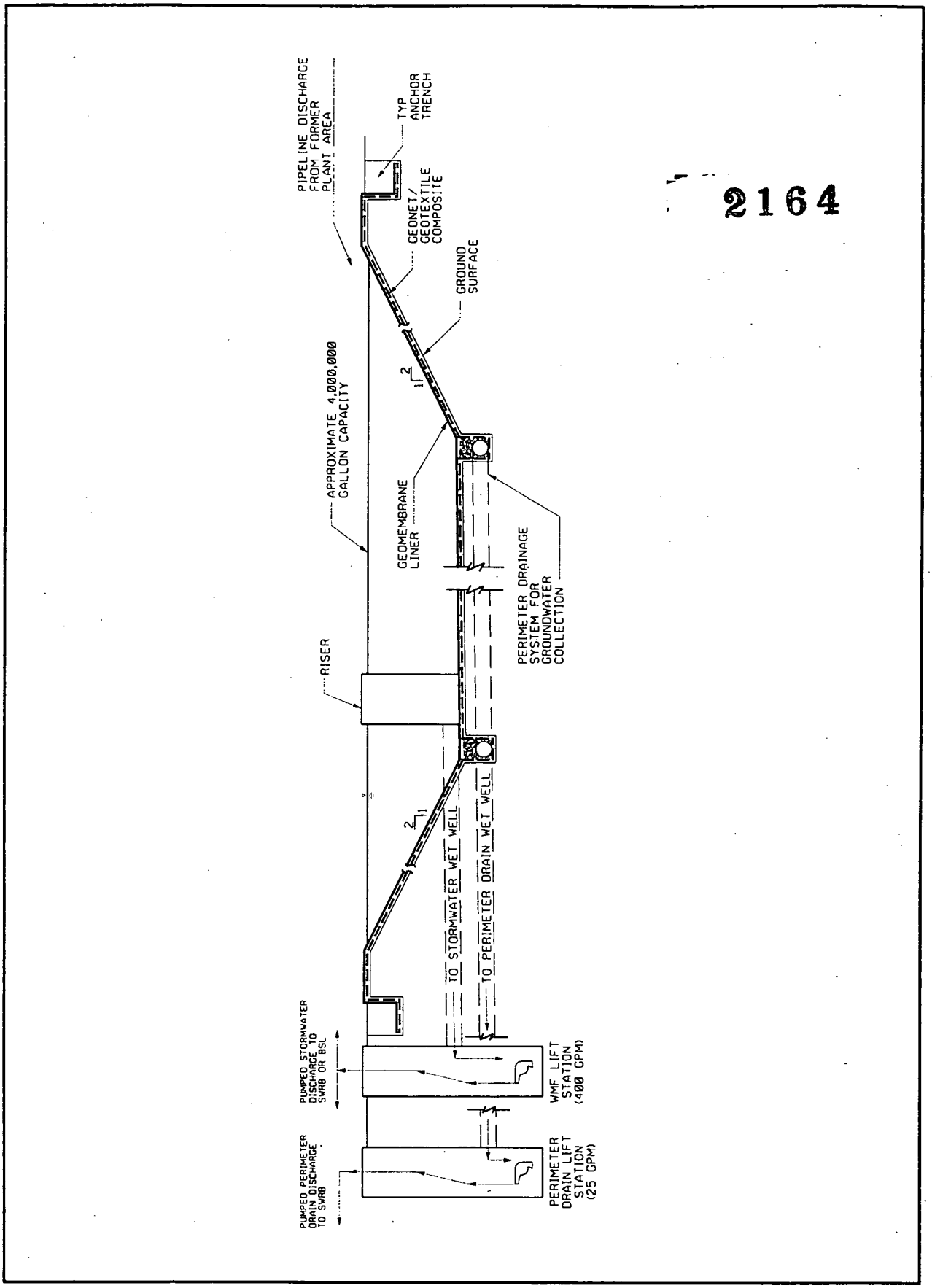

Figure 3-5 – Typical Section Water Management Facility

SECTION 4

4.0 Water Management During Excavation

4.1 Inspection

During excavation the construction area will be monitored by a qualified representative of the contractor and Fluor Daniel Fernald, Inc., (FDF) every 7 calendar days or within 24 hours of a precipitation event of 0.5 inches or greater. Inspections will include areas under excavation, unstabilized exposed areas, erosion control measures, and locations where vehicles enter/exit the project area. Where portions of the project area have been completed and permanent stabilization measures have been implemented, inspections will be conducted at least once every month until the entire project area is completely stabilized.

Disturbed areas and areas used for storage of materials will be inspected for evidence of pollutants entering the local drainage systems. Locations where vehicles exit the project area will be inspected for evidence of off-site tracking of contaminated soil or impacted material.

If the inspections indicate that control measures are not adequate or effective, modifications to the control measures will be implemented immediately by FDF. A report summarizing the scope of the inspection, name of the inspector, inspection date, observations relating to the implementation of this plan, and corrective action measures (if any) will be made and retained in the FDF project files to demonstrate compliance. The reports will either identify any areas of noncompliance with this plan, or contain certification that control measures are effective and in compliance with this plan.

4.2 Operation

During excavation activities temporary control measures will be used to manage surface water and to keep the working area as dry as possible. Field-located sumps will be constructed at low-points within the excavation area. The Contractor will divert surface water to these sumps utilizing berms and/or ditches. As water collects in the sumps, portable pump(s) will be used to pump the water to the existing storm sewer via the temporary hose connection and new piping/manhole constructed during site preparation.

4.3 Maintenance

Erosion and sediment controls will be maintained in good operating condition until the project area has been stabilized. Sediments collected along silt fences and in temporary sumps will be cleaned to maintain desired performance. Sediments removed from silt fences and sumps will be treated as impacted material and disposed of in the OSDF.

5.0 WMF Operation

The LSP Contractor will manage the WMF until project acceptance by FDF. After completion of the conversion to the WMF, Construction Acceptance Testing will be performed and the facility turned over to FDF. After acceptance, FDF's Aquatic Restoration Wastewater Project (ARWWP) will manage and operate the WMF lift stations, pumps, and discharge lines; they will control the discharge of water from the WMF to the BSL and the SWRB. The FPA construction contractor will pump water to the WMF and clean the WMF of sediment. The FDF Construction Manager will coordinate the work with the AWRRP and the FPA construction contractor.

It is anticipated that the WMF will not be operational during the winter months in order to coincide with the schedule for future soil/debris remediation work. The winter shut-down in soil/debris remediation work is required because the OSDF is not operational during this period. Steps to be taken for winter shutdown include shutting off the WMF lift station, draining the discharge piping where freezing may occur, and allowing water to remain in the WMF to preserve the integrity of the liner. The PD lift station will not be shut down and will be operated year-around.

Additional steps and/or modifications may be made to future operations by FPA projects depending upon project design specific to a particular area.