FINAL

Focused Remedial Investigation
Lincoln Park/Milwaukee River Channel Sediments
Milwaukee, Wisconsin

START CONTRACT NO. EP-S5-06-03
TECHNICAL DIRECTION DOCUMENT NO. S05-0801-002

August 10, 2009

PREPARED FOR:

GREAT LAKES NATIONAL PROGRAM OFFICE
U.S. ENVIRONMENTAL PROTECTION AGENCY, REGION 5
77 WEST JACKSON BLVD, CHICAGO, IL 60604

PREPARED BY:

STN ENVIRONMENTAL JV
125 South Wacker Drive, Suite 1180. Chicago, IL 60606

TABLE OF CONTENTS

Title **Page**

TABLES

FIGURES

APPENDICES

EXECUTIVE SUMMARY

Introduction

The Lincoln Park/Milwaukee River Channel Sediments (Site) Remedial Investigation (RI) was conducted to investigate the nature and extent of sediment contamination at the Site, characterize physical conditions that may affect movement of contaminants, and assess the potential risk that the contamination poses to the environment. The RI was performed by STN JV for the Great Lakes National Program Office (GLNPO) of United States Environmental Protection Agency (U.S. EPA), under the Superfund Technical Assessment and Response Team (START) contract. The study area for the RI included the West Oxbow of the Milwaukee River and approximately one-mile stretch of the Lincoln Creek until its confluence with the primary channel of the Milwaukee River (Figure 1). In 2009, samples were collected just west of the Eastbrook Dam in the Milwaukee River.

Site Background and History

The Estabrook Impoundment located within the Cities of Glendale and Milwaukee, Wisconsin, is formed by the Estabrook Dam (Figure 1). The Estabrook Dam backs up water approximately two and one-half miles to a point approximately 0.3 miles upstream of Silver Spring Road on the Milwaukee River, creating a 103-acre pool. The dam and the impoundment influences flow within Lincoln Creek to a point approximately 0.5 miles upstream of the confluence with the Milwaukee River. The dam was historically closed soon after the spring season to flood the study area for recreational use and was opened in the beginning of the fall to drain the water. The area within Lincoln Park comprises the site that was originally occupied by an oxbow of the Milwaukee River. This area was excavated in the 1930s to create the West Oxbow, to which Lincoln Creek empties. An oxbow (East Oxbow) was also excavated to the east of the Milwaukee River. The sediments in the Lincoln Park area are comprised of sediments that were transported from Lincoln Creek and the Milwaukee River and have been deposited following the excavation of the oxbow.

Previous Investigations

PCB contamination was initially identified in the area through fish tissue samples. The first fish advisory for the site area was issued by WDNR in 1981.

Investigations by WDNR (2005) and Steuer (1999) estimated contaminated sediment volume of 64,000 cubic yards with a mass of 5,381 pounds of PCBs in the impoundment. In the West Oxbow area, there is an estimated 56,000 cubic yards of sediment contaminated with 5,000 pounds of PCBs. During the Blatz Pavilion Remedial Action from March 2008 through August 2008, approximately 4,700 cubic yards of contaminated sediment/soil was removed and backfilled through funding from WDNR.

During February 2008 and March 2009, START conducted sediment sampling activities in support of the RI. Primary focus was in the Lincoln Creek (Zone 1) and West Oxbow (Zone 2) with additional characterization activities by the Estabrook Dam (Zone 5) (Figure 2). Sediment sampling was conducted to determine sediment thickness, horizontal and vertical extent of PCB contamination, and the nature of contaminants.

