Kilby Ditch / Low-Lying Area Corrective Measures Implementation Plan

Coliseum Boulevard Plume Site
Montgomery, Alabama

Submitted By:

Alabama Department of Transportation
1409 Coliseum Boulevard
Montgomery, Alabama

December 2008
R1 – April 2011
R2 – September 2014

DEPARTMENT OF TRANSPORTATION

Kilby Ditch / Low-Lying Area
Corrective Measures Implementation Plan

Revision 2
September 2014

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COLISEUM BOULEVARD PLUME SITE
MONTGOMERY, ALABAMA

SUBMITTED BY:

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LIST OF ABBREVIATIONS

ADEM	Alabama Department of Environmental Management
ALDOT	Alabama Department of Transportation
ARBCA	Alabama Risk-Based Corrective Action
BMP	Best Management Practices
CBP	Coliseum Boulevard Plume
CM	Corrective Measures
CME	Corrective Measures Evaluation
CMIP	Corrective Measures Implementation Plan
COC	Constituent of Concern
CP	Compliance Point
ESC	Erosion and Sediment Control
ICB	Institutional Control Boundary
ICM	Interim Corrective Measures
LLA	Low-Lying Area
LTM	Long-Term Monitoring Plan
MCL	Maximum Contaminant Level
NPDES	National Pollutant Discharge Elimination System
PH12	Probehole 12 Area
PSLE	Preliminary Screening Level Evaluation
TCE	Trichloroethylene
TSS	Total Suspended Solids
VOCs	Volatile Organic Compounds

1. INTRODUCTION

The Voluntary Settlement Agreement between the Alabama Department of Environmental Management (ADEM) and the Alabama Department of Transportation (ALDOT) for the Coliseum Boulevard Plume (CBP) was executed in December 2011. The Agreement required the submittal and approval of four (4) Corrective Measures Implementation Plans (CMIPs), as follows:

- Kilby Ditch/Low-Lying Area CMIP
- Institutional Control Plan
- Long-Term Monitoring Plan
- Southwest Treatment Area CMIP

Each of these plans have been approved by ADEM and implemented by ALDOT. This revision is limited to certain operational and maintenance requirements that have changed (since approval of the CMIPs) as the systems have stabilized (for example, locations of monitoring points, frequency of samples, etc.).

1.1. PROJECT OVERVIEW

The Coliseum Boulevard Plume (CBP) is an area of approximately 1,200 acres in north Montgomery, Alabama where the shallow groundwater contains or is predicted to contain trichloroethylene (TCE) by 2039. The CBP extends generally from the Kilby Ditch in the northeast to the former North Montgomery Materials, LLC (NMM) sand and gravel mine in the southwest (see Figure 1-1).

Investigations to assess the extent and nature of the CBP began in 1999. Groundwater remains below the ground surface throughout the CBP with the exception of three limited areas: 1) the Kilby Ditch/Low-lying Area in the northeast part of the CBP; 2) the Southwest Treatment Area (SWTA) of the CBP; and, 3) the Zoo Pond/Zoo Ditch in the northern part of the CBP. The Alabama Department of Transportation (ALDOT) has accepted responsibility for monitoring and management of the CBP, and has recommended the following remedial actions:

- Control groundwater at the distal portions of the CBP;
- Treat TCE-containing surface water prior to discharge from the CBP;
- Restrict access to groundwater via institutional controls; and,
- Restrict access to surface water via engineering controls.

In the report entitled "Site-Wide Corrective Measures Evaluation Report, October 2007, Revised July 2008" (CME), ALDOT recommended the following actions to address the CBP:

- Cover West Kilby Ditch and slope stabilization of the northern section of Main Kilby Ditch;
- Retain or reposition security fencing along Main Kilby Ditch;
- Construct a Wetland Treatment System and perimeter security fencing in the Low-lying Area;
- Hydraulic control in the Southwestern Area of the CBP;
- Monitor surface-water and groundwater; and,
- Implement institutional controls to restrict access to and prevent use of groundwater.

Based on the completed investigations, an Institutional Control Plan (ICP, April 2008) and a Long-Term Monitoring Plan (LTM, August 2008) were developed and approved by ADEM. Figures 1-1A and 1-1B are an overview of the investigation reports, Corrective Measures Implementation Plans and Quarterly (2001-2011) and Annual (2011-2014) reports for this project. Figure 1-2 shows the institutional control parcels, West, Main and Lower Kilby Ditches, and the Low-Lying Area.

1.2. PURPOSE AND OBJECTIVES

This Corrective Measures Implementation Plan (CMIP) for Kilby Ditch/Low-Lying Area and a Southwest CMIP document the specific measures to control and treat TCE-containing groundwater prior to exiting the institutional control boundary

(ICB). The CMIP documents the corrective measures proposed for the Kilby Ditch/Low-Lying Area, which include:

- Restrict access to TCE within the surface-water through engineering controls;
- Reduce TCE in the Main Kilby Ditch and the Low-Lying Area to meet the Alabama Department of Environmental Management (ADEM) TCE action level in Three Mile Branch[1], and;
- Intercept TCE-containing groundwater from migrating beyond the ICB at concentrations above the 0.005 milligram per liter (mg/L) Alabama Drinking Water maximum contaminant level (MCL).

[1] In May 2011, the action level of TCE will change from the current level of 0.175 mg/l to 0.0175 mg/l in accordance with ADEM regulations. The evaluation of corrective measures was based on the current water-quality standard; however, ALDOT will design treatment systems to comply with the lower water-quality standards, where appropriate.

2. KILBY DITCH / LOW-LYING AREA CORRECTIVE MEASURES

2.1. ENGINEERING CONTROLS

Engineering controls are designed to restrict or minimize potential contact with water that contains TCE. These controls include the following:

- West Kilby Ditch - The West Kilby Ditch between Coliseum Boulevard and the Main Kilby Ditch will be converted from an open channel to two (2) 7 foot (ft.) by 6 ft. precast concrete box culverts. The chain-link fence that surrounds the West Kilby Ditch will be removed and the area above the box culverts will be backfilled and stabilized with vegetative cover and landscaped with sod (Figure 2-1).

- Main Kilby Ditch - Engineering controls will be implemented from the confluence of the Main Kilby Ditch with West Kilby Ditch to North Boulevard (Figure 2-1).

  - A riprap-lined channel will extend from the intersection of West Kilby and Main Kilby Ditches to the two existing 12 ft. by 10 ft. reinforced concrete box culverts that extend beneath North Boulevard. Part of the Main Kilby Ditch channel will be realigned to reduce sedimentation in the box culverts beneath North Boulevard. The channel design minimizes the amount of soil to be removed from the Main Kilby Ditch. A geotextile fabric will be placed in portions of the Main Kilby Ditch channel and along the channel side-walls to stabilize the banks. The fabric will reduce bank erosion thereby reducing in-stream sedimentation. Riprap will be placed in the channel to a minimum thickness of 2 ft. and the channel slope will be graded as shown in Table 2-1.

  - The Main Kilby construction area will be landscaped during construction to include planting of vegetation and mature trees.

  - o A chain-link security fence will surround the Main Kilby Ditch from the confluence of West Kilby to North Boulevard (Figure 2-1).

- Low-Lying Area –The Lower Kilby Ditch will be stabilized to improve the channel cross-section and profile at high potential scour locations by placing structures to prolong the channel's configuration and enhancing its overall biological, ecological and physical functions. Improvements within the Low-Lying Area will consist of channel and floodplain enhancement; constructed wetlands; natural wetland, and; a groundwater interceptor trench. A chain-link security fence will surround the Low-Lying Area between the CSX railroad, North Boulevard, Three Mile Branch, and immediately west of Lower Kilby Ditch (Figure 2-1). The plans in Appendix A provide an overview of the proposed enhancements. Vegetation and planting within the Low-Lying Area is discussed in Section 2.2.2.2.

2.2. TCE TREATMENT AND REDUCTION

2.2.1. MAIN KILBY DITCH

The Main Kilby Ditch, from its confluence with West Kilby Ditch to North Boulevard, is approximately 1,400 feet. The channel bottom and side-walls (up to the groundwater seepage interface) will be covered in riprap to restrict direct access to base flow in the channel. Elevation changes within channel segments will create turbulence in base flow (e.g., surface water resulting from groundwater discharge to the open channel) resulting in TCE volatilization.

2.2.2. LOW-LYING AREA

The following treatment mechanisms will be used within the Low-Lying Area to remove TCE in surface water:

- Channel and floodplain enhancement;
- Constructed wetlands;
- Natural wetland, and;
- Groundwater interceptor trench.

The treatment components within the LLA maximize enhancement of the natural physical, geochemical, and biological processess associated with TCE reduction in shallow groundwater and surface water flow through the LLA.

2.2.2.1. CHANNEL AND FLOODPLAIN ENHANCEMENTS

Lower Kilby Ditch is the section of Kilby Ditch between North Boulevard and its discharge to Three Mile Branch. Existing channel conditions in the Lower Kilby Ditch include:

- Excessive channel down-cutting (i.e., incision);
- Excessive aggradation (deposition);
- Bank failure/sloughing, and;
- Channel blockage and corresponding floodplain aggradation.

The Lower Kilby Ditch will be stabilized to improve the channel cross-section and profile at high potential scour locations by placing structures to prolong the channel's configuration and enhance its overall biological, ecological and physical functions. The plans in Appendix A provide an overview of the proposed enhancements.

The Hydrologic Engineering Center's – River Analysis System (HEC-RAS®) model, detailed topographic surveys, and collection of site-specific geomorphic data were used to design a Priority 3 restoration[2] on select portions of the Lower Kilby Ditch channel. Priority 3 restoration is generally defined as widening the floodplain at the existing bankfull elevation. The HEC-RAS® model design is presented in Appendix B.

The specific actions proposed for improving channel stability include:

1. <u>Floodplain restoration</u> - Steep banks will be sloped to provide a "bankfull bench" allowing higher flow events to overflow the Lower Kilby Ditch channel and spread out on a

[2] Rosgen, D.L. 1997. A geomorphologic approach to restoration of incised rivers. In *Proceedings of the Conference on Management of Landscapes Disturbed by Channel Incision*, ed. S.S.Y. Wang, E.J. Langendoen and F.B. Shields, Jr. Oxford, Miss.: University of Mississippi.

flat, 5 ft. to 10 ft. wide vegetated floodplain; thus, reducing in-channel sheer and scour during higher flow events. Floodplain restoration will include application of appropriate seed mixes, rolling and keying-in jute mat (biodegradable coconut fiber stabilization blanket) from the toe of all restored channels to the top of bank on the floodplain, and shrub plantings.

2. Install grade control structures and bank stabilization features at key locations – Proposed stabilization includes armoring some riffles and high sheer stress outer meanders and installing step pools, rock and/or long cross vanes, log vanes and root wads within the channel. These structures will reduce bed erosion, direct stream flow toward the center of the channel (away from the banks), provide vertical energy dissipation, and increase TCE volatilization in steeper portions of the channel.

2.2.2.2. CONSTRUCTED WETLAND

One natural wetland has been delineated in the LLA and a second wetland will be constructed to reduce TCE in the surface-water. A properly constructed wetland will emulate the same physical, chemical and biological processes as a natural wetland system. Wetlands improve water quality by reducing contaminant concentrations through numerous and often interrelated mechanisms as described below:

- Adsorption and ion exchange on the surfaces of plants, substrate, sediment, and litter;
- Aerobic and anaerobic breakdown processes;
- Breakdown and transformation of pollutants by microorganisms and plants;
- Chemical transformation;
- Filtration and chemical precipitation through contact of the water with the substrate and litter;
- Settling of suspended particulate matter;
- Uptake and transformation of nutrients by microorganisms (bioremediation) and plants (phytoremediation), and;
- Volatilization.

These mechanisms have been shown to reduce VOCs, total suspended solids, hydrocarbons, nitrogenous compounds, phosphoric compounds, metals and pathogens (ITRC, 2003). The reducing conditions found in wetland sediments combined with the chemical breakdown and uptake abilities of plants are two major benefits of using wetlands to attenuate and reduce TCE concentrations. The greater concentrations of carbon and other potential terminal electron receptors (e.g., sulfur salts) at the groundwater/wetland interface in wetlands increase the VOC removal capabilities of wetlands (Mitsch and Gosselink, 1993).

Because base flow consists of groundwater discharge into the Kilby Ditch system, the constructed wetland will be designed to treat base flow only. Base flow is estimated to range between one and two cubic feet per second (cfs) through the constructed wetland.

The main structural elements of the constructed wetland include:

1. Diversion channel;
2. High marsh (water depth of 0.1 ft. to 0.5 ft);
3. Low marsh (water depth of 0.5 ft to 1.5 ft);
4. Deep pools (water depth of 6.0 ft to 8.0 ft);
5. In-basin diversion dike;
6. Outfall structure, and;
7. High water spillway.

Base flow will be diverted to the constructed wetland through use of a cross-vane structure elevated above the Lower Kilby Ditch channel invert by 0.5 ft. to 1.0 ft. Base flow will drop over two 0.5 ft. to 0.75 ft. vertical steps (step pools) into a deep pool that will also function as a settling basin. A riprap pad will be constructed adjacent to this pool to allow access to perform periodic sediment clean-out. Base flow will continue into the constructed wetland, which will be a combination of shallow and deep-water habitats. An in-basin diversion dike will be constructed to prohibit hydraulic short-circuiting between the inlet and the outlet. Base flow will exit the system through several step pools. The vertical drops designed in the step pools will not exceed 0.75 ft to maintain upstream movement of aquatic organisms. Most of the high flows will by-pass the constructed wetland via the main channel. A high water spillway is proposed for the constructed wetland to avoid hydraulic overload and potential uncontrolled washout during periods of higher flow. This high water spillway, proposed for the eastern end of the constructed wetland basin, will allow water to sheetflow over riprap into the existing scrub-shrub/meadow wetland. Appendix A includes design drawings for the constructed wetland.

Treatment mechanisms will be enhanced through oxidation provided by several step pools and reduction provided through the deep water pools and in the anoxic (oxygen-free) wetland sediments. All but the deepest portions of the constructed wetland will be vegetated with appropriately selected wetland plants.

The proposed Kilby Ditch system design and corrective measures are currently under review by the ALDOT for development of final plans and specifications for construction bidding. Thus, minor modifications or adjustment could be applied to the final Kilby Ditch system design to meet the ALDOT bid requirements. Appendix A provides the design of the constructed wetland. Sizing calculations for the constructed wetland are provided in Table 2-2.

2.2.2.3. NATURAL WETLAND

Approximately 3.1 acres of emergent and forested/scrub-shrub wetlands are within the LLA. The dominant emergent species include rice cutgrass (*Leersia oryzoides)*, tear-thumb (*Polygonum sagittatum)*, smartweed (*Polygonum* sp.), and great ragweed (*Ambrosia trifida).* The dominant tree and shrub species include black willow (*Salix nigra*), Chinese tallow (*Triadica sebifera*), Chinese privet (*Ligustrum sinense),* and box-elder (*Acer negundo*). As stated previously natural wetlands provide similar functions as those described above for constructed wetlands with efficiency varying depending on plant types, hydraulic retention time, water temperature, and contaminant load. The channel banks within the LLA and natural wetland area will be sloped to allow for surface water overflow into the natural wetlands.

2.2.2.4. GROUNDWATER INTERCEPTOR TRENCH (TREATMENT)

A groundwater interceptor trench will be constructed along the northern portion of the Low-Lying Area. The trench channel will be excavated to an elevation ranging between 169 ft. and 172 ft. and will drain to the Lower Kilby Ditch. The typical cross-section of the ditch will be trapezoidal with a base width of approximately 10 ft. with 3 to 1 (horizontal to vertical) side-slopes. The ditch will be approximately 1,200 feet long. A pond will be excavated to an elevation of approximately 170 ft. to 172 ft. at the west end of the trench. This pond will be approximately 0.1 acre and will maintain a permanent pool depth of two feet. The pond will be planted with rooted aquatic plants and the trench will be planted with other hydrophytic (water-loving) herbaceous and woody vegetation to maximize reductive dechlorination associated with root/soil interface in saturated conditions and anoxic muds. In addition plant uptake will result in the removal of TCE from groundwater (e.g., phytoremediation).

2.3. GROUNDWATER INTERCEPTOR TRENCH

The groundwater interceptor trench will also intercept shallow groundwater in this portion of the CBP. The dissolved TCE in the LLA is flowing to the north/northeast and is within several inches to approximately 4 ft. beneath ground surface. Groundwater entering the interceptor trench will be conveyed as surface water to the Lower Kilby Ditch. The interceptor trench is designed to protect the ICB so that groundwater TCE concentrations greater than 0.005 mg/L are contained and treated within the LLA.

3. IMPLEMENTATION AND SCHEDULE

3.1. MATERIALS MANAGEMENT AND EROSION AND SEDIMENT CONTROL

An Erosion and Sediment Control (ESC) plan for all phases of construction in the West Kilby Ditch, Main Kilby Ditch, and Low-Lying Area will be developed for sediment control. The ESC plan will follow the ESC guidelines set forth in the "Alabama Handbook for Erosion Control, Sediment Control and Stormwater Management on Construction Sites and Urban Areas, June 2003" and ADEM administrative code 335-6-12. Best Management Practices (BMPs), such as phasing and sequencing of construction activities to minimize disturbed areas, will be employed. A materials management plan for this CMIP has been developed and is provided in Appendix C.

3.2. PERMIT REQUIREMENTS

The following permits are required prior to construction:

- United States Army Corps of Engineers Nationwide 38 Permit. This Permit allows for construction in a water body for the purpose of environmental remediation (obtained September 2008).
- ADEM Clean Water Act 401 Water Quality Certification
- ADEM Construction Stormwater Permit
- City and County Construction Permits

3.3. SCHEDULE

Implementation of the corrective measures identified for the Main Kilby Ditch, West Kilby Ditch and Low-lying Area will require regulatory approval, design, contract procurement, and construction. An estimated timeline for implementing the corrective measures is summarized below.