During the February 2008 sampling, 33 sediment samples for PCB analysis from varying depths were collected from the in West Oxbow (Zone 2) area. Few of the samples were analyzed for bulk properties, including specific gravity, moisture content, and Atterberg limits (Table 1). In addition to sampling, sediment thickness was determined using the direct push technology equipment and manual probing techniques. Each of the sampling and probing location was surveyed. During the March 2009 sampling, sediment samples were collected from the Lincoln Creek (Zone 1), 33 samples from the West Oxbow for PCB analysis and 2 samples were collected in front of the Estabrook Dam in Zone 5 for sediment characterization. Sediment thickness surveys conducted in Zone 1 and Zone 2 was determined using manual poling at over 300 locations. The survey area extended from the north of the dam through the west oxbow and the Lincoln Creek up to the Green Bay Road to the north and up to the Milwaukee River Parkway through the primary channel on the northeast. All sampling and poling locations were surveyed to document their spatial coordinates. The horizontal control used was the WI Height Modernization monument by I43 and Hampton. The vertical control used was the chiseled cross on the bridge over the river at Hampton, just North of the Blatz Pavilion.

Physical Characteristics of the Study Areas

Sediment thickness measurements varied within each Zone of the study area. In the Lincoln Creek, fine sand and gravel was encountered below 1-foot thickness in most sections of the creek. Towards the Creek's confluence with the primary channel of the Milwaukee River, the sediment thickness increased up to 4 to 5 ft thickness.

In the West Oxbow area surrounded by the Milwaukee River Parkway and the primary channel, the sediment thickness ranged from 2.2 ft to approximately 9.5 ft. Sediments between the east side of the North Milwaukee River Parkway and the Milwaukee River indicated 6 to 7 ft thickness to the north and 3 to 5 ft to the south of the primary channel. The dominant sediment in the north was fine-grained and occurred in the upper four ft or more of the sediments while in the south, the sediment was sandy in the top 0.5 foot. The sediment thickness in the area north of the pier ranged from 5 ft to the north to about 9.5 ft by the pier. The sediments in the moderately narrow area between the primary channel and the pier, ranged in thickness from 4 ft to 7.9 ft, with the shallower areas being encountered closer to the pier. Sediments to the south are located in a narrow zone and ranged from 2.2 ft to 5.3 ft in thickness.

In general, in the area between the North Milwaukee River Parkway Bridge and the primary channel of Zone 2, the maximum sediment thickness was encountered just north of the pier (9.5 ft) and the minimum sediment thickness was encountered south of the pier (2.2 ft). Much of this area had sediment thickness between 5.5 and 7.0 ft and the sediments are dominantly fine-grained with minor, interbedded sandy intervals of generally 1 foot or less in thickness.

Sediments surrounding the small island in the impoundment between the Primary and Secondary Channels are fine grained with interbedded sandy intervals of 1.5 ft or less. Sediments had a fairly consistent thickness ranging from 5.5 ft to 6.5 ft on the east of the island while to the north and west of the island, the sediment thickness was variable ranging from 4 to 7 ft. Sediments to the south and southeast of the island varied in thickness from 6 to 8.5 ft and were sandy with a thinner fine grained interval.

Overall in the study area, the sediment thickness varied from less than 3 ft, generally adjacent to the channels, to as much as 9.5 ft in other areas. Typical sediment thickness tends to be between 5 and 7 ft although it was thinner in some areas. Sediments tend to be fine grained (silts and clays) in their upper interval, and sandy in their lower interval, although this relationship did not hold through out the study area. Thinner interbedded units of a contrasting texture occur at a number of locations. At some locations, the upper most sediments tend to be sandy and appear to represent accumulations of sandy material in small sand bars on top of the sediment flats.

Bulk characteristic profiling of sediments indicate a distinct difference between the fine-grained and coarse grained sediment intervals. The fine-grained sample intervals tend to be predominately silts (60 to

70%) with lesser portions of clay and fine sand, while the coarse grained intervals are almost exclusively fine to medium sand (greater than 90%).

Nature and Extent of Contamination

Historical information, as well as this current investigation has not identified any particular current pollution sources to Lincoln Creek/ Milwaukee River. The RI sampling and historical sampling indicates that the sediments in the study area are contaminated with PCBs from historical sources.

Lincoln Creek (Zone 1)

The focus of this RI was to investigate the historical hot spot EST5-7, with 42 milligrams per kilogram PCBs, to determine if contamination is being transported from upstream sources in to the West Oxbow. The highest PCB concentration of 5.4 mg/Kg was observed in sample LC-B-1-N in the area that was previously known to have had 41 mg/Kg PCB contamination (Figure 4). This location is closer to Green Bay Road, the upstream extent of the Lincoln Creek site. Sediment thickness in the Lincoln Creek ranged from 0 to 4.6 ft, with of fine sand and gravel below 1 foot in the northern 3/4th section of the creek. Sediment thickness was greater nearest the creek banks and towards the creek's confluence with the primary channel. Based on the RI results, no identifiable upstream migration sources were observed. However, low level PCB-contaminated sediments are present in the Lincoln Creek sediments.

West Oxbow (Zone 2)

West Oxbow investigations were conducted through 33 sediment sample analyses for PCBs (Figure 5). Sediment thickness survey through probing/polling occurred at over 300 locations, samples were collected at some locations for chemical analysis. Sediment thickness in the West Oxbow ranged from 0 to 9.5 ft in depth.

PCBs were detected in all sediment samples collected from the West Oxbow. In the top 1-foot of sediments (surface sediments), the highest PCB concentration of 143.9 mg/Kg was observed in the northern section of the primary channel at S-2 location west of the North Milwaukee River Parkway and north of the pier (Figure 3). Downstream PCB concentrations in the surface sediments were relatively low (less than 10 mg/Kg) except at sample location WO-I-2, just southwest of the Lincoln Creek's entrance in to the primary channel, where it was observed at 120 mg/Kg (Figure 8).

PCB contamination is higher sediments collected from greater than 1 foot below the sediment surface. The highest levels of contamination were seen in sediment averaging 4-6 feet below the sediment surface. The deeper depth contamination did not correlate to the locations where surface contamination was observed. PCB contamination ranged from 0.14 mg/Kg to 823 mg/Kg in the deeper sediments and was observed in sample depths up to 5.5 ft. Deeper sediment contamination was observed in two primary locations: in the pier area and in the island area of the West Oxbow. The higher PCB contamination was observed to the north, west, and southwest of the pier, with the highest concentration occurring to the southwest of the pier in location S-6. In the West Oxbow Island, the highest PCB contaminated sediment was observed in WO-I-2 location, which was situated southwest of the Lincoln Creek's confluence with the primary channel. Historical sampling to the east and south of the West Oxbow Island had PCB contamination ranging from 1 to as much as 870 mg/Kg.

Contaminant Fate and transport

PCBs found in the site sediments are most likely to adsorb to the sediments and transport with the migration of the sediments. PCBs are known to bioaccumulate in organisms and humans and bioconcentrate significantly in aquatic organisms. The fish advisory already in effect in the site area indicates the documented exposure pathway to humans. Of the 14 Beneficial Use Impairments, the Milwaukee Estuary has the following 11 impairments listed at the GLNPO website http://www.epa.gov/greatlakes/aoc/milwaukee.html#Beneficial_:

Restrictions on fish and wildlife consumption
Eutrophication or undesirable algae
Degradation of fish and wildlife populations
Beach closings
Fish tumors or other deformities
Degradation of aesthetics
Bird or animal deformities or reproduction problems
Degradation of benthos
Degradation of phytoplankton and zooplankton populations
Restriction on dredging activities
Loss of fish and wildlife habitat

Focused Ecological Hazard Evaluation

Because of documented PCB contamination in the fish tissues and the fish advisory in the site area, a focused ecological hazard evaluation for the bottom dwelling species was conducted. The consensus-based sediment quality guidelines (CBSQG) were developed to identify concentrations of chemicals that would be protective of the majority of bottom dwelling species that reside on or in the sediment and sediment port water. The guidelines establish two concentration levels: the TEC, at which no or minimal effects are predicted and the PEC at which adverse effects is highly probable (WDNR, 2003).

The limited available data for metals in the Estabrook Impoundment sediments indicated that the combined concentrations of cadmium, chromium, copper, lead, nickel and zinc in Zone 2 were high enough that adverse toxic effects on sediment dwelling species are probable. The concentrations of chromium and lead exceeded the PEC for the individual metals.