December 2008	Regulatory Approval – Since the proposed corrective measures include modifications to channels that are identified as Waters of the U.S., authorization was obtained from

	the U.S. Army Corps of Engineers to implement the CMIP. ADEM must review and approve this CMIP.
January-March 2009	Finalization of Design Documents – The design documents will be prepared in accordance with ALDOT's standards and requirements.
March-April 2009	Public Notice – All corrective measures plans will be placed on public notice for review and comment.
April-June 2009	Contract Procurement – Construction of the corrective measures will be bid as an ALDOT project. The contract procurement and bidding process will include Notice to Contractors, Bid Opening, Contract Award, Contract Bonding, Execution of Contract, Approval of Contract and Notice to Proceed.
September 2009	Construction – Construction of the project will be initiated.

4. KILBY DITCH AND LOW-LYING AREA MONITORING

4.1. SURFACE WATER MONITORING

Samples will be collected within the Low-Lying Area to monitor the effectiveness of the treatment system and reduction of TCE concentrations. Low-Lying Area samples will consist of the following:

- LLA-1 Upstream of constructed wetland
- LLA-2 Discharge from constructed wetland
- LLA-3 Internal constructed wetland
- LLA-4 Small tributary south of existing natural wetland
- LLA-5 Groundwater interceptor trench pond
- LLA-6 Groundwater interceptor trench before confluence with Lower Kilby Ditch
- LLA-7 Lower Kilby Ditch after confluence with groundwater interceptor trench
- LLA-8 Existing wetland
- LLA-9 Unnamed tributary immediately south of Northern Boulevard
- LLA-10 Surface water south of Northern Boulevard groundwater seeps from west of unnamed tributary
- LLA-11 Discharge from Russell Distribution facility stormwater/groundwater

Figure 4-1 shows the monitoring sites. Samples are analyzed for volatile organic compounds (VOCs). Samples were collected monthly in 2011 for LLA-1 through LLA-9, the first year following completion of construction. Previous locations N, O, and P were renamed LLA-9, LLA-10, and LLA-11. Beginning in 2012, sampling frequency was changed to quarterly, and more frequent sampling may be performed, at the discretion of ALDOT, to document seasonal concentration variations, trends or confirm results from previously collected samples.

Water quality samples will not be collected from West and Main Kilby Ditches following CMIP construction and implementation of the Long-Term Monitoring Plan. Base flow will not be accessible in West Kilby Ditch due to enclosure within box culverts and base flow in Main Kilby Ditch will be below the top of the riprap channel (Long-Term Monitoring Plan, August 2008).

4.2. COMPLIANCE POINT MONITORING

Samples will be collected at the surface water compliance point at the confluence of Three Mile Branch and Lower Kilby Ditch. Samples will be collected at the compliance point every two weeks consistent with sampling requirements under a National Pollutant Discharge Elimination System (NPDES) permit. Based on the ADEM / ALDOT Agreement, the concentration of TCE within the discharge cannot exceed a monthly average of 37.38 ug/L. Figure 4-1 shows the compliance point.

4.3. MONTHLY SITE INSPECTIONS

Monthly inspections of the Kilby Ditch and Low-Lying Areas will be performed to observe and assess the following:

- Vegetation conditions
- Channel bank stability structures
- Areas of erosion or deposition
- Effects from beaver activities
- Access road conditions
- Accessibility to sample locations.

5. REFERENCES

Alabama Department of Environmental Management. 2005. Alabama Risk-Based Corrective Action Guidance Manual. ADEM, Montgomery, AL. (February 2005).

ALDOT. 2008. Kilby Ditch Hydrology and Hydraulics Evaluation (July 2008).

Harrelson, C.C., C.L. Rawlins, and J.P. Potyondy. 1994. Stream channel reference sites: An illustrated guide to field technique. U.S. Forest Service, Rocky Mountain Forest and Range Experiment Station. General Technical Report RM-245.

ITRC Wetland Team. 2003. Technical and Regulatory Guidance Document for Constructed Treatment Wetlands. IRTC p199.

Mitsch, W.J. and J.G. Gosselink. 1993. Wetlands, 2nd ed., 722 pp. New York: Van Nostrand Reinhold.

Rosgen, D.L. 1997. A geomorphologic approach to restoration of incised rivers. In *Proceedings of the Conference on Management of Landscapes Disturbed by Channel Incision*, ed. S.S.Y. Wang, E.J. Langendoen and F.B. Shields, Jr. Oxford, Miss.: University of Mississippi.

USGS. 2003. Magnitude and Frequency of Floods in Alabama, Scientific Investigation Report 2007-5204.

Tables

Table 2-1
Section Descriptions for Main Kilby Ditch

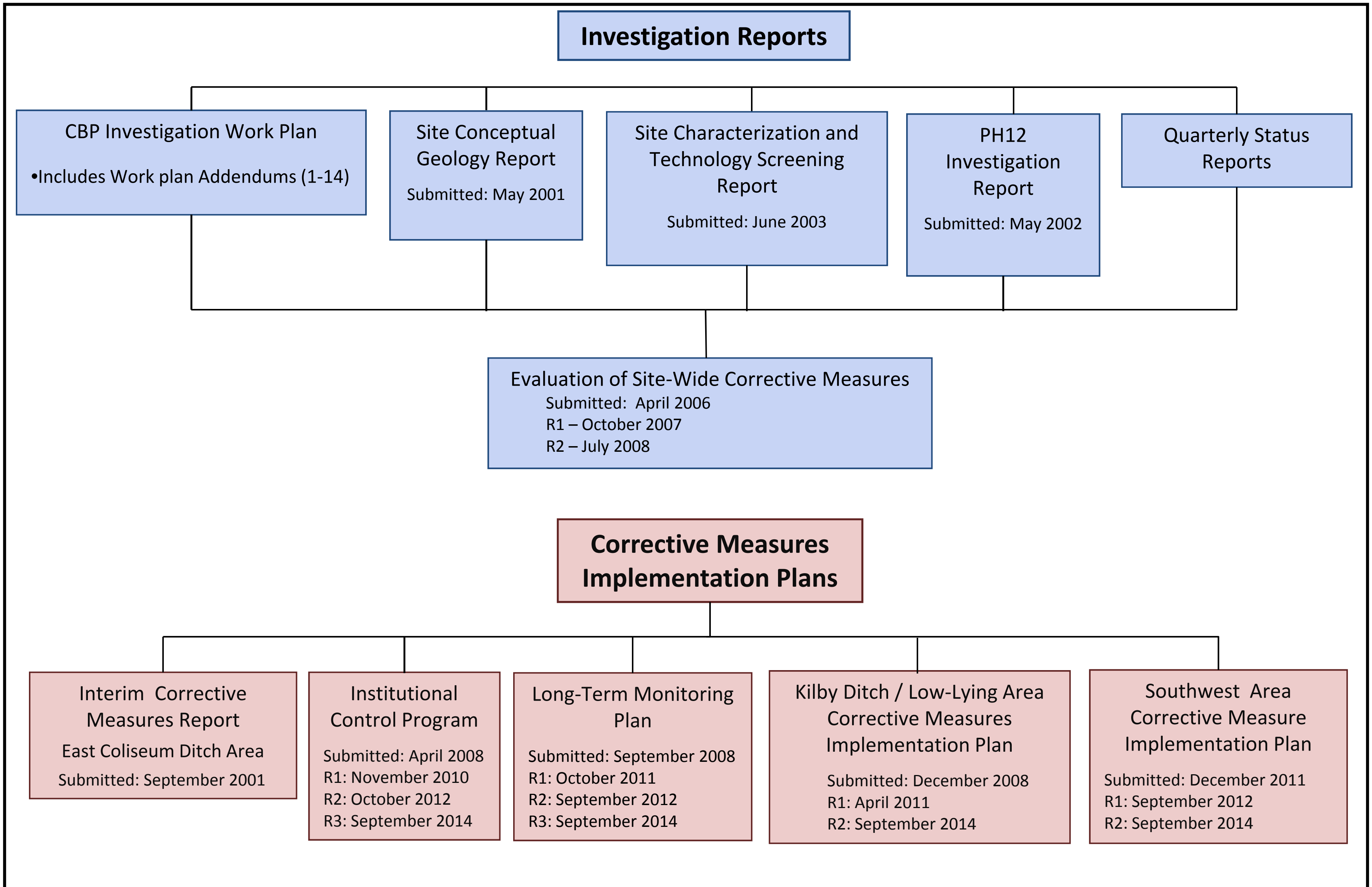
Section	Bottom Width (feet)	Slope (foot/foot)	Side Slopes	From Station (feet)	To Station (feet)
1	24	0.0188	3:1	0+00	0+50
2	14	0.0052	3:1	0+50	5+75
3	14	0.0075	3:1	5+75	13+87

Table 2-2

Sizing Calculations for Constructed Wetland System

Estimated Base flow	1 to 2 cubic feet per second
Constructed Wetland Size	1.1 acres
Estimated Treatment Volume	2 acre-feet
Hydraulic Retention Time (HRT)	0.5 to 1 day
Proposed Permanent Pool Elevation (AMSL)	177 feet