The total PAH concentration, adjusted to 1% TOC, exceeded the PEC level for only one surface sediment sample and did not exceed the PEC level in any subsurface samples. These results suggest that the concentrations of PAHs in the sediments are below the levels where adverse effects on sediment dwelling species are probable.

The data from both the 2003 sampling event (WDNR, 2005) and the 2008 START sampling event show that the total PCB concentrations in the biologically active zone exceeded the PEC in more than 50% of the samples analyzed. This suggests that adverse effect on sediment dwelling organisms due to elevated total PCB concentrations are probable in much of the surface sediment in the site area. When combined with reasonable estimates of concentrations of metals and PAHs, the overall mean PEC-Q values show an estimated average incidence of toxicity that exceeds 95% for 28% of the samples from the 2008 and 2009 START sampling event. Therefore, the probability of adverse effects to sediment dwelling species is high over large portions of the Western Oxbow in Zone 2.

Acronym List

AOC	Area of concern
ASTM	American Society for Testing and Materials
CLP	Contract Laboratory Program
Yd3	Cubic yards
DOT	Department of Transportation
EPA	Environmental Protection Agency
ft	ft
FFS	Focused Feasibility Study
FSP	Field sampling plan
GLNPO	Great Lakes National Program Office
GPS	Global positioning system
Kg	Kilogram
MCPD	Milwaukee County Parks Department
mg/Kg	milligrams per kilogram
MMSD	Milwaukee Metropolitan Sewerage District
MS	Matrix Spike
MSD	Matrix spike duplicate
msl	mean sea level
PAH	Polycyclic aromatic hydrocarbons
PCB	Polychlorinated biphenyls
QA	Quality assurance
QAPP	Quality assurance project plan
QC	Quality control
RAP	Milwaukee Remedial Action Plan Technical and Citizen Advisory Committees
RI	Remedial investigation
SAP	Sampling and analysis plan
SEWRPC	Southeastern Wisconsin Regional Planning Commission
SOW	Scope of work
START	Superfund Technical Assessment and Response Team
STN	STN Environmental Joint Venture
SVOC	Semi-Volatile organic compounds
TDD	Technical Direction Document
TOC	Total organic carbon
TSCA	Toxic Substances Control Act
USCS	Unified Soil Classification System
WDNR	Wisconsin Department of Natural Resources

1.0 INTRODUCTION

STN Environmental Joint Venture (STN) has prepared this Focused Remedial Investigation (RI) for the Great Lakes National Program Office (GLNPO) of the U.S. Environmental Protection Agency (EPA). All Focused RI activities were conducted under the Superfund Technical Assessment and Response Team (START) contract, in accordance with the requirements of the U.S. Environmental Protection Agency (U.S. EPA) Technical Direction Document (TDD) Number S05-0801-002. The scope of this TDD was to conduct a focused RI for the Lincoln Park/Milwaukee River Channel Sediments Site (Site) located in Milwaukee, Milwaukee County, Wisconsin. START was tasked to prepare a health and safety plan; prepare a field sampling plan (FSP) and Quality Assurance Project Plan (QAPP), collect sediment samples and sediment thickness samples; conduct a RI to include a screening ecological risk assessment, and prepare this RI report. This Focused RI is managed by the GLNPO's Sediment Team.

1.1 Purpose of Report

The goal of this report Site project is to evaluate the extent, both vertical and lateral, to determine if remediation of contaminated sediments is necessary, within the boundaries of the Site. Previous investigations characterized Lincoln Creek and the Blatz Pavilion. The West Oxbow area, to the west of the North Milwaukee River Parkway (Parkway) Bridge and the remainder section of the primary channel south of the Parkway until its confluence with the Milwaukee River, requires additional sediment characterization to fill in data gaps. Additional investigations to evaluate/verify the transport of total PCBs (as Aroclors) in the Lincoln Creek from upstream sources are also part of the scope of this RI.

1.2 Site Background

The Milwaukee River drains approximately 850 square miles in southeastern Wisconsin (Steuer et al, 1999). PCB contamination in the river was initially identified through fish tissue sampling, and fish advisories were issued in 1981. Based on the fish sampling results, numerous studies have been completed focusing on the river or specific reaches thereof, which indicated that there were a number of locations where PCBs accumulated in river sediments. One of these areas was the Estabrook Impoundment, which is located immediately upstream of the Estabrook Dam.

The Estabrook Impoundment contributes the greatest mass loading of PCBs in the Milwaukee River Basin (Baird & Associates, 1997), and it is estimated to contain 64,000 cubic yards (yd3) of contaminated sediment with slightly more than 5,380 pounds of PCBs (WDNR, 2005). A portion of this impoundment

is the small area immediately adjacent to the Blatz Pavilion, which was originally estimated to contain approximately 3,600 yd3 of contaminated sediment and 286 pounds of PCBs. The Blatz Pavilion area is isolated from the other contaminated areas in the impoundment and has easy public access. Despite signs indicating the presence of PCBs, the public continued to risk potential exposures through swimming, wading, and fishing activities. Therefore, the Blatz Pavilion site was selected by the WDNR to be the first area to be remediated in the impoundment (WDNR RIFS Blatz Pavilion 2007). The removal of the contaminated sediments and backfilling with clean material at the Blatz Pavilion was conducted in March 2008 and was completed in August 2008. The West Oxbow, upstream from the Blatz Pavilion is the subject of this RI.

1.2.1 Site Description

West Oxbow, termed Zone 2 for the ease of project description, consists of the primary and secondary channels of the Milwaukee River (Figure 1). The primary channel is connected to the Milwaukee River at the channel's north and south ends and is located to the east of the island located in the West Oxbow. The secondary channel, located to the west of the island, begins where Lincoln Creek empties into the primary channel north of the island, and connects with the primary channel southeast of the island (Figure 1).

Lincoln and Estabrook Parks are an integral part of the county park system, and continue to serve as recreational points for local residents. Aquatic activities are an important aspect of the parks, as well as the open green space they provide. The Milwaukee County Parks Department (MCPD) allows residents to portage non-motorized watercraft across park land and to launch into the rivers controlled by the Department, including the Milwaukee River and the Estabrook Impoundment. There are three designated access sites for canoeing and kayaking in Estabrook Park and one near the Lincoln Park fishing pier, which is located on the east bank of the river, north of Hampton Avenue.

Within Lincoln Park, there are picnic areas as well as baseball and softball diamonds, football/soccer fields, a playground, a swimming pool, and walking trails. The relative location of these areas to the Blatz Pavilion affords easy access to the river, which increases the possibility of exposure by the public to PCBs in the river sediments. This is especially true in summer, when outdoor temperatures are elevated and the river provides opportunities for wading and/or (possibly) swimming as a means for cooling off at this time of year.

1.2.2 Site History

The Estabrook Impoundment is formed by the Estabrook Dam, and it is a 103-acre pool with a maximum storage of 700 acre-ft. The impoundment extends approximately 2.5 miles upstream, which is just upstream of Silver Spring Road. The dam and resulting impoundment also influences flow within Lincoln Creek to a point approximately 0.5 miles upstream of the confluence with the Milwaukee River. The Milwaukee County Park System was created on January 1, 1937, through consolidation of the Milwaukee County Park Commission and the City of Milwaukee Park Board, and both Estabrook and Lincoln Parks were incorporated into the park system at that time.

In addition to the park system, the Milwaukee County Parks Department (MCPD) controls operation of the Estabrook Dam, which includes opening and closing the dam in the fall and spring of each year, respectively, or whenever necessary, given expected flow/precipitation conditions. The water pool behind the dam has also been lowered in anticipation of high flows. Periodic opening of the dam has caused the contaminated sediment to be periodically dewatered and resulted in some compaction of the sediment in the impoundment.