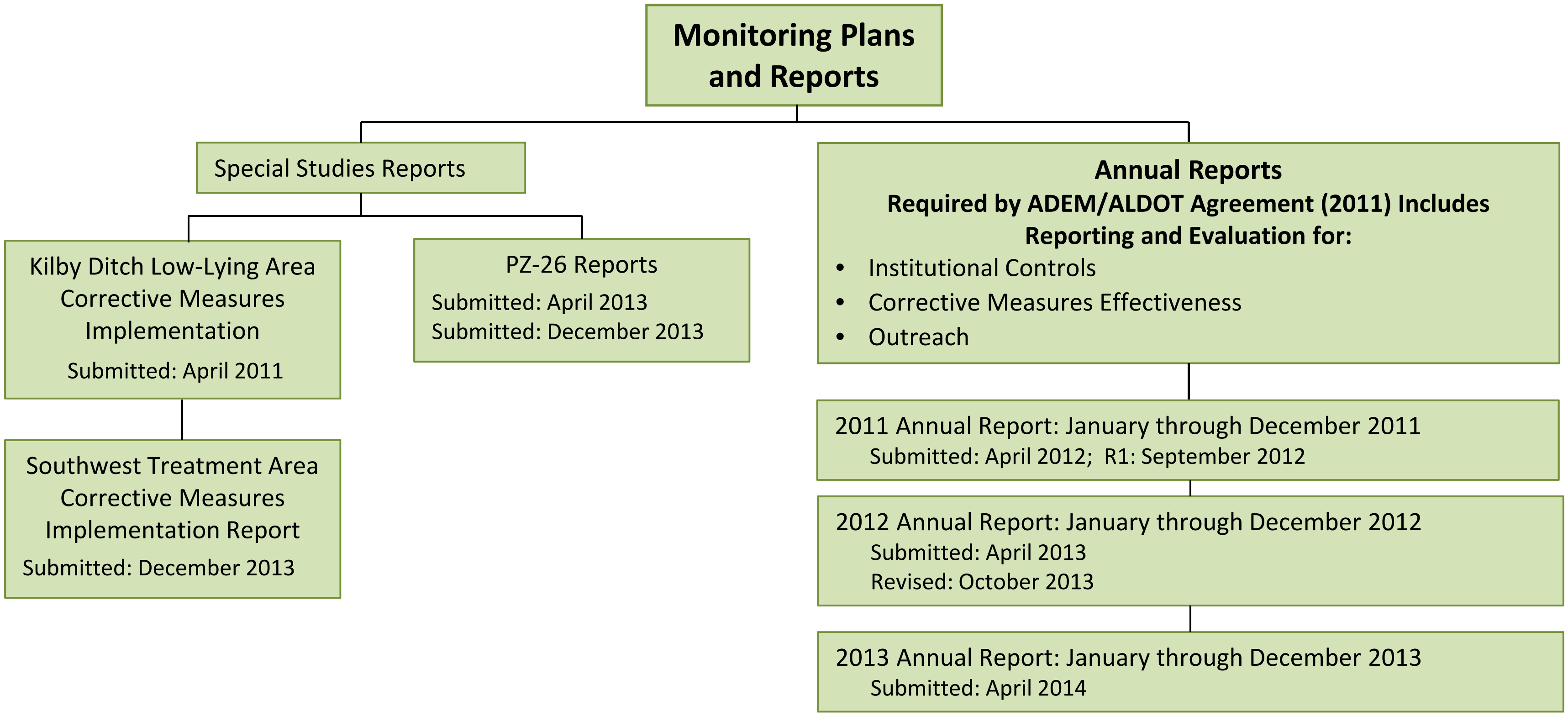
Figures



DEPARTMENT OF TRANSPORTATION

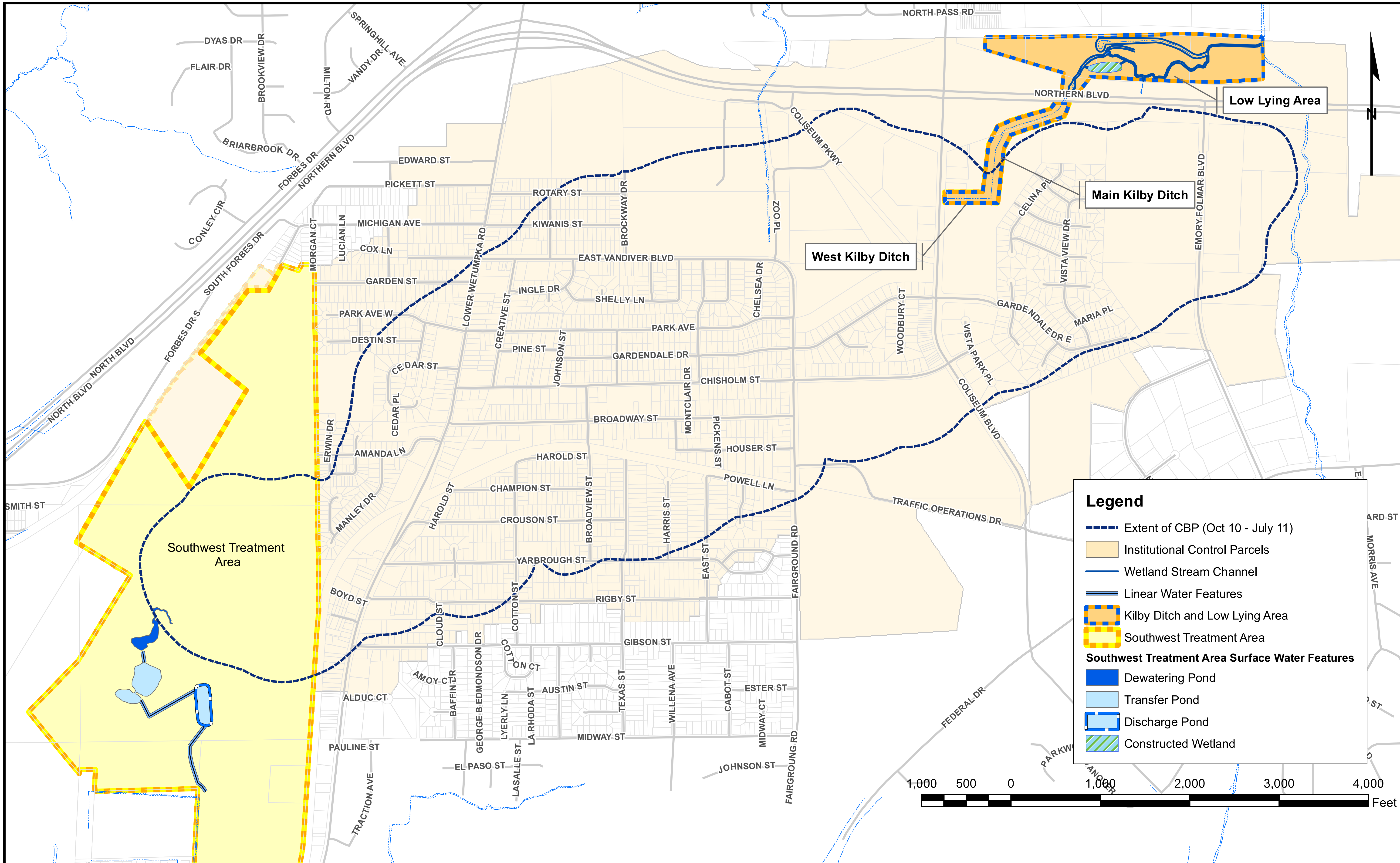
ALABAMA DEPARTMENT OF TRANSPORTATION
COLISEUM BOULEVARD PLUME

FIGURE 1-1A
Overview of Reports and Monitoring Plans



ALABAMA DEPARTMENT OF TRANSPORTATION
COLISEUM BOULEVARD PLUME

FIGURE 1-1B
Overview of Annual and Special Reports

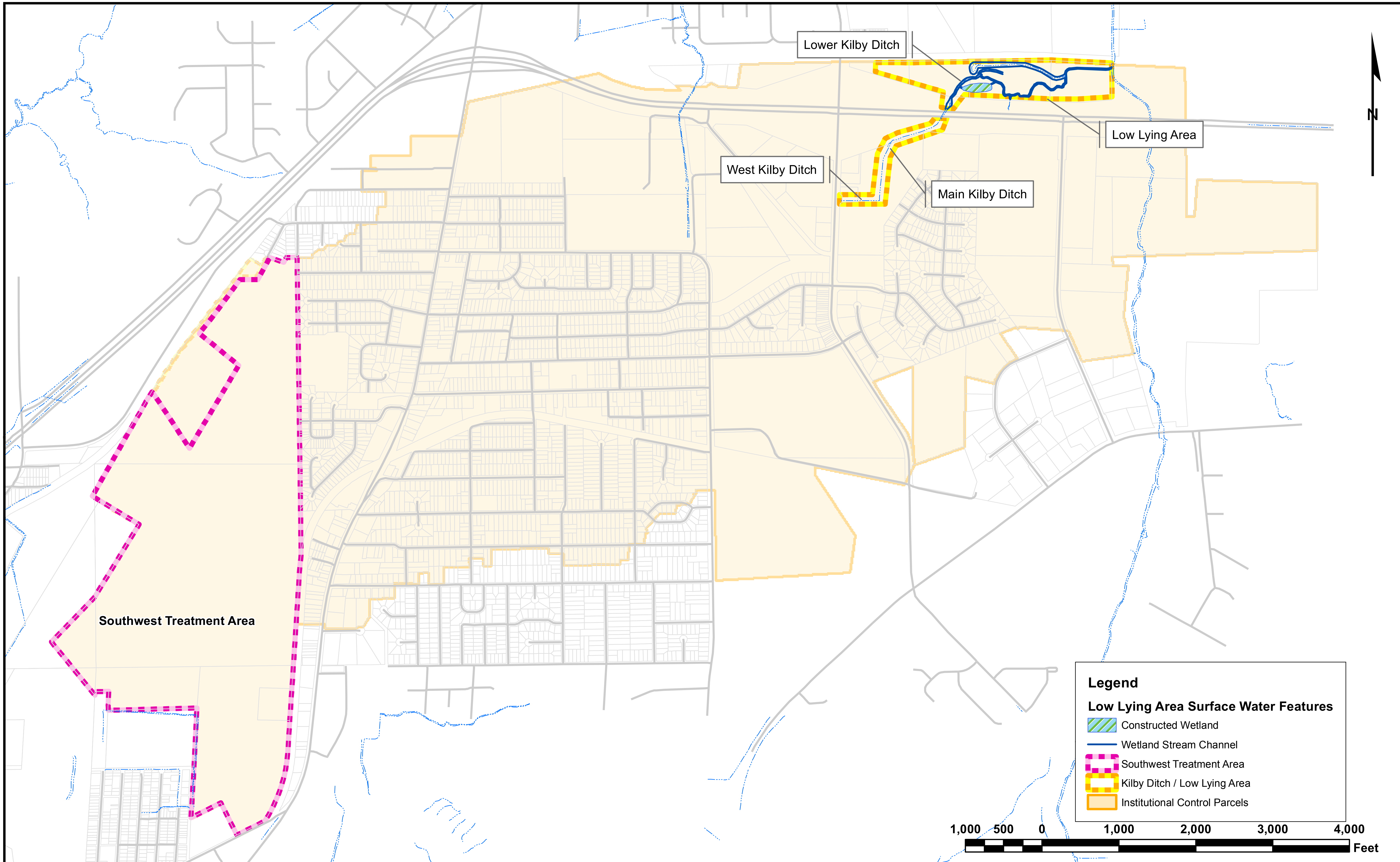


COLISEUM BOULEVARD PLUME

EXTENT OF TRICHLOROETHYLENE IN GROUNDWATER

September 2014

Figure 1-1



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KILBY DITCH / LOW-LYING AREA CORRECTIVE MEASURE LOCATIONS

September 2014

Figure 1-2

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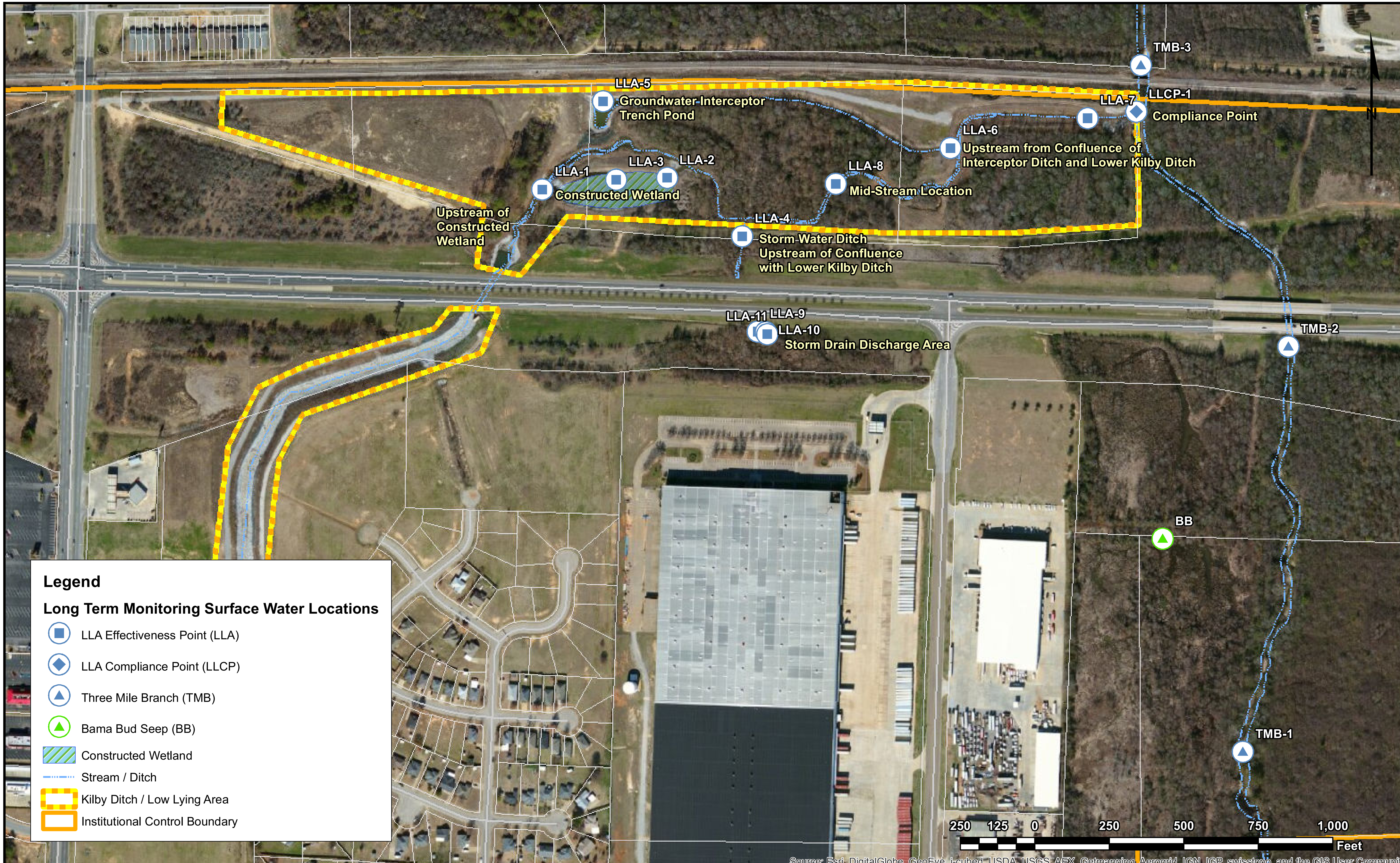
COLISEUM BOULEVARD PLUME PROJECT

KILBY DITCH AND LOW-LYING AREA ENGINEERING CONTROLS

September 2014

Figure 2-1



ALABAMA DEPARTMENT OF TRANSPORTATION
COLISEUM BOULEVARD PLUME PROJECT

LOW-LYING AREA SURFACE WATER MONITORING

September 2014

Figure 4-1

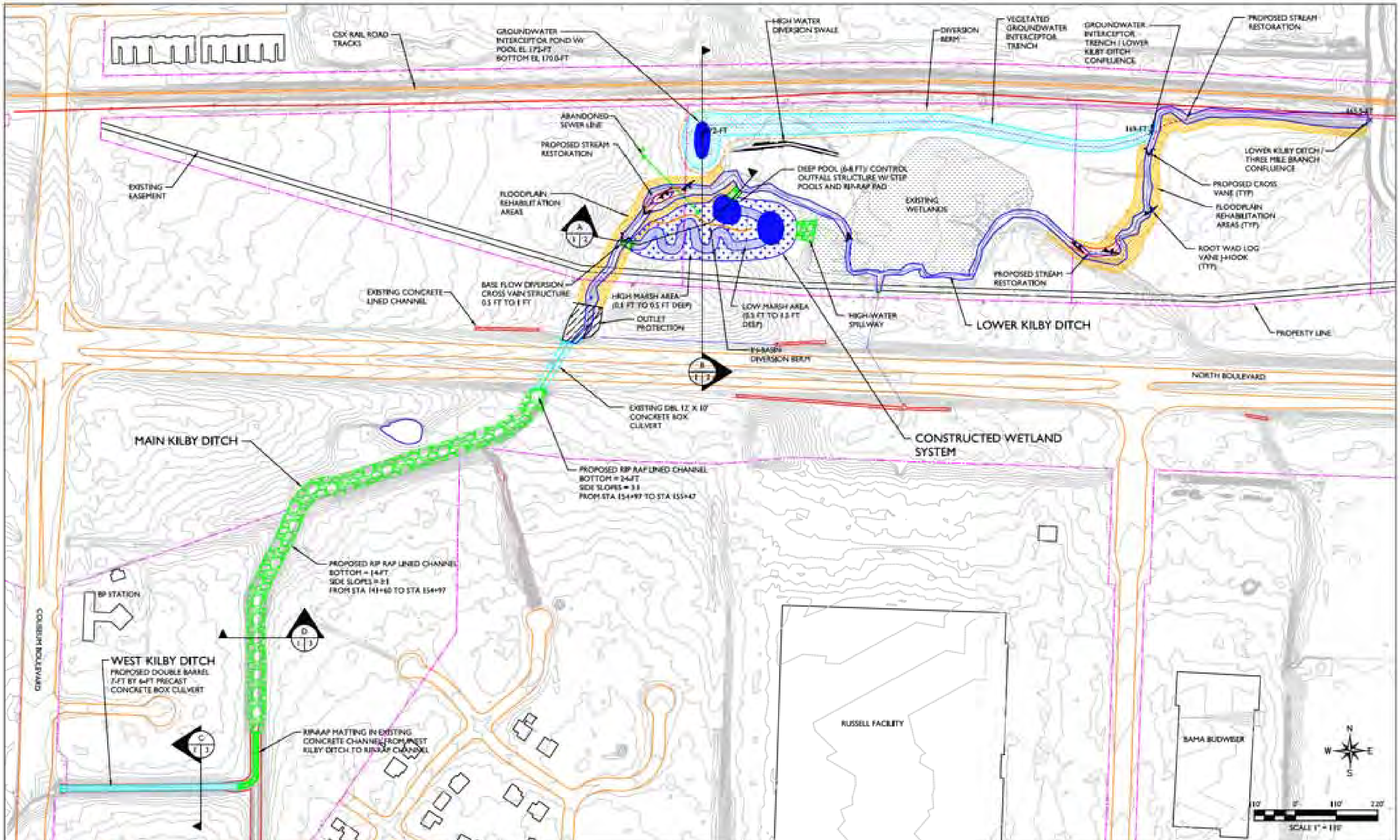
Appendix A

Plates (half size)

Corrective Measures Implementation Plan

COLISEUM BOULEVARD PLUME SITE
MONTGOMERY, ALABAMA

ALABAMA
DEPARTMENT OF TRANSPORTATION



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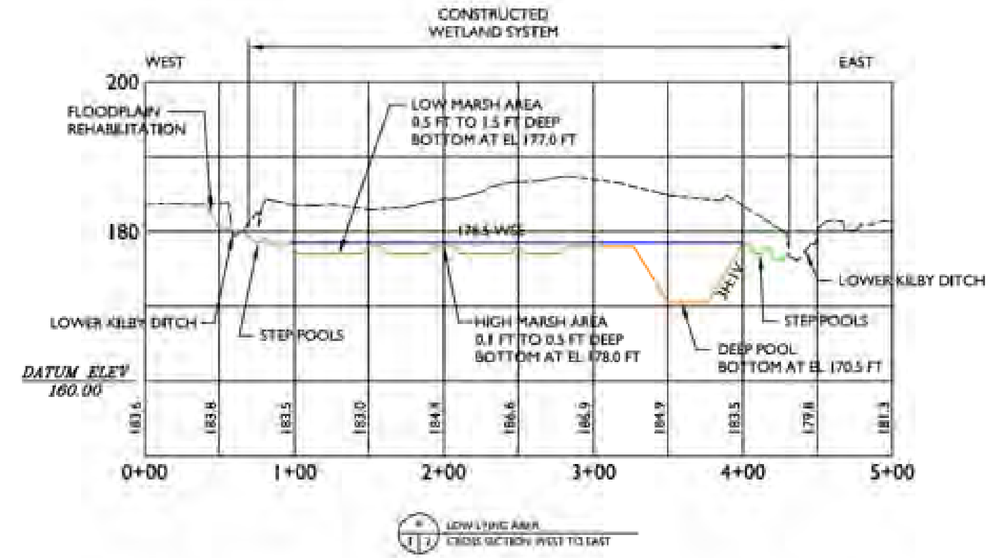
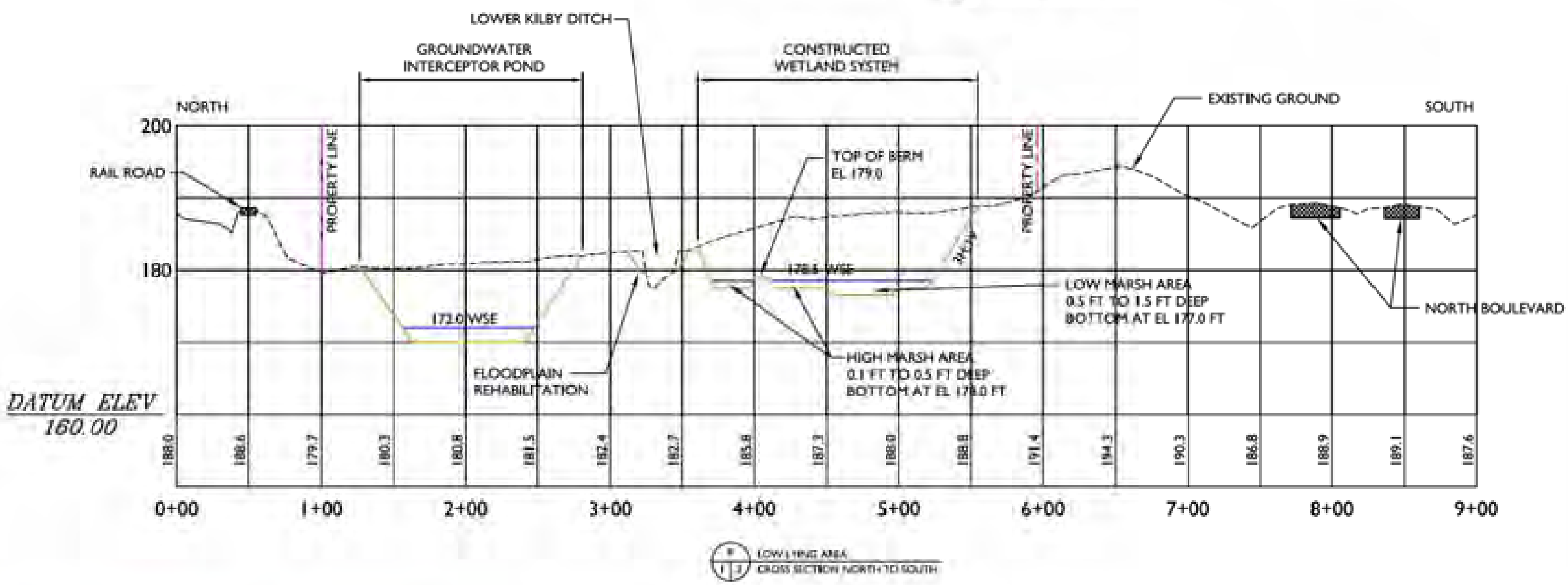
ALABAMA DEPARTMENT OF TRANSPORTATION
MONTGOMERY, AL

COLISEUM BOULEVARD PLUME PROJECT

PROJECT OVERVIEW
KILBY DITCH & LOW LYING AREA
CORRECTIVE MEASURE
NOT TO SCALE

DATE AUGUST 2008
A1





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MONTGOMERY, AL

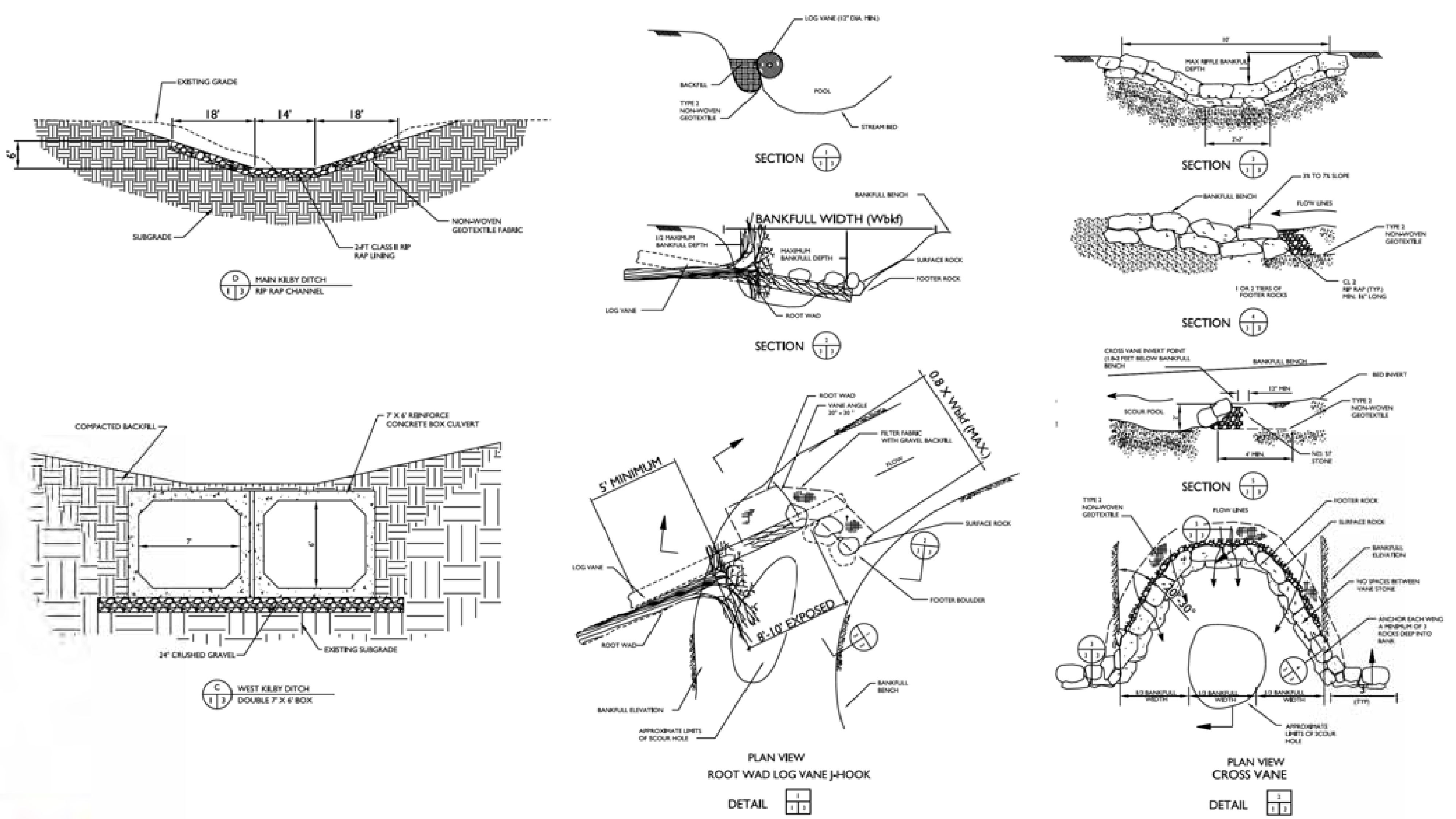
COLISEUM BOULEVARD PLUME PROJECT

PROJECT OVERVIEW

KILBY DITCH & LOW LYING AREA
CORRECTIVE MEASURE

NOT TO SCALE

DATE AUGUST 2008
A2 SHEET 2 OF 4



ALABAMA DEPARTMENT OF TRANSPORTATION
MONTGOMERY, AL

COLISEUM BOULEVARD PLUME PROJECT

TYPICAL DETAILS

KILBY DITCH & LOW-LYING AREA CORRECTIVE MEASURE

NOT TO SCALE

DATE: AUGUST 2008

A3 SHEET 1 OF 1

CAD REF. NO.