Currently for the Milwaukee Estuary Area of Concern, of the 14 Beneficial Use Impairments listed, the Milwaukee Estuary has the following 11 impairments listed at the GLNPO website http://www.epa.gov/greatlakes/aoc/milwaukee.html#Beneficial_:

Restrictions on fish and wildlife consumption
Eutrophication or undesirable algae
Degradation of fish and wildlife populations
Beach closings
Fish tumors or other deformities
Degradation of aesthetics
Bird or animal deformities or reproduction problems
Degradation of benthos
Degradation of phytoplankton and zooplankton populations
Restriction on dredging activities
Loss of fish and wildlife habitat

1.2.3 Previous Investigations

The Milwaukee Remedial Action Plan Technical and Citizen's Advisory Committees (RAP) recognized contaminated sediment as the major contributor to use impairments within the area of concern (AOC). Significant examples of the use impairment cited by RAP are the fish consumption advisories, in effect

from Grafton to the mouth of the Milwaukee River because of contamination from PCBs (WDNR, 1994a).

The contaminated sediment management strategy of the RAP identified remediation of upstream sources of contaminated sediments as a top priority. An earlier study of the Site estimated that the Estabrook Impoundment on the Milwaukee River holds over 100,000 cubic yards of sediment contaminated with an estimated 5,200 Kg of PCBs (Baird and Associates, 1997). This study found that the Estabrook Impoundment contributes the greatest mass loading of PCBs to the Milwaukee River and Milwaukee Harbor. Remediation of contaminated sediment in the impoundment was expected to result in a long-term reduction in PCB mass transport in the Milwaukee River of up to 70% (Baird & Associates, 1997). The Wisconsin DNR initiated a pre-design study of the impoundment in 2000. Funding for this study was granted by the Environmental Protection Agency's GLNPO.

PCB contamination was initially identified in the area with fish tissue samples. The Milwaukee River PCB Mass Balance Study which was completed and reported in the 1997 *Milwaukee River PCB Mass Balance Project*. Additional study of the contamination in the area was conducted by the WDNR on the *Impacts of Stormwater Runoff on Urban Streams in Milwaukee County, Wisconsin* (1994). USGS published the 1999 report on the *Distribution and Transport of Polychlorinated Biphenyls and Associated Particulates in the Milwaukee River System, Wisconsin 1993-1995*.

Following the projects mentioned above, WDNR prepared the *Estabrook Impoundment Sediment Remediation Pre-Design Study* (August 2005). This study identified the volume of contaminated sediment estimated in the Estabrook Impoundment. It defined the horizontal and vertical extent of the contamination. The study also identified that there were no significant sources of PCB contamination coming from Lincoln Creek. The data gathered for the study identified the sediment handling characteristics and met WDNR Administrative Code NR347 requirements to help identify disposal options.

A remedial investigation/feasibility study was conducted for the Lincoln Park/Blatz Pavilion Site by Natural Resource Technology in March 2007.

1.3 Report Organization

The field investigations are discussed in Section 2.0 and the physical characteristics are discussed in Section 3.0. Section 4.0 discusses the nature and extent of the PCB contamination while Section 5.0

discusses the fate and transport of the PCBs. The Focused Ecological Hazard Evaluation (FEHE) is discussed in Section 6.0. The report is summarized in Section 7.0.

2.0 STUDY AREA INVESTIGATION

The study area for this RI includes the Lincoln Creek (Zone 1) and the West Oxbow (Zone 2) (Figure 1).

2.1 Results of Site Characterization

2.1.1 Surface Features

The Lincoln Park consists of approximately 312 acres of recreational property within Milwaukee County. Lincoln and Estabrook Parks are an integral part of the park system, and continue to serve as recreational points for local residents. The MCPD allows residents to portage non-motorized watercraft across park land and to launch into the rivers controlled by the Department, including the Milwaukee River and the Estabrook Impoundment. There are three designated access sites for canoeing and kayaking in Estabrook Park and one near the Lincoln Park fishing pier, which is located on the east bank of the river, north of Hampton Avenue. Within Lincoln Park there are picnic areas as well as baseball and softball diamonds, football/soccer fields, a playground, a swimming pool, and walking trails.