HYDRAULIC BARRIER PLANTING SCHEDULE

SCIENTIFIC NAME	COMMON NAME	DENSITY	QUANTITY
Liriodendron tulipifera	Yellow Poplar	680/acre (8 X 8)	986 units
Pontederia cordata	Pickerel Weed	10,890/acre (2-ft centers)	871 units
Sagittaria latifolia	Broad-Leaf Arrowhead	10,890/acre (2-ft centers)	871 units

NOTE: Wetland seed mix broadcast

TREATMENT WETLAND PLANTING SCHEDULE

SHALLOW MARSH

SCIENTIFIC NAME	COMMON NAME	DENSITY	QUANTITY
Polygonum arifolium	Tearthumb	10,890/acre (2-ft centers)	980 units
Juncus effusus	Soft Rush	10,890/acre (2-ft centers)	980 units
Leersia oryzoides	Rice Cutgrass	10,890/acre (2-ft centers)	980 units

NOTE: Wetland seed mix broadcast

DEEP WATER - NO PLANTINGS

Notes:

1. Density and quantity for Black Willow does not include live stakes required for outside of meander bank planting.
2. Plant these species randomly.
3. Alder and Buttonbush shall be bareroot or tubelings (approx. 2.25" x 4") a minimum of 12" tall Black Willow are live stakes.

GROUND COVER FOR FORESTED SCRUB-SHRUB ZONE

PLANT NAME	COMMON NAME	MIXTURE PERCENT BY WEIGHT
Elymus virginicus	Virginia Wild Rye	30%
Onoclea sensibilis	Sensitive Fern	12%
Leersia oryzoides	Rice Cutgrass	12%
Scirpus cyperinus	Woolgrass	8%
Polygonum arifolium	Tearthumb	7%
Carex lupulina	Hop Sedge	5%
Sparganium americanum	Eastern Bur-Reed	5%
Asclepias incarnata	Swamp Milkweed	5%
Carex comosa	Common Sedge	4%
Carex crinita	Fringed Sedge	4%
Juncus effusus	Soft Rush	4%
Bidens cernua	Nodding Bur-Marigold	4%

Notes:

1. Bench Seed Mix shall be applied at a rate of 10 to 12 lbs per acre.
2. Optimal seeding period is from March 1 – October 1
3. If seeding occurs between October 1 and March 1, add annual rye (grain) at a rate of 90 lbs/acre as a nurse crop.

PLANTING FOR FLOODPLAIN REHABILITATION AREAS

TEMPORARY SEEDING

AUGUST 1 – MARCH 31
120 #/acre rye (grain)
3,000 #/acre lime
750 #/acre 10/10/10 fertilizer
Jute netting mulch over entire slope

PERMANENT SEEDING (FOLLOWING TEMPORARY SEEDING)

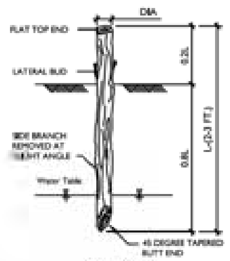
APRIL 1 – JULY 31
60 #/acre common bermuda grass
1,000 #/acre lime
250 #/acre 10/10/10 fertilizer

PERMANENT SEEDING (NO TEMPORARY SEEDING)

APRIL 1 – JULY 31
80 # /acre common bermuda grass
3,000 #/acre lime
500 #/acre 10/10/10
Jute netting mulch over entire slope

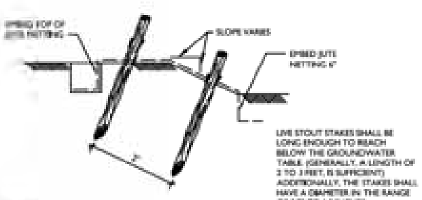
SHRUB PLANTINGS

SCIENTIFIC NAME	COMMON NAME	DENSITY	QUANTITY
Salix nigra	Black Willow	2-4/sq. yd.	1,740 units



SECTION VIEW

LIVE STOUT STAKES SHALL BE SPACED 2 FEET BY 3 FEET APART TO GIVE A DENSITY OF 2 TO 4 CUTTINGS PER SQUARE YARD

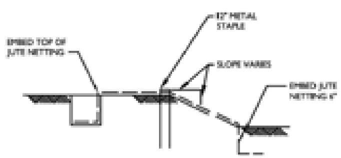


LIVE STOUT STAKES SHALL BE LONG ENOUGH TO REACH BELOW THE GROUNDWATER TABLE. (GENERALLY, A LENGTH OF 2 TO 3 FEET, IS SUFFICIENT) ADDITIONALLY, THE STAKES SHALL HAVE A DIAMETER IN THE RANGE OF 0.75 TO 1.5 INCHES.

FLOODPLAIN REHABILITATION TYPICAL PLANTING

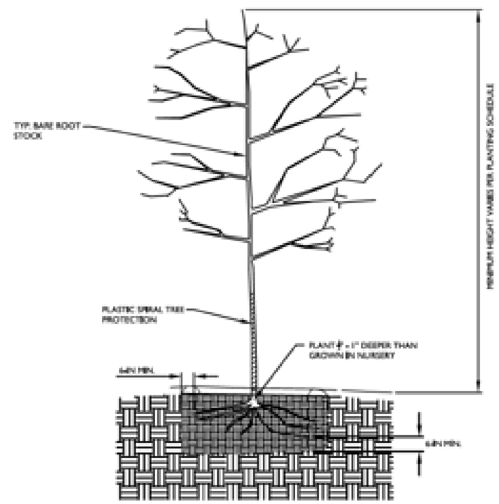
DETAIL 3/4

NOT TO SCALE



DETAIL 4/4

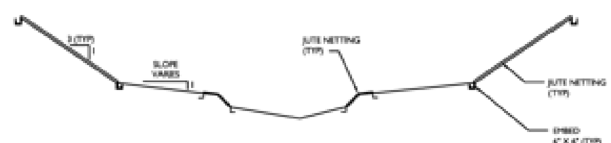
NOT TO SCALE



BARE ROOT DECIDUOUS TREE AND SHRUB PLANTING DETAIL

DETAIL 5/4

NOT TO SCALE



TYPICAL FLOODPLAIN REHABILITATION

SECTION 1/4

SCALE: 1" = 5'

ALABAMA DEPARTMENT OF TRANSPORTATION MONTGOMERY, AL COLISEUM BOULEVARD PLUME PROJECT	TYPICAL DETAILS KILBY DITCH & LOW-LYING AREA CORRECTIVE MEASURE NOT TO SCALE	DATE AUGUST 2008 A4 SHEET 4 OF 4 CAD REF. NO.

DEPARTMENT OF TRANSPORTATION

REVISIONS

DES. DWN. CKD.

Appendix B

Surface Water Modeling

Corrective Measures Implementation Plan

Coliseum Boulevard Plume Site
Montgomery, Alabama

ALABAMA

DEPARTMENT OF TRANSPORTATION

The Hydrologic Engineering Center – River Analysis System (HEC-RAS®) computer model was utilized to evaluate the hydraulics of water flow through the existing Kilby Ditch system (Main Kilby, West Kilby and Lower Kilby Ditches). Surface water elevations following the proposed corrective measures were calculated using the HEC-RAS model to evaluate potential flooding. HEC-RAS analysis in the Lower Kilby Ditch was also used to evaluate channel stability in the Low-lying Area and to design the proposed in-stream structures and channel bank elevations. This evaluation is necessary to properly design a passive treatment system to mitigate TCE.

In order to size the corrective measures to be implemented on the West and Main Kilby Ditches, a hydrologic and hydraulic analysis of the Kilby Ditch drainage basin was performed. Topographic data used for the analysis consists of 2-foot elevation contoured LIDAR data (2005) provided by ALDOT and site-specific surveys.

1.1 SURFACE WATER MODELING

Corrective measures to limit access to groundwater seeping into the Main and West Kilby Ditches must not only be sized for low flow conditions but also be sized to accommodate storm events. Local design requirements for storm water conveyance structures are provided below:

1. City of Montgomery Storm Water Management Manual requires that a storm sewer system having a total drainage area of <u>less</u> than one (1) square mile be sized to accommodate peak discharges resulting from a 25-year storm event.

2. City of Montgomery Storm Water Management Manual requires that a storm sewer system having a total drainage area <u>greater</u> than one (1) square mile be sized to accommodate peak discharges resulting from a 100-year storm event.

3. ALDOT Hydraulic Manual requires that culverts be sized to accommodate peak discharges resulting from a 50-year storm event.

Additionally, the corrective measures design for the West and Main Kilby Ditches cannot result in a decrease in hydraulic capacity of the existing drainage system.

1.1.1. HYDROLOGIC ANALYSIS

A hydrologic analysis was completed to estimate the peak storm water discharges resulting from the 2, 10, 25, 50, and 100-year storm events. The Kilby Ditch drainage basin was divided into five sub-basins. Sub-basins were delineated using locations of storm water contributions and major structures. The watershed network developed for the Kilby Ditch drainage basin is presented in Figure B-1.

ALDOT's Hydraulic Manual specifies the methodology for estimating peak storm water discharges for unregulated urban watersheds.

1. The West Kilby Ditch drainage basin is 0.229 square miles (147 acres). Since the drainage basin area is <u>less</u> than 200 acres, peak storm water discharges were estimated using the Rational Method.

2. The Main Kilby Ditch drainage basin is approximately 1.450 square miles (928 acres). Since the drainage basin area is <u>greater</u> than 200 acres, peak storm water discharges at various locations within the drainage basin were estimated using the USGS urban regression equations contained in *Magnitude and Frequency of Floods in Alabama, 2003*. The urban regression equations not only consider the drainage area but also the percent of impervious cover within the drainage area.

Table B-1 summarizes the peak storm water discharges estimated for each storm event at select locations within the Kilby Ditch drainage basin.

Table B-1
Peak Storm Water Discharges

LOCATION	AREA (MI^2)	DISCHARGE (CFS)				
		2-YR	10-YR	25-YR	50-YR	100-YR
J-3	0.647	408	810	1,026	1,163	1,352
J-2	1.114	637	1,266	1,604	1,814	2,113
J-1	1.220	668	1,324	1,677	1,898	2,210
Outfall	1.450	668	1,324	1,677	1,898	2,210
West Kilby	0.229	319	420	483	533	582

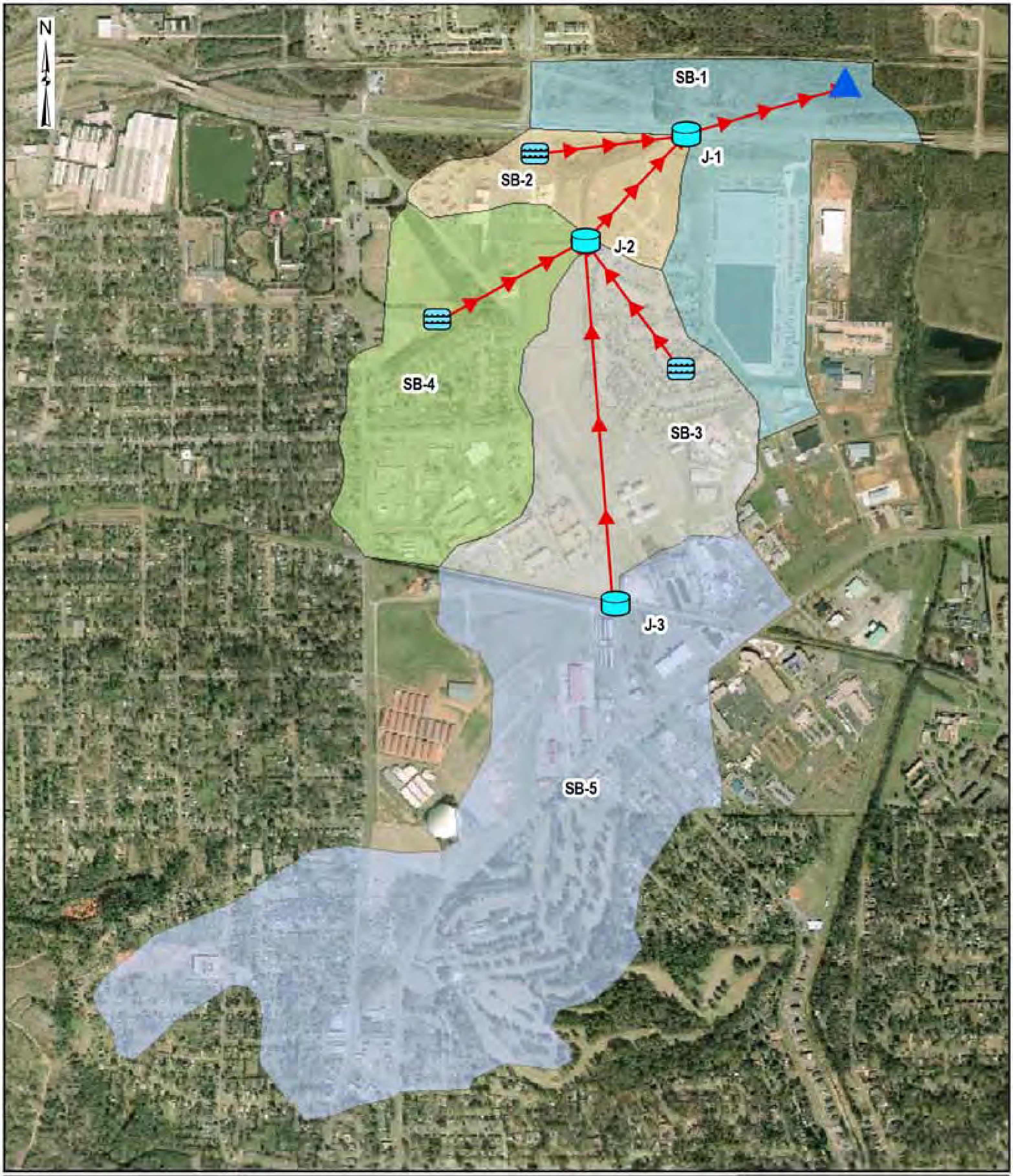
A detailed description of the assumptions, methods, and parameters incorporated into the hydrologic model are presented in the report titled *Kilby Ditch, Hydrology & Hydraulic Evaluation* dated July 2008.

1.1.2. HYDRAULIC ANALYSIS

Existing Conditions Model - An existing conditions HEC-RAS model was developed to establish baseline water surface elevations within the Kilby Ditch drainage system for each storm event. The flow file was developed using the peak discharges estimated by the hydrology analysis. The geometry file was developed using field survey data for cross sections, field survey data for existing culverts and structures, and field observations to estimate Manning's "n" values.

Proposed Conditions Model - A proposed conditions HEC-RAS model was developed by incorporating the proposed corrective measures for West and Main Kilby Ditches into the existing conditions HEC-RAS model. Model results provide estimated water surface elevations within the West and Main Kilby Ditches that would result from implementing the proposed corrective measures.

Based on a comparison of the existing conditions HEC-RAS model to the proposed conditions HEC-RAS model indicates that the proposed corrective measures will not adversely impact the hydraulic capacity of the Kilby Ditch drainage system.



Kilby Ditch Watershed

Figure B-1

Coordinate System: StatePlane
Alabama East FIPS 0101 Feet
Horizontal Datum: NAD 1983
Projection: Transverse Mercator

Appendix C

Materials Management Plan

Corrective Measures Implementation Plan

COLISEUM BOULEVARD PLUME SITE
MONTGOMERY, ALABAMA

ALABAMA

DEPARTMENT OF TRANSPORTATION

TABLE OF CONTENTS

MATERIALS MANAGEMENT PLAN

FIGURES

ATTACHMENTS

1. INTRODUCTION

1.1. PURPOSE

This *Materials Management Plan* (MMP) has been developed for the West and Main Kilby Ditches and the Low-Lying Area. The MMP documents procedures for material handling and management of soil, water, and debris generated during corrective measure construction.

1.2. BACKGROUND

As an element of the corrective measures for the CBP, ALDOT recommends that the open channel of West Kilby Ditch be converted to two (2) 7 ft. x 6 ft. concrete box culverts. Additionally, ALDOT recommends modification to the Main Kilby Ditch to include slope stabilization and riprap in the base of the channel and along the channel side-walls to a height equal to the groundwater seepage interface. Implementation of these corrective measures will require excavation adjacent to and within the channels of Main and West Kilby Ditches and the Low-Lying Area.

1.3. MATERIAL MANAGEMENT INVESTIGATIONS

ALDOT has collected soil samples from proposed construction areas along the Main and West Kilby Ditches and Low-Lying Area to determine if site COCs are present and develop a construction plan for re-using soils during construction, as needed. The following sections summarize the results of these investigations.

1.3.1. MAIN AND WEST KILBY DITCHES

The sampling procedures and analytical results for characterization of soil at Main and West Kilby Ditches are documented in the report entitled "*West Kilby Ditch and Main Kilby Ditch Corrective Measures Pre-construction Soil Characterization Coliseum Boulevard Plume Site*", dated and submitted to ADEM on June 9, 2008. The results of sample analyses indicate that soil in the proposed construction area does not contain detectable volatile organic compounds (VOCs). No CBP constituent of concern was detected above a laboratory method reporting limit in any sample. Barium was the only constituent detected at a level above a laboratory method reporting limit. Based on the results of the investigation, ALDOT will utilize excavated soil for grading, landscaping, or filling, as needed on the project. Soil excavated below the water table will also be used for grading, landscaping, or filling after dewatering.

1.3.2. LOW-LYING AREA

Soil and sediment samples have been collected routinely from the Low-Lying Area since November 2001. Low levels of TCE, ranging from less than the method reporting limit to 0.081 mg/kg have been detected in soil and sediment (ALDOT Status Reports, 2001-2008). Although the maximum concentration of TCE detected in Low-Lying Area samples is below the ADEM Preliminary Screening Value (PSV) for TCE in commercial soil, soil excavated in the Low-Lying Area will not be removed from the boundary of the Low-Lying Area treatment system (reference CMIP Figure 2-1 for the Low-Lying Area treatment system boundary). Excavated soil from the Low-Lying Area will be used for filling and grading within the designated and secured bounds of the Low-Lying Area. If soil is to be transported beyond the boundary of the Low-Lying Area, it will be containerized, managed, and characterized prior to transportation.

2. MATERIALS MANAGEMENT

2.1. UNSATURATED SOIL CONTAINMENT

Unsaturated soil along the West Kilby and Main Kilby Ditches will not require dewatering prior to re-use. However, unsaturated soil staged within the construction zone will be covered and managed to prevent erosion or sedimentation from stormwater run-off. Erosion and best management protections will be included in a stormwater management plan.

2.2. CONTAINER MANAGEMENT AREA (SATURATED SOIL)

Soil excavated from below the water table will require dewatering prior to reuse on project due to saturated conditions. Soil excavated below the water table (saturated soil) will be placed in dewatering box containers at the point of excavation and transported to a "Container Management Area" for dewatering. Each steel container will be a dewatering box lined with a geotextile fabric to serve as a soil retention and sediment filter, and covered to prevent rain from contacting the soil in the dewatering box. Upon filling the dewatering box at the point of excavation, the filled container will be immediately transported to a "Container Management Area" to complete the following:

- Dewatering box inventory procedures;
- Soil dewatering
- Water treatment, and;
- Discharge water sampling and monitoring;

Filled dewatering boxes, debris and dewatering equipment used during management of saturated soil will also be stored in the Container Management Area. The Container Management Area will be constructed within the fenced construction zone on property owned by ALDOT. Additionally, the Container Management Area will be bermed with impervious material to prevent escape of soil or water from filled containers or dewatering equipment. Rainwater will be contained within the bermed areas during a storm event.

Empty/unused dewatering boxes will be staged on property owned by ALDOT. Only empty, decontaminated, or unused dewatering boxes or equipment will be placed in areas outside the Container Management Area. The Container Management Area will be inspected each day for integrity of the bermed areas. Inspections and observations will be recorded daily in the onsite operating record. Excavation and transportation activities will cease if the Container Management Area requires corrective actions and until such time as the required corrective action activities have been completed. The construction zone is shown in Figure C-1. Figure C-2 depicts a typical dewatering box that will be used for soil dewatering operations.

2.3. LOW-LYING AREA

Soil excavated in the Low-Lying Area will not be removed from the boundary of the Low-Lying Area treatment system (see CMIP Figure 2-1). Excavated soil from the Low-Lying Area will be used for filling and grading within the bounds of the Low-Lying Area. If soil is to be transported beyond the boundary of the Low-Lying Area, it will be containerized, characterized, and managed as outlined in this MMP.

2.4. EQUIPMENT DECONTAMINATION AREA

An equipment decontamination area for equipment wash down will be constructed by using impervious material (e.g., liner or steel) and will be bermed with the same material to prevent escape of soil or water from the decontamination area. The floor will be sloped to a low corner. An elevated truck entrance ramp will be installed across the width of the high end of the pad. The equipment decontamination area will be inspected each day for integrity of the liner and bermed areas. The equipment decontamination area will be inspected and observations recorded daily in the onsite operating record. Decontamination activities will cease if the equipment decontamination area requires corrective actions and until the required corrective action activities have been completed. The equipment decontamination will be sized to hold the largest piece of equipment to be used during construction.

2.5. DEWATERING AND LIQUIDS HANDLING

Dewatering will be required for excavated soil in dewatering boxes, the decontamination areas, and bermed construction management areas. The following steps will minimize the amount of water generated during site operations:

- Excavations will proceed in stages to minimize open excavations.
- Construction plans have been designed to minimize disturbance of saturated soils.
- Stormwater, sediment erosion, and containment area controls such as berms and covering of soil will eliminate or reduce rain from contributing excess water and water treatment.

2.5.1. DEWATERING PROCEDURES

Soil will be dewatered by placing the saturated soil into a dewatering box. The dewatering box will consist of two compartments: 1) an enclosed compartment to contain the saturated soil, and; 2) an enclosed compartment that contains water drained from the saturated soil. The soil compartment will be lined with geotextile fabric to filter sediment from the water as it drains to the liquid compartment. Water from dewatering boxes will be transported to holding tanks and a treatment system prior to discharge.

Water from dewatering saturated soil in dewatering boxes (e.g., dewatering boxes) or water generated from construction and equipment dewatering will be pumped or drained to an equalization tank. A sedimentation tank will also be at the site for additional treatment and sediment removal. Additional tanks, treatment systems, or pumps may be used in the event that greater storage capacity is deemed necessary to meet flow or treatment requirements. Gate valves, flow monitoring equipment, and sample ports will be used with all tanks and piping.

2.5.2. DEWATERING BOX MANAGEMENT

Each empty dewatering box shipped to the project site will be inspected for structural integrity before it is entered into the on-site operations inventory. Following acceptance of the dewatering box, the container will be assigned a unique identifying control number that will be recorded in the on-site operating record. The following procedures will be used to manage saturated soil:

- Each dewatering box will be inspected and inventoried by the site manager or designee and determined to be in sound structural condition, clean, and ready to receive excavated soil.
- Upon filling the dewatering box with excavated soil, the soil within the container will require dewatering.
- The soil will be dewatered by draining water from the soil in the dewatering box through a geotextile fabric. The mechanism of dewatering with geotextile comes from the filtration function of the geotextile. This function involves draining the water through the plane of the fabric and at the same time retaining the soil within the dewatering box.
- Water collected from dewatering operations will be retained, sampled, and treated to meet all discharge requirements and compliance concentrations.

2.5.3. WATER DISCHARGE AND COMPLIANCE MONITORING

A site manager, or designee, will be responsible for collecting water samples from the sampling ports in any discharge line in accordance with discharge requirements. Sample collection protocol, interpretation of results, and reporting will be completed in accordance with previous ALDOT Work Plans and Addendums to maintain compliance with discharge requirements and compliance concentrations.

2.6. EQUIPMENT DECONTAMINATION

All equipment used in the completion of the project will be cleaned in the decontamination area or in some other manner which prevents runoff of water. Decontamination will consist of high pressure water or steam rinse to remove films and solid debris from materials and equipment. A soap and water wash using either a brush, mop, or pressure washer will be followed by a final high pressure water or steam rinse to remove any detergent. All water generated during decontamination will be pumped to a holding tank. Solids that accumulate in the decontamination pad will be transferred to a dewatering box for dewatering and management.

Equipment such as trucks, excavators, sampling equipment, and dewatering pumps will be decontaminated prior to use and prior to leaving the site. The site manager will determine the need for decontamination and will not permit contaminated machinery to leave designated work areas. Decontamination will proceed until the site manager determines that dirt or debris have been sufficiently removed from the equipment.

Materials such as sheeting, liners, and filter fabric may be reused, but must be decontaminated and undergo characterization if the material is to be disposed. The site manager will determine if materials require decontamination, waste characterization and when decontamination is complete.

2.7. NOISE, DUST, AND SITE CONTROL

Noise will be controlled during construction activities by:

- If available, compressors will be sound reduced and pneumatic drills, etc. should be fitted with an effective muffler.
- Machines in intermittent use will be shut down when not in use or throttled down to a minimum.
- Equipment which breaks concrete by pressure rather than by percussion will be used as practicable.
- Noisy equipment will be sited as far away as practicable from residential or other noise sensitive properties.
- Care will be taken when loading and unloading vehicles, dismantling equipment, or moving materials to reduce noise impact.
- No persons at the site will cause unnecessary noise from their activities (e.g., excessive "revving" of vehicle engines, music from radios, shouting, and general behavior).

Dust will be controlled during construction activities by:

- Haul routes or drives will be watered as necessary to minimize dust nuisance. Routes will be stabilized (e.g., compacted) and trucks will be washed to reduce off site transport of soil. This applies especially to construction site exits.
- Suitable wheel washing equipment will be provided at site entrances and exits. Washing and spraying will be conducted in designated areas.
- Haul routes or drives will not be through residential areas.

- Storage locations for all materials that create dust, including soil, will be away from site boundaries except where impractical.
- Paved roads near exits will be kept clean, and vehicles transporting dusty materials onto or off site will be covered.
- Rubbish and general waste will not be allowed to accumulate on site. A good standard of "house-keeping" will be maintained.
- There will be no fire for any purpose.
- Engines will not be left running unnecessarily.

The site will be controlled during construction activities by:

- A 6-foot chain link fence with a visibility barrier will be constructed around the site.
- All vehicles or personnel entering or exiting the site must sign-in with the site manager, or designee.
- An equipment delivery area will be placed away from residential properties.

3. MATERIAL CHARACTERIZATION

3.1. MATERIAL CHARACTERIZATION

Samples may be collected from a material to determine if it is a regulated waste. If the site manager determines that any waste generated during construction may be a special waste or regulated material, the material will be characterized in accordance with EPA and ADEM regulations for waste characterization.

All waste sampling procedures will be in general accordance with the "*Waste Sampling*" guidance provided in EPA Region IV Science and Ecosystems Support Division's (SESD) "*Field Branches Quality System and Technical Procedures*" (EPA Region IV, November 2007). EPA's "*Field Branches Quality System and Technical Procedures*" supersede the "*Environmental Investigations Standard Operating Procedures and Quality Assurance Manual*" (EISOPQAM), November 2001. The "*Waste Sampling*" portion of the EPA Region IV SESD "*Field Branches Quality System and Technical Procedures*" is provided as Attachment 2.

3.2. CHARACTERIZATION PROCEDURES

Based on previous investigations, special waste or hazardous waste is not anticipated during corrective measure construction. If any material is deemed a potential special or hazardous waste by the site manager, the material will require sampling and characterization prior to final disposition.

If a material is determined to be a potentially regulated waste, the material will be characterized and manifested prior to transporting from the site. Using the similar analytical procedures presented in the "*West Kilby Ditch and Main Kilby Ditch Corrective Measures Pre-construction Soil Characterization Coliseum Boulevard Plume Site Investigation*", characterization samples will be analyzed for: Filterable Solids/Paint Filter Test; volatile organic compounds, and toxicity characteristic leaching procedure (TCLP) VOCs. If total volatile organic compounds are less than the method reporting limit for the constituent, the material will be not be a special waste. Any characterization sample having a volatile organic compound constituent concentration greater than the reporting limit and less than the TCLP (as provided in the TCLP Toxicity Characteristics Revisions, June 2001) will indicate that the material is non-hazardous special waste and it will be transported and disposed as a solid waste (See Section 4.1). If any characterization sample has a concentration greater than a TCLP limit, the material will be handled and transported as a hazardous waste.

The appropriate sampling equipment and procedures will be determined based on the physical characteristics and nature of the material. Sampling equipment and procedures will be selected to accurately characterize the sample. Sample collection, analysis, and reporting will also generally follow procedures provided in the CBP Investigation Work Plan, Work Plan Addendums 1 through 14, and EPA and ADEM recommended protocols. All samples will be handled and collected using disposable nitrile gloves, and disposable and/or decontaminated sampling tools. Waste characterization samples will be placed in appropriate laboratory provided containers, placed in a cooler, maintained at 4 degrees Celsius or less and submitted under appropriate chain of custody to the laboratory for analysis.

3.3. CHARACTERIZATION PARAMETERS

Waste characterization samples will be analyzed for Volatile Organic Compounds using EPA Method 8260 and TCLP EPA Method 1311 for the following VOC analytes:

TCLP Volatiles Parameter	CAS No.	TCLP Limit mg/l
1,1-Dichloroethylene	75-35-4	0.7
1,2-Dichloroethane	107-06-2	0.5
Carbon tetrachloride	56-23-5	0.5
Chloroform	67-66-3	6.0
Trichloroethylene	79-01-6	0.5
Vinyl chloride	75-01-4	0.2

3.4. INCOMPATIBLE OR UNKNOWN WASTE

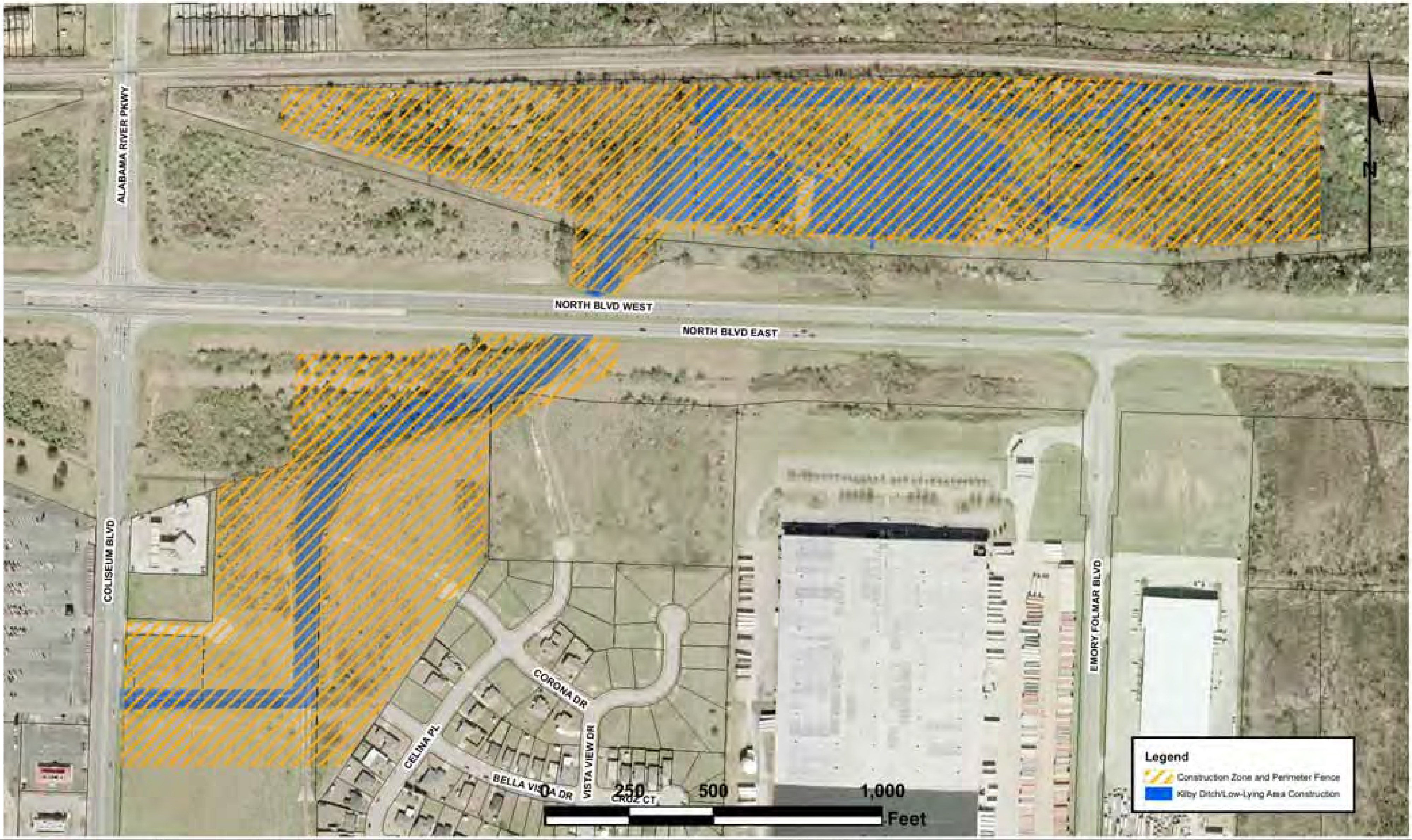
Based on investigations at the construction area, incompatible or unknown wastes are not anticipated at this site. If any intact liquid-filled and closed container is identified during soil excavation, work will cease until the container is placed in a lab pack or other appropriate container for waste characterization and disposal as a solid or hazardous waste. Incompatible wastes (Appendix V to CFR Part 265 - *Examples of Potentially Incompatible Waste*) will not be placed in the same lab pack or container.

3.5. DATA MANAGEMENT AND REPORTING

An operating record for environmental data will be maintained at the site by the site manager or designee. A final report will be issued that includes collected data and will be presented in a clear and logical format including narrative descriptions and discussions, tabular presentation of data, waste management documentation, and graphical and pictorial displays including sample locations and site restoration.

3.6. HEALTH AND SAFETY PLAN

A site-specific health and safety plan will be developed and implemented at the site. Each person entering the site will be required to follow the health and safety procedures developed for the site. All health and safety monitoring records will be maintained at the site during operations.

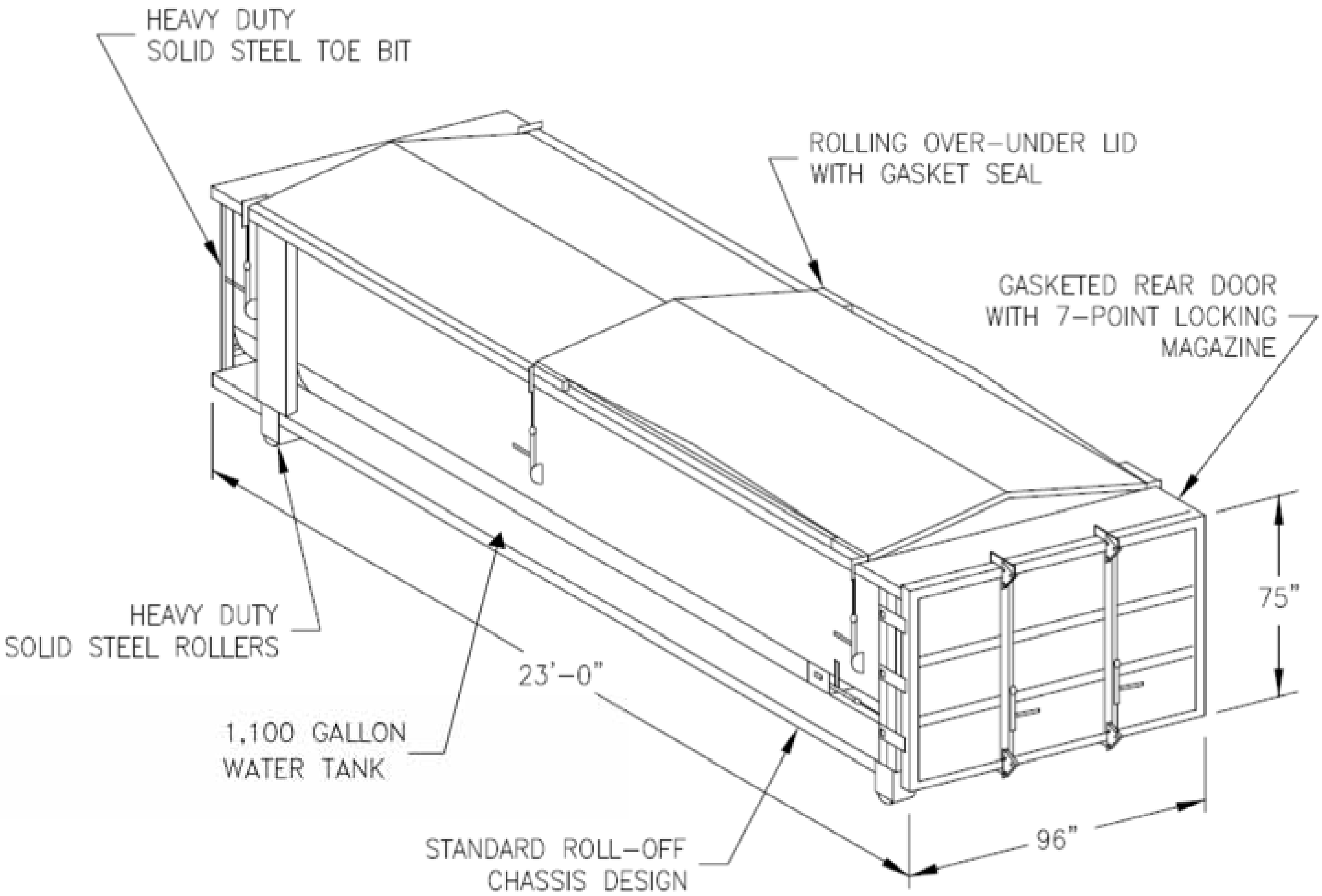


ALABAMA DEPARTMENT OF TRANSPORTATION
COLISEUM BOULEVARD PROJECT

CONSTRUCTION AREA

FIGURE C-1

December 2008



ALABAMA DEPARTMENT OF TRANSPORTATION
COLISEUM BOULEVARD PLUME PROJECT

DEWATERING BOX
CONTAINER

DECEMBER 2008

FIGURE C-2

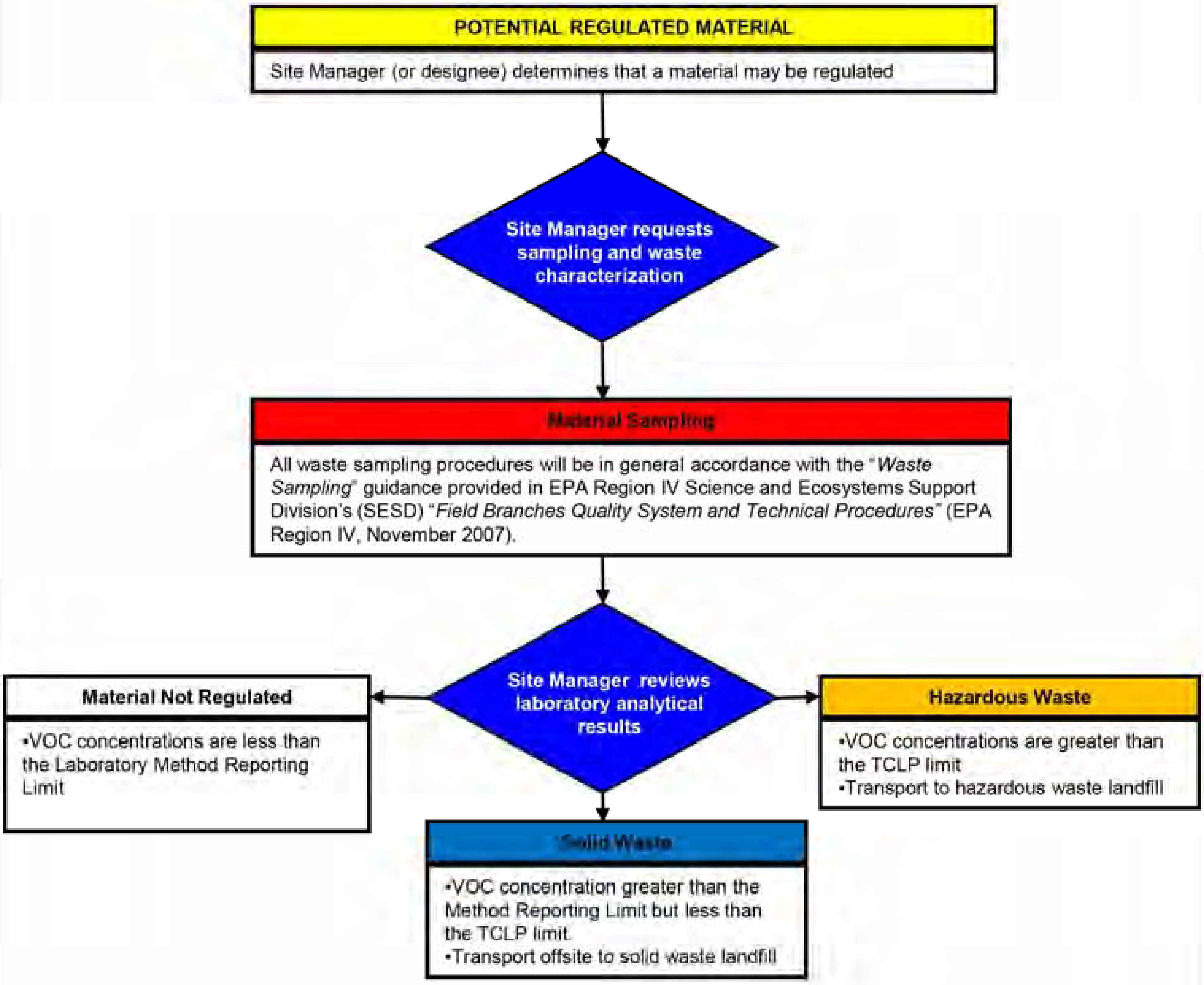


FIGURE C-3

WASTE CHARACTERIZATION PROCEDURES

December 2008

ALABAMA DEPARTMENT OF TRANSPORTATION

Bureau of Materials & Tests – Geotechnical Section
3700 Fairground Road, Montgomery, Alabama 36110
Phone: 334-206-2271 FAX: 334-264-6263

Bob Riley
Governor

Joe McInnes
Transportation Director

June 9, 2008

Ms. Kristy Wright
Land Division
Alabama Department of Environmental Management
1400 Coliseum Boulevard
Montgomery, AL 36110

Re: West Kilby Ditch and Main Kilby Ditch Corrective Measures
Pre-construction Soil Characterization
Coliseum Boulevard Plume Site

Dear Ms. Wright,

The Alabama Department of Transportation (ALDOT) has conducted pre-construction soil analyses at West Kilby Ditch and Main Kilby Ditch to characterize soil prior to construction or soil disturbance in these areas. The objective of this activity is to determine if the soil will require management as a special waste during construction activities.

As an element of the corrective measures for the Coliseum Boulevard Plume (CBP) Site, ALDOT recommended that West Kilby Ditch be enclosed with a concrete storm culvert to restrict access. Additionally, ALDOT recommended modification to the Main Kilby Ditch to include slope stabilization and using rip-rap in the base to prevent direct access to surface water (Corrective Measures Evaluation, 2007). Implementation of these corrective measures will require soil excavation adjacent to and within the channels of Main and West Kilby Ditches. Although constituents of concern have not been detected in soil during previous investigations at West and Main Kilby Ditches, ALDOT collected additional soil samples from proposed excavation areas to determine if the soil can be used on-site in the construction of the project.

The results of the sample analyses indicate that soil in the proposed construction area does not contain detectable volatile organic compounds (VOCs) and is not a special waste. No constituent of concern was detected above a laboratory method reporting limit with the exception of barium at a concentration below the regulatory level. Therefore, ALDOT proposes to utilize excavated soil for grading, landscaping, or filling, as needed on the project.

Sample Collection

Prior to sample collection, boring locations were identified based on proposed construction alignments. Boring locations were grouped to define segments representative of the soil quality adjacent to the West Kilby Ditch and Main Kilby Ditch. A description for each segment is described below:

- Segment 1 along and adjacent to the north and south of the West Kilby Ditch;
- Segment 2 along the east side of Main Kilby Ditch; and,
- Segment 3 along the west side of Main Kilby Ditch.

Six boring locations were placed within each Segment for a total of 18 boring locations in the proposed construction area.

Three soil samples were collected from each of the 18 boring locations:

1. one sample in the unsaturated zone, generally 2 to 3 feet below the ground surface;
2. one sample approximately one to 1.5 feet above the groundwater table (estimated smear zone); and,
3. one sample collected at the maximum depth allowed by field conditions, approximately one to three feet below the top of the groundwater table.

A total of 54 soil samples were collected from 18 borings installed in the delineated construction area and analyzed for volatile organic compounds using EPA Method 8260. Additionally, composite samples were collected from the soil boring locations within each of three construction Segments (e.g. Segment 1, 2, and 3) and analyzed for:

- Toxicity Characteristic Leaching Procedure (TCLP) VOCs using EPA extraction method 1311 and EPA Method 8260;
- TCLP semi-volatile organic compounds (SVOCs) using EPA extraction method 1311 and EPA Method 8270;
- TCLP metals using EPA extraction method 1311 and EPA Method 6010B; and,
- polychlorinated biphenyls (PCBs) using EPA Method 8082.

Soil boring locations, construction Segment locations, sample depths, and analytical results are provided in the attached Figure. Surveyed ground surface elevations for each sample location are shown in Table 1.

Soil samples were collected at selected depth intervals, as noted above, using a stainless steel hand auger. Prior to collection of each sample, all sampling equipment was decontaminated by a thorough Alconox® solution wash and several distilled water rinses. From each location, soil samples for VOC analyses were collected using EnCore samplers. Other soil samples were placed into laboratory-supplied sampling jars for submission to the laboratory for analyses. The samples were packed in insulated coolers and on ice to maintain a sample temperature of 4°C or less. The samples were delivered by overnight courier to EnviroChem, Inc. in Mobile, Alabama and Micro-Methods, Inc. in Ocean Springs, Mississippi under chain-of-custody procedures.

Results

Review of the analytical results indicates that no constituent was detected above a laboratory method reporting limit with the exception of one TCLP Metal. TCLP Barium was detected at 0.336 mg/L and 0.102 mg/L in Segment 2 and Segment 3 composite samples, respectively. The concentrations of Barium are well below the TCLP limit of 100 mg/L. Analytical results are provided in the attached Table 2 and Figure. Laboratory analytical reports are provided as an attachment.

Conclusion

The results indicate that soil in the proposed construction area is not a hazardous waste. No constituent was detected above a laboratory method reporting limit with the exception of barium at a concentration below the TCLP regulatory level. Therefore, ALDOT proposes to utilize excavated soil for re-grading, landscaping, or filling, as needed on the project.

This investigation was conducted for soil in the construction areas of West Kilby Ditch and Main Kilby Ditch. It should be noted that excavated saturated soils may be encountered during construction activities. All saturated soils encountered during construction activities will be contained in roll-off containers lined with polyethylene for dewatering. All water generated during soil dewatering operations will be containerized and treated in accordance with ALDOT's permitted discharge to the Montgomery Water Works and Sanitary Sewer Board.

Based on ADEM's concurrence with these findings, ALDOT will complete the soil management component for the West Kilby Ditch and Main Kilby Ditch construction activities. ALDOT would appreciate ADEM's prompt response to our determination that soil within the estimated Kilby Ditch and West Kilby Ditch construction area is not regulated and can be used in construction on the project. If you have any questions regarding this submittal, please contact this office.

Yours very truly,

B. E. Cox, Jr., P. E.
Geotechnical Engineer

BEC:bec
Attachment

cc. Mr. Jim Ippolito
Ms. Ashley Cousins
Mr. Andy Eversull
Mr. Floyd Gilliland
file

FIGURE

ALABAMA DEPARTMENT OF TRANSPORTATION
COLISEUM BOULEVARD PROJECT

KILBY DITCH SOIL SAMPLE LOCATIONS AND RESULTS

FIGURE

MAY 2008

TABLES

Table 1

Ground Surface Elevations and Sample Depths

SEGMENT 1	Elevation feet (AMSL)	Sample Depth feet (bls)
A	196.41	
1		2
2		4
3		6
B	196.06	
1		2
2		5
3		8
C	197.56	
1		2
2		7
3		8

SEGMENT 2	Elevation feet (AMSL)	Sample Depth feet (bls)
A	196.27	
1		2
2		5
3		9
B	195.78	
1		2
2		4
3		7
C	198.60	
1		2
2		7
3		9

SEGMENT 3	Elevation feet (AMSL)	Sample Depth feet (bls)
A	188.59	
1		2
2		3
3		8
B	191.91	
1		2
2		4
3		7
C	193.59	
1		2
2		4
3		6

SEGMENT 4	Elevation feet (AMSL)	Sample Depth feet (bls)
A	189.91	
1		2
2		3
3		7
B	190.14	
1		2
2		3
3		5
C	196.81	
1		2
2		5
3		10

SEGMENT 5	Elevation feet (AMSL)	Sample Depth feet (bls)
A	187.99	
1		2
2		6
3		10
B	187.78	
1		2
2		5
3		6
C	187.78	
1		3
2		5
3		6

SEGMENT 6	Elevation feet (AMSL)	Sample Depth feet (bls)
A	187.28	
1		2
2		4
3		5
B	188.16	
1		3
2		5
3		8
C	191.82	
1		3
2		6
3		8

AMSL - above mean sea level
bls - below land surface
Sample 1 was taken 2 - 3 feet below ground surface.
Sample 2 was taken approximately 1 - 1.5 feet above the elevation at which the soil was completely saturated
Sample 3 was taken at the maximum depth allowed by field conditions, generally 1 - 3 feet below the elevation at which the soil was completely saturated.
Soil samples were collected from March 10 - 13, 2008

Table 2

West Kilby Ditch and Main Kilby Ditch Corrective Measures
Pre-construction Soil Investigation
Laboratory Analytical Summary

Segment 1 Analytical Results

Location	Depth (Feet)	VOCs[1]	PCBs[2]	TCLP[3] VOCs	TCLP SVOCs[4]	TCLP Metals
Composite	NA[5]		<MRL[6]	<MRL	<MRL	0.102 mg/L Barium
1A-1	2.0	<MRL				
1A-2	4.0	<MRL				
1A-3	6.0	<MRL				
1B-1	2.0	<MRL				
1B-2	4.5	<MRL				
1B-3	7.5	<MRL				
1C-1	2.0	<MRL				
1C-2	6.5	<MRL				
1C-3	7.5	<MRL				
2A-1	2.0	<MRL				
2A-2	5.0	<MRL				
2A-3	9.0	<MRL				
2B-1	2.0	<MRL				
2B-2	4.0	<MRL				
2B-3	7.0	<MRL				
2C-1	2.0	<MRL				
2C-2	6.5	<MRL				
2C-3	8.5	<MRL				

[1] Volatile organic compounds by EPA Method 8260
[2] Polychlorinated biphenyls
[3] Toxicity characteristic leaching procedure by EPA Method 1311
[4] Semi-volatile organic compounds
[5] Not applicable
[6] Below laboratory method reporting limit

Table 2

West Kilby Ditch and Main Kilby Ditch Corrective Measures
Pre-construction Soil Investigation
Laboratory Analytical Summary

Segment 2 Analytical Results

Location	Depth (Feet)	VOCs 8260	PCBs	TCLP VOCs	TCLP SVOCs	TCLP Metals
Composite	NA		<MRL	<MRL	<MRL	2.63 mg/L Barium
4A-1	2.0	<MRL				
4A-2	3.0	<MRL				
4A-3	7.0	<MRL				
4B-1	2.0	<MRL				
4B-2	3.0	<MRL				
4B-3	5.0	<MRL				
4C-1	2.0	<MRL				
4C-2	5.0	<MRL				
4C-3	10.0	<MRL				
6A-1	2.0	<MRL				
6A-2	3.5	<MRL				
6A-3	5.0	<MRL				
6B-1	3.0	<MRL				
6B-2	4.5	<MRL				
6B-3	7.5	<MRL				
6C-1	3.0	<MRL				
6C-2	6.0	<MRL				
6C-3	8.0	<MRL				

Table 2

West Kilby Ditch and Main Kilby Ditch Corrective Measures
Pre-construction Soil Investigation
Laboratory Analytical Summary

Section 3 Analytical Results

Location	Depth (Feet)	VOCs 8260	PCBs	TCLP VOCs	TCLP SVOCs	TCLP Metals
Composite	NA		<MRL	<MRL	<MRL	0.336 mg/L Barium
3A-1	2.0	<MRL				
3A-2	3.0	<MRL				
3A-3	8.0	<MRL				
3B-1	2.0	<MRL				
3B-2	4.0	<MRL				
3B-3	6.5	<MRL				
3C-1	2.0	<MRL				
3C-2	4.0	<MRL				
3C-3	6.0	<MRL				
5A-1	2.0	<MRL				
5A-2	6.0	<MRL				
5A-3	10.0	<MRL				
5B-1	2.0	<MRL				
5B-2	4.5	<MRL				
5B-3	6.0	<MRL				
5C-1	3.0	<MRL				
5C-2	4.5	<MRL				
5C-3	6.0	<MRL				

COPY

Region 4 **U.S. Environmental Protection Agency** **Science and Ecosystem Support Division** **Athens, Georgia**
OPERATING PROCEDURE

Title: **Waste Sampling**	
Effective Date: November 1, 2007	**Number:** SESDPROC-302-R1

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Revision History

This table shows changes to this controlled document over time. The most recent version is presented in the top row of the table. Previous versions of the document are maintained by the SESD Field Quality Manager.

History	Effective Date
SESDPROC-302-R1, *Waste Sampling*, replaces SESDPROC-302-R0. **General** Corrected any typographical, grammatical and/or editorial errors. **Title Page** Changed title for Antonio Quinones from Environmental Investigations Branch to Enforcement and Investigations Branch. **Section 1.3** Updated information to reflect that the procedure is located on the H: drive of the LAN. Clarified Field Quality Manager (FQM) responsibilities. **Section 1.4** Updated referenced operating procedures due to changes in title names. Alphabetized and revised the referencing style for consistency. Added one reference (49 CFR). **Section 1.5.1** Corrected the title of the Safety, Health, and Environmental Management Program Procedures and Policy Manual. **Section 1.5.2, 4th bullet** Added references to the CFR and IATA's Dangerous Goods Regulations. **Sections 1.6 and 1.7** Updated referenced operating procedures due to changes in title names. **Sections 1.8** Added references to SESDPROC-002, 010 and 005.	November 1, 2007
SESDPROC-302-R0, Waste Sampling, Original Issue	February 05, 2007

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Contents

1 General Information

1.1 Purpose

This document describes general and specific procedures, methods and considerations to be used and observed when collecting waste samples for field screening or laboratory analysis.

1.2 Scope/Application

The procedures contained in this document are to be used by field personnel when collecting and handling waste samples in the field. On the occasion that SESD field investigators determine that any of the procedures described in this section are inappropriate, inadequate or impractical and that another procedure must be used to obtain a waste sample, the variant procedure will be documented in the field log book, along with a description of the circumstances requiring its use.

1.3 Documentation/Verification

This procedure was prepared by persons deemed technically competent by SESD management, based on their knowledge, skills and abilities and have been tested in practice and reviewed in print by a subject matter expert. The official copy of this procedure resides on the H: drive of the SESD local area network. The Field Quality Manager (FQM) is responsible for ensuring the most recent version of the procedure is placed on the H: drive and for maintaining records of review conducted prior to its issuance.

1.4 References

ASTM. 2000. Manual 42, RCRA Waste Management: Planning, Implementation and Assessment of Sampling Activities, Cosgrove, Neill and Hastie, West Conshohocken, PA.

ASTM. 2001. Standard Guide for Sampling Strategies for Heterogeneous Wastes, D 5956-01.

ASTM. 2003. Standard Guide for Selection of Sampling Equipment for Wastes and Contaminated Media Data Collection Activities, D 6232-03.

Federal Register, Volume 55, Issue 26, Friday, June 29, 1990: Page 26990.

International Air Transport Authority (IATA). Dangerous Goods Regulations, Most Recent Version

SESD Operating Procedure for Sample and Evidence Management, SESDPROC-005, Most Recent Version

SESD Operating Procedure for Logbooks, SESDPROC-010, Most Recent Version

SESD Operating Procedure for Field Sampling Quality Control, SESDPROC-011, Most Recent Version

SESD Operating Procedure for Equipment Inventory and Management, SESDPROC-108, Most Recent Version

SESD Operating Procedure for Management of Investigation Derived Waste, SESDPROC-202, Most Recent Version

SESD Operating Procedure for Field Equipment Cleaning and Decontamination, SESDPROC-205, Most Recent Version

SESD Operating Procedure for Field Equipment Cleaning and Decontamination at the FEC, SESDPROC-206, Most Recent Version

SESD Operating Procedure for Packaging, Marking, Labeling and Shipping of Environmental and Waste Samples, SESDPROC-209, Most Recent Version

SESD Operating Procedure for Soil Sampling, SESDPROC-300, Most Recent Version

SESD Operating Procedure for Wipe Sampling, SESDPROC-304, Most Recent Version

Title 40 Code of Federal Regulations, Pts. 260 to 265, US-EPA, July 1, 2004. 55 FR 26990.

Title 49 Code of Federal Regulations, Pts. 171 to 179, Most Recent Version

United States Environmental Protection Agency (US EPA). 1981. "Final Regulation Package for Compliance with DOT Regulations in the Shipment of Environmental Laboratory Samples," Memo from David Weitzman, Work Group Chairman, Office of Occupational Health and Safety (PM-273), April 13, 1981.

US EPA. 1995. SUPERFUND PROGRAM Representative Sampling Guidance Volume 4: Waste, Interim Final US-EPA, EPA/540/R95/141 (OSWER Directive 9360.4-14), December 1995.

US EPA. 2000. Test Methods for Evaluating Solid Waste - Physical/Chemical Methods (SW-846), Third Edition, Draft Update IVB, US-EPA, Office of Solid Waste and Emergency Response, Washington, D.C., November, 2000.

US EPA. 2001. Environmental Investigations Standard Operating Procedures and Quality Assurance Manual. Region 4 Science and Ecosystem Support Division (SESD), Athens, GA

US EPA. Analytical Support Branch Laboratory Operations and Quality Assurance Manual. Region 4 SESD, Athens, GA, Most Recent Version

US EPA. Safety, Health and Environmental Management Program Procedures and Policy Manual. Region 4 SESD, Athens, GA, Most Recent Version

1.5 General Precautions

1.5.1 Safety

Proper safety precautions must be observed when collecting waste samples. Refer to the SESD Safety, Health and Environmental Management Program (SHEMP) Procedures and Policy Manual and any pertinent site-specific Health and Safety Plans (HASP) for guidelines on safety precautions. These guidelines, however, should only be used to complement the judgment of an experienced professional. Sampling of waste units should be assessed for potential hazards by both the project leader and the site safety officer (SSO). It is the SSO's responsibility to enforce the site safety plan, and to ensure that procedures used during waste sampling are in accordance with Branch safety procedures and protocols found in SESD SHEMP Procedures and Policy Manual and the HASP.

When using this procedure, minimize exposure to potential health hazards through the use of protective clothing, eye wear and gloves. Address chemicals that pose specific toxicity or safety concerns and follow any other relevant requirements, as appropriate. Specific levels of dress for waste sampling will be described in greater detail later in this operating procedure.

Sampling equipment contaminated during waste sampling investigations should be cleaned in accordance with SESD Operating Procedure for Field Equipment Cleaning and Decontamination (SESDPROC-205). Contaminated sampling equipment that is to be discarded must be properly disposed according to the SESD Operating Procedure for Management of Investigation Derived Waste (SESDPROC-202). These procedures should be specified in the site-specific study plan or Quality Assurance Project Plan.

1.5.2 Procedural Precautions

The following precautions should be considered when collecting waste samples.

- Special care must be taken not to contaminate samples. This includes storing samples in a secure location to preclude conditions which could alter the properties of the sample. Samples shall be custody sealed during long-term storage or shipment.
- Collected samples must remain in the custody of the sampler or sample custodian until the samples are relinquished to another party.

- If samples are transported by the sampler, they will remain under his/her custody or be secured until they are relinquished.
- Shipped samples shall conform to all U.S. Department of Transportation (DOT) rules of shipment found in Title 49 of the Code of Federal Regulations (49 CFR parts 171 to 179), and/or International Air Transportation Association (IATA) hazardous materials shipping requirements found in the current edition of IATA's Dangerous Goods Regulations.
- Documentation of field sampling is done in a bound logbook.
- Chain-of-custody documents shall be filled out and remain with the samples until custody is relinquished.
- All shipping documents, such as air bills, bills of lading, etc., shall be retained by the project leader and stored in a secure place.

1.6 Quality Control Procedures

In some instances, special decontamination procedures will be necessary and should be developed on a case-by-case basis according to the specific material encountered. Any cleaning procedures and equipment repairs conducted in the field which deviate from those specified in SESD Operating Procedure for Field Equipment Cleaning and Decontamination (SESDPROC-205) or the study plan should be thoroughly documented in the logbooks. Equipment blanks should be collected in accordance with the SESD Operating Procedure for Field Sampling Quality Control (SESDPROC-011) if equipment is field cleaned and re-used on-site or if necessary to document that low-level contaminants were not introduced by any sampling equipment. All air monitoring and field analytical/screening equipment should be checked and calibrated before being issued for field studies, as specified in the SESD Operating Procedure for Equipment Inventory and Management (SESDPROC-108).

1.7 Auxiliary Information and Data Collection

The collection of auxiliary information and data is particularly important when collecting waste samples. Any field analyses or field screening results should be recorded in a logbook as outlined in SESD Operating Procedure for Logbooks (SESDPROC-010). Sketches of waste units, sampling locations, containers, tanks and ancillary equipment, markings/labels, etc., should be fully documented in logbooks. Photographs are extremely useful for recording this information and may be used during waste sampling operations. A field log of the photographs taken should be maintained as outlined in SESD Operating Procedure for Logbooks (SESDPROC-010).

1.8 Records

Information generated or obtained by SESD personnel will be organized and accounted for in accordance with SESD records management procedures found in SESD Operating Procedure for Control of Records, SESDPROC-002. Field notes, recorded in a bound field logbook, will be generated, as well as chain-of-custody documentation in accordance with SESD Operating

Procedure for Logbooks, SESDPROC-010 and SESD Operating Procedure for Sample and Evidence Management, SESDPROC-005.

1.9 Investigation Derived Waste

Sampling and decontamination can generate investigation derived waste (IDW), the disposition of which must be considered. See SESD Operating Procedure for Management of Investigation Derived Waste (SESDPROC-202) for guidance on management or disposal of this waste.

2 Waste Sampling - Background

2.1 General

Hazardous wastes are regulated by the USEPA under 40 CFR Parts 260-268. As a consequence, many of the methods that are used to manage, store, treat, and dispose hazardous wastes and potential hazardous wastes are of concern to both the regulators and the regulated community.

Samples are often required of regulated or potentially regulated materials. While it is understood that each facility and wastestream may present its own unique sampling and analytical challenges, this operating procedure will list equipment and procedures that have been used to safely and successfully sample specific waste units.

2.2 Waste Unit Types

Waste management units can be generally categorized into two types: open and closed. In practice, open units are larger than closed units. Open units include waste piles and surface impoundments whereas closed units include containers and tanks as well as ancillary tank equipment. Besides containers and tanks, sumps may also be considered closed units because they are designed to collect the spillage of liquid wastes and are sometimes configured as a confined space.

Although both may pose hazards, units that are open to the environment are generally less hazardous than closed units. Sampling of closed units is considered a higher hazard risk because of the potential of exposure to toxic gases and flammable/explosive atmospheres. Because closed units prevent the dilution of the wastes by environmental influences, they are more likely to contain materials that have concentrated levels of hazardous constituents. While opening closed units for sampling purposes when the unit's contents are unknown, investigators shall use Level B personnel protective equipment (PPE), air monitoring instruments to ensure that the working environment does not contain hazardous levels of flammable/explosive gases or toxic vapors, and follow the appropriate safety requirements stipulated in the site specific safety plan.

Buried waste materials should be located and excavated with extreme caution. Once the buried waste is uncovered, the appropriate safety and sampling procedures utilized will depend on the type of waste unit.

2.2.1 Open Units

While open units may contain many types of wastes and come in a variety of shapes and sizes, they can be generally regarded as either waste piles or surface impoundments. Definitions of these two types of open units from 40 CFR Part 260.10 are:

- (Waste) pile - any non-containerized accumulation of solid, non-flowing hazardous waste that is used for treatment or storage and that is not a containment building.

- Surface impoundment - "...a facility or part of a facility which is a natural topographic depression, man-made excavation, or diked area formed primarily of earthen materials (although it may be lined with man-made materials), which is designed to hold the accumulation of liquid wastes or wastes containing free liquids, and which is not an injection well. Examples of surface impoundments are holding, storage, settling and aeration pits, ponds, and lagoons."

One of the distinguishing features between waste piles and surface impoundments is the state of the waste. Waste piles typically contain solid or non-flowing materials whereas liquid wastes are usually contained in surface impoundments. The nature of the waste will also determine the mode of delivering the waste to the unit. Wastes are commonly pumped or gravity fed into impoundments while heavy equipment or trucks may be used to dump wastes in piles. Once the waste has been placed in an open unit, the state of the waste may be altered by environmental factors (e.g., temperature, precipitation, etc.).

Surface impoundments may contain several phases such as floating solids, liquid phase(s), and sludges. Waste piles are usually restricted to solids and semi-solids. All of the potential phases contained in a waste unit should be considered in developing the sample design to meet the study's objective.

2.2.2 Closed Units

There are a variety of designs, shapes, sizes, and functions of closed units. In addition to the challenges of the various designs and the safety requirements for sampling them, closed units are difficult to sample because they may contain liquid, solid, semi-solid/sludge, or any combination of phases. Based on the study's design, it may be necessary to obtain a cross sectional profile of the closed unit in an attempt to characterize the unit. The following are definitions of types of closed waste units described in 40 CFR Part 260.10:

- Container - any portable device in which a material is stored, transported, treated, disposed, or otherwise handled. Examples of containers are drums, overpacks, pails, totes, and roll-offs.
- Tank - a stationary device, designed to contain an accumulation of hazardous waste which is constructed primarily of non-earthen materials which provide structural support.
- Portable tanks, tank trucks, and tank cars vary in size and may range from simple to extremely complex designs. Depending on the unit's design, it may be convenient to consider some of these storage units as tanks for sampling purposes even though they meet the definition of a container.
- Ancillary equipment (tank) - any device including, but not limited to, such devices as piping, fittings, flanges, valves, and pumps that is used to distribute, meter, or control the flow of hazardous waste from its point of generation to a storage or treatment tank(s), between hazardous waste storage and treatment tanks to a point of disposal on-site, or to a point of shipment for disposal off-site.

- Sump - any pit or reservoir that meets the definition of a tank and those troughs/trenches connected to it that serve to collect hazardous wastes.

Note: some outdoor sumps may be considered open units/surface impoundments.

Although any of the closed units may not be completely sealed and may be partially open to the environment, the unit should be treated as a closed unit for sampling purposes until a true determination can be made. Once a closed unit is opened, a review of the proposed sampling procedures and level of protection can be performed to determine if the personal protective equipment is suitable for the site conditions.

Samples collected from different waste units should not be composited into one sample container without additional analytical and/or field screening data to determine if the materials are compatible and will not cause an inadvertent chemical reaction.

3 Waste Sampling Equipment

3.1 General

Selecting appropriate equipment to sample wastes is a challenging task due to the uncertainty of the physical characteristics and nature of the wastes. It may be difficult to separate, homogenize and/or containerize a waste due to its physical characteristics (viscosity, particle size, etc.). In addition, the physical characteristics of a waste may change with temperature, humidity, or pressure. Waste streams may vary depending on how and when a waste was generated, how and where it was stored/disposed, and the conditions under which it was stored/disposed. Also, the physical location of the wastes or the unit configuration may prevent the use of conventional sampling equipment.

Given the uncertainties that a waste may present, it is desirable to select sampling equipment that will facilitate the collection of samples that will meet the study's objective, and that will not unintentionally bias the sample by excluding some of the sample population that is under consideration. However, due to the nature of some waste matrices or the physical constraints of some waste units, it may be necessary to collect samples knowing that a portion of the desired population was omitted due to limitations of the equipment. Any deviations from the study plan or difficulties encountered in the field concerning sample collection that may have an effect on the study's objective should be documented in a log book, reviewed with the analytical data, and presented in the report.

3.1.1 Waste Sampling Equipment

Waste sampling equipment should be made of non-reactive materials that will neither add to nor alter the chemical or physical properties of the material that is being sampled. Table 1 lists some conventional equipment for sampling waste units/ phases and some potential limitations of the equipment. Another reference for selecting sampling equipment is the ASTM, *Standard Guide for Selection of Sampling Equipment for Wastes and Contaminated Media Data Collection Activities*, D 6232-03.

3.1.2 Ancillary Equipment for Waste Sampling

In addition to the equipment listed in Table 1 which provides the primary device used to collect various waste samples, ancillary equipment may be required during the sampling for safety and/or analytical reasons. Some examples of these types of equipment are glass mixing pans, particle size reducers, remote drum opening devices and spark resistant tools. Any influences that these types of ancillary equipment may have on the data should be evaluated and reported as necessary.

4 Waste Sampling Procedures

4.1 Waste Piles

Waste piles vary in size, shape, composition, and compactness, and may vary in distribution of hazardous constituents and characteristics (strata). These variables will affect safety and access considerations. The number of samples, the type of sample(s), the sample location(s) and interval(s) should be based on the study's objectives. Commonly used equipment to collect samples from waste piles is listed in Table 1. Specific procedures will vary depending on the equipment and objectives of the investigation. All equipment should be compatible with the waste and should be cleaned to prevent cross contamination of the sample.

4.2 Surface Impoundments

Surface impoundments vary in size, shape and waste content, and may vary in distribution of hazardous constituents and characteristics (strata). The number of samples, the type of sample(s), and the sample location(s) and interval(s) should be based on the study's objectives. Commonly used equipment to collect samples from surface impoundments is listed in Table 1. Specific procedures will vary depending on the equipment and objectives of the investigation. All equipment should be compatible with the waste and should be cleaned to prevent cross contamination of the sample.

Because of the potential danger of sampling waste units suspected of containing elevated levels of hazardous constituents, personnel should never attempt to sample surface impoundments used to manage potentially hazardous wastes from a boat. All sampling should be conducted from the banks or piers of surface impoundments. Any exception must be approved by the appropriate site safety officer and/or the Occupational Health and Safety Designee (OHSD).

4.3 Drums

Drums are the most frequent type of containers sampled by field investigators for chemical analyses and/or physical testing. Caution should be exercised by the field investigators when sampling drums because of the potential presence of explosive/flammable gases and/or toxic vapors. Therefore, the following procedures should be used when collecting samples from drums of unknown material:

1. Visually inspect all drums that are being considered for sampling for the following:

    - pressurization (bulging/dimples);
    - crystals formed around the drum opening;
    - leaks, holes, stains;
    - labels, markings;
    - composition and type (steel/poly and open/bung);
    - condition, age, rust; and
    - sampling accessibility.

Drums showing evidence of pressurization and crystals should be furthered assessed to determine if remote drum opening is needed. If drums cannot be accessed for sampling, heavy equipment is usually necessary to stage drums for the sampling activities. Adequate time should be allowed for the drum contents to stabilize after a drum is handled.

2. Identify each drum that will be opened (e.g., paint sticks, spray paint, cones, etc)

NOTE: LEVEL "B" PROTECTION IS REQUIRED FOR THE FOLLOWING STEPS:

3. Before opening, ground each metal drum that is not in direct contact with the earth using grounding wires, alligator clips, and a grounding rod or metal structure. If a metal drum is in an over-pack drum, the metal drum should be grounded.

4. Touch the drum opening equipment to the bung or lid and allow an electrical conductive path to form. Slowly remove the bung or drum ring and/or lid with spark resistant tools (brass/beryllium).

5. Screen drums for explosive gases and toxic vapor with air monitoring instruments as bung or drum lid is removed. Depending on site conditions, screen for one or more of the following:

   - radioactivity;
   - cyanide fumes;
   - halogen vapors;
   - pH; and/or
   - flash point (requires small volume of sample for testing).

   Note the state, quantity, phases, and color of the drum contents. Record all relevant results, observations, and information in a logbook, Drum Data Form or Drum Data Table. Table 2 is an example of a Drum Data Table. Review the screening results with any pre-existing data to determine which drums will be sampled.

6. Select the appropriate sampling equipment based on the state of the material and the type of container. Sampling equipment should be made of non-reactive material.

7. Place oil wipe (as necessary), sampling equipment, and sample containers near drum(s) to be sampled.

NOTE: AIR MONITORING FOR TOXIC VAPORS AND EXPLOSIVE GASES AND OXYGEN DEFICIENT ATMOSPHERES SHOULD BE CONDUCTED DURING DRUM SAMPLING

Liquids – COLIWASAs (COmposite LIquid WAste SAmplers) and drum thiefs are used to collect liquid samples from drums. The COLIWASA or drum thief is slowly lowered to the bottom of the container. Close the COLIWASA with the inner rod or create a vacuum with the sampler's gloved thumb on the end of the thief and slowly remove the sampling device from the drum. Release the sample from the device into the sample container. Repeat the procedure until a sufficient sample volume is obtained.

Solids/Semi-Solids – Use a push tube, bucket auger, or screw auger or if conditions permit a pneumatic hammer/drill to obtain the sample. Carefully use a clean stainless steel spoon to place the sample into container(s) for analyses.

Close the drums when sampling is complete. Segregate contaminated sampling equipment and investigative derived wastes (IDW) containing incompatible materials as determined by the drum screening procedure (Step #5). At a minimum, contaminated equipment should be cleaned with laboratory detergent and rinsed with tap water prior to returning it from the field. IDW should be managed according to SESD Operating Procedure for Management of Investigation Derived Waste (SESDPROC-202) and Region 4's *Contaminated Media Policy*.

4.4 Tanks

Sampling tanks is considered hazardous due to the potential for them to contain large volumes of hazardous materials and therefore, appropriate safety protocols must be followed. Unlike drums, tanks may be compartmentalized or have complex designs. Preliminary information about the tank's contents and configuration should be reviewed prior to the sampling operation to ensure the safety of sampling personnel and that the study's objectives can be achieved.

In addition to having discharge valves near the bottom of tanks and bulk storage units, most tanks have hatches at the top. It is desirable to collect samples from the top hatch because of the potential for the tank's contents to be stratified. Additionally, when sampling from the discharge valve, there is a possibility of a stuck or broken valve which could cause an uncontrolled release. Investigators should not utilize valves on tanks or bulk storage devices unless they are operated by the owner or operator of the facility, or a containment plan is in place should the valve stick or break. If the investigator must sample from a tank discharge valve, the valving arrangement of the particular tank must be clearly understood to insure that the compartment(s) of interest is sampled.

Because of the many different types of designs and materials that may be encountered, only general sampling procedures that outline sampling a tank from the top hatch are listed below:

1. All relevant information concerning the tank such as the type of tank, the tank capacity, markings, condition, and suspected contents should be documented in a logbook.

2. The samplers should inspect the ladder, stairs, and catwalk that will be used to access the top hatch to ensure that they will support the samplers and their equipment.

3. Before opening, ground each metal tank using grounding wires, alligator clips, and a grounding rod or metal structure.

NOTE: LEVEL "B" PROTECTION IS REQUIRED FOR THE FOLLOWING STEPS:

4. Any vents or pressure release valves should be slowly opened to allow the unit to vent to atmospheric pressure. Air monitoring for explosive/flammable gases and toxic vapors should be conducted during the venting with the results recorded in a log book. If dangerous concentrations of gases evolve from the vent or the pressure is too great, leave the area immediately.

5. Touch tank opening equipment to the bolts in the hatch lid and allow electrical conductive path to form. Slowly remove bolts and/or hatch with spark resistant tools (brass/beryllium). If a pressure build up is encountered or detected, cease opening activities and leave the area.

6. Screen tanks for explosive/flammable gases and toxic vapors with air monitoring instruments. Depending on the study objectives and site conditions, conduct characteristic screening (e.g., pH, halogen, etc.) as desired. Collect a small volume of sample for flash point testing, if warranted. Note the state, quantity, number of phases, and color of the tank contents. Record all relevant results, observations, and information in a logbook. Compare the screening results with any pre-existing data to determine if the tank should be sampled.

7. Select the appropriate sampling equipment based on the state of the material and the type of tank. Sampling equipment should be constructed of non-reactive materials.

8. Place oil wipe (as necessary), sampling equipment, and sample containers near tanks(s) to be sampled.

NOTE: AIR MONITORING FOR TOXIC VAPORS AND EXPLOSIVE GASES AND OXYGEN DEFICIENT ATMOSPHERES SHOULD BE CONDUCTED DURING DRUM SAMPLING

Liquids -- Slowly lower the bailer, bacon bomb, Dipstick™, COLIWASA, or Teflon® tubing to the desired sampling depth. (NOTE: In work areas where explosive/flammable atmospheres could occur, peristaltic pumps powered by 12 V. batteries should not be used.) Close the sampling device or create a vacuum and slowly remove the sampling device from the tank. Release the sample from the device into the sample container. Repeat the procedure until a sufficient sample volume is obtained.

Solids/Semi-Solids - Use a push tube, bucket auger, screw auger, Mucksucker™, or if conditions permit a pneumatic hammer/drill to obtain the sample. Carefully extrude the sample from the sampling device or use a clean stainless steel spoon to place the sample into containers for analyses.

9. Close the tank when sampling is complete. Segregate contaminated sampling equipment and investigative derived wastes (IDW) containing incompatible materials as determined by the screening procedure (Step #6). At a minimum, contaminated equipment should be cleaned with laboratory detergent and rinsed with tap water prior to returning it from the field. IDW should be managed according to the SESD Operating Procedure for Management of Investigation Derived Waste (SESDPROC-202-R0) and Region 4's *Contaminated Media Policy*.

4.5 Miscellaneous Contaminated Materials

Sampling may be required of materials or equipment (e.g., documents, building materials, equipment, etc.) to determine whether or not various surfaces are contaminated by hazardous constituents, or to evaluate the effectiveness of decontamination procedures.

Wipe or swab samples may be taken on non-absorbent, smooth surfaces such as metal, glass, plastic, etc. The methodology for wipe sampling is found in the SESD Operating Procedure for Wipe (Contaminated Surface) Sampling (SESDPROC-304). All surfaces and areas selected for sampling should be based on the study's objectives.

For items with porous surfaces such as documents (usually business records), insulation, wood, etc., actual samples of the materials are required. It is therefore important that during the collection and/or analyses of the sample that evidentiary material is not destroyed. Use scissors or other particle reduction devices that have been cleaned as specified in the SESD Operating Procedures for Field Equipment Cleaning and Decontamination (SESDPROC-205) or the SESD Operating Procedures for Field Equipment Cleaning and Decontamination at the FEC (SESDPROC-206) to cut/shred the sample. Mix in a glass pan as specified in SESD Operating Procedure for Soil Sampling (SESDPROC-300), Section 2.5, Sample Handling, Preservation and Transport. The shredded, homogenized material is then placed in sample containers.

5 Waste Sample Handling Procedures

5.1 General

When collecting samples of concentrated wastes for laboratory analyses, field personnel are required to screen the waste materials to ensure safe handling and transportation of the samples. Safety procedures, sampling and screening methods used to collect the samples must comply with those procedures/methods described in this manual. It should be noted that waste samples should not be preserved because of the potential for an inadvertent chemical reaction with the preservative. Additionally, concentrated waste samples are not required to be cooled to 4°C.

After samples have been collected and containerized, the outside of the sample containers should be cleaned with water, paper towels and/or oil wipes to remove any spilled material from the exterior of the container. It should be noted that each sample container should be tagged and sealed, placed in a plastic bag, and the bag securely closed. Samples collected from materials that did not demonstrate any hazardous characteristics during the screening process may be placed in coolers and handled as non-hazardous samples in accordance with the SESD Operating Procedure for Packaging, Marking, Labeling and Shipping of Environmental and Waste Samples (SESDPROC-209).

Field investigators will use knowledge gained of site practices and processes, labels and marking on waste containers, field screening results, and personal observations made during their investigation to determine the hazard potential of a sample. Samples considered to be hazardous by the field investigators will be placed in secondary containment for transport to the SESD laboratory and for subsequent handling upon arrival. The tagged, sealed and bagged samples will be placed in a plastic pail and sealed with a tight fitting lid. The project number for the sampling investigation and the specific sample station number will be marked on the secondary container in indelible ink. A standard SESD Hazard Communication Label will be affixed to the side of the secondary container. The appropriate hazard(s) for the sample (Health, Flammability, and/or Reactivity) will be indicated with an "X". Additionally, an "X" will be placed in the "Protective Equipment" section of the label if protective equipment was required for collection of the sample.

All secondary containing pails will be secured in the vehicles while transporting the samples from the field to the laboratory for analyses. In addition, each pail should indicate when protective equipment is recommended to handle the actual waste/sample material.

6 Particle Size Reduction

6.1 General

Particle size reduction of waste samples is periodically required in order to complete an analytical scan or the Toxicity Characteristic Leaching Procedure (TCLP) test. Samples that may require particle size reduction include slag, bricks, glass/mirror cullet, wire, etc. Method 1311 (TCLP) states "Particle size reduction is required, unless the solid has a surface area per gram of material equal to or greater than 3.1 cm^2, or is smaller than 1 cm in its narrowest dimension (i.e., capable of passing through a 9.5 mm (0.375 inch) standard sieve). If the surface area is smaller or the particle size larger than described above, prepare the solid portion of the waste for extraction by crushing, cutting, or grinding the waste to a surface area or particle size as described above" (55 FR 26990). The method also states that the surface criteria are meant for filamentous (paper, cloth, etc.) waste materials, and that "Actual measurement of the surface area is not required, nor is it recommended". Also, the loss of volatile organic compounds could be significant during particle size reduction.

Waste samples that require particle size reduction are often too large for standard sample containers. If this is the case, the sample should be secured in a clean plastic bag and processed using normal chain-of-custody procedures (SESD Operating Procedure for Sample and Evidence Management (SESDPROC-005). Note that the sample labels or tags that will be required for the various containers should be prepared in the field and either inserted into or attached to the sample bag. The bag should then be sealed with a custody seal.

Because of the difficulty in conducting particle size reduction, it may be completed at the Field Equipment Center (FEC). The following procedure may be used for crushing and/or grinding a solid sample:

1. Remove the entire sample, including any fines that are contained in the plastic bag and place them on the standard cleaned stainless steel pan or cover the sample material with clean plastic.

2. Using a clean hammer, carefully crush or grind the solid material (safety glasses are required), attempting to minimize the loss of any material from the pan. Some materials may require vigorous striking by the hammer, followed by crushing or grinding. The material may be subject to crushing/grinding rather than striking.

3. Continue crushing/grinding the solid material until the sample size approximates 0.375 inch. Attempt to minimize the creation of fines that are significantly smaller than 0.375 inch in diameter.

4. Pass the material through a clean 0.375-inch sieve into a glass pan.
5. Continue this process until sufficient sample is obtained. Thoroughly mix the sample as described in SESD Operating Procedure for Soil Sampling (SESDPROC-300), Section

2.5, Sample Handling, Preservation and Transport. Transfer the contents of the glass pan into the appropriate containers.

6. Attach the previously prepared tags and submit for analyses.

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TABLE 1
SAMPLING EQUIPMENT for VARIOUS WASTE UNITS

Equipment	Waste Units/Phases	Limitations
scoop with bracket/conduit	impoundments, piles, containers, tanks/liquids, solids, sludges	Can be difficult to collect deeper phases in multiphase wastes. Depth constraints.
spoon	impoundments, piles, containers/solids, sludges	Similar limitations as the scoop. Generally not effective in sampling liquids.
push tube	piles, containers/cohesive solids, sludges	Should not be used to sample solids with dimensions >½ the diameter of the tube. Depth constraints.
auger	impoundments, piles, containers/solids	Can be difficult to use in an impoundment or a container, or for solidified wastes.
sediment sampler	impoundments, piles/ solids, sludges	Should not be used to sample solids with dimensions >½ the diameter of the tube.
ponar dredge	impoundments/solids, sludges	Must have means to position equipment to desired sampling location. Difficult to decon.
COLIWASA or drum thief	impoundments, containers, tanks/liquids	Not good with viscous wastes. Devices ≥ 7' require 2 samplers to use effectively.
Dipstick™ / Mucksucker™	impoundments, containers, tanks/liquids, sludges	Not recommended for tanks >11 feet deep. Devices ≥ 7' require 2 samplers to use effectively.
bacon bomb	impoundments, tanks/ liquids	Not good with viscous wastes.
bailer	impoundments, tanks/ liquids	Only if waste is homogeneous. Not good with viscous wastes.
peristaltic pump with vacuum jug assembly	impoundments, tanks/ liquids	Cannot be used in flammable atmospheres. Not good with viscous wastes.
back-hoe bucket	piles/solids, sludges	May be difficult to access desired sampling location. Difficult to decon. Can lose volatiles.
split-spoon	piles/solids	Requires drill rig or direct push equipment.
roto-hammer	piles, containers/solids	Physically breaks up sample. May release volatiles. Not for flammable atmospheres.

TABLE 2 - DRUM DATA TABLE

Dates ____________________ Page __________

PROJECT NO.______________ SITE NAME:__________________________

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CITY______________________ STATE:_____________________________

SESD Drum No.	Markings	Drum Size	Drum Type	Drum Condition	Drum Open Team	Volume	Drum Contents Description Phase Color	Air Monitoring FID-PID / CGI / pH	Fl. Pt./ Hal.	Sample Collected	Sampler / Time
		55 /	S / P /___	G / F / P		F / ½ / E	L / S				
		55 /	S / P /___	G / F / P		F / ½ / E	L / S				
		55 /	S / P /___	G / F / P		F / ½ / E	L / S				
		55 /	S / P /___	G / F / P		F / ½ / E	L / S				
		55 /	S / P /___	G / F / P		F / ½ / E	L / S				
		55 /	S / P /___	G / F / P		F / ½ / E	L / S				
		55 /	S / P /___	G / F / P		F / ½ / E	L / S				
		55 /	S / P /___	G / F / P		F / ½ / E	L / S				