2.1.2 Contaminant Source Investigations

Previous investigations were conducted by WDNR and their contractors. PCB contamination was detected in the fish tissues. The Milwaukee Estuary Remedial Action Plan called for a completion of the Milwaukee River PCB Mass Balance Study, which was completed in 1997. WDNR is in the process of completing a source identification report for the project area.

2.1.3 Meteorological Investigations

The average temperature for Milwaukee, Wisconsin, is 46.1 degrees Fahrenheit (°F) (http://www.climate-zone.com/climate/united-states/wisconsin/milwaukee). The highest average temperature is in the month of July at 79.9°F, with the minimum average temperature in the month of January at 11.6°F.

Milwaukee receives an average of 32.9 inches of precipitation every year, with an average of 47.1 inches of snowfall. The months with the highest amount of precipitation is April, July and August with 3.5 inches. January has the most snowfall with an average of 13.7 inches.

The average wind speed is 11.4 miles per hour (http://www.uwex.edu/sco/milwind.html). The annual prevailing wind is west-northwest at 10.9 miles per hour.

2.1.4 Sediment Investigations

Sediment investigations occurred in two phases, first one in February 2008 and the second one in March 2009. All PCB Aroclor samples were analyzed by the U.S. EPA Contract Laboratory Program (CLP) Laboratory and the detection limits were the Contract Required Quantization Limit (CRQL). TCLP and bulk property analysis was conducted by STAT Analytical Corporation in Chicago, Illinois.

2.1.4.1 2008 Sediment Investigations

START conducted sediment investigations in February 2008 to address data gaps and define PCB contamination in the West Oxbow. START collected sediment samples from 13 locations in the West Oxbow following the *Final Field Sampling Plan* prepared for these investigations. Sampling was conducted using direct push technology (DPT) Geoprobe® equipment visual estimate of knowledge gap between 2005 based on concentrations and TSCA significance of 50 ppm. A total of 33 samples were collected from various depths for PCBs and total organic carbon (TOC) analysis (Figure 2). As part of this sampling, quality assurance/quality control (QA/QC) samples consisting of four duplicates and two matrix spike/matrix spike duplicates (MS/MSD) were collected. Of the 33 samples, four samples were also analyzed for bulk properties such as specific gravity, moisture content, and Atterberg limits (Table 1).

Sample locations were labeled S-1 through S-13 and sample identification included the area, location and depth of the sample. For example, sample collected at S-1 location in the Lincoln Park/Milwaukee River at a depth of 0 to 0.5 ft was labeled as LPMR-S-1-0-0.5. S-1 location was in the northern section of the primary channel just west of the Parkway, while S-13 was at the southernmost section of the West Oxbow area.

Of the 13 sampling locations, S-1 was the only location with PCB contamination below 1 milligram per Kilogram (mg/Kg). All other sample locations had surface (0 to 1 foot) PCB contamination over 1 mg/Kg. Sample location S-2 was located 200 ft downstream of S-1 and had 143.9 mg/Kg PCBs in the surface sediments and below 1 mg/Kg in the sample collected from over 2.5 ft (ft) depth (Figure 2). Both S-1 and S-2 were located closer to the western shores of the primary channel (Figure 3 and Table 2). Sample location S-3 was located approximately 40 ft east of S-2 on the same transect line as S-2 and represents the mid section of the channel. Here, PCB contamination was detected in all the three depths extending up to the 4-6 ft interval sample. PCB contamination was highest in the middle section of the boring sample, at 0.5 to 2 ft interval.

Sample locations S-4, S-5, and S-6 were situated surrounding the pier in the primary channel. Sample location S-4, situated to the north of the pier, had sediment deposits up to 9.5 ft. PCB contamination increased up to 5 ft depth in 2 sample intervals before falling to below 1 mg/Kg in the 7.5 to 9 ft interval sample. Sample location S-5, located to the west of the pier, had sediment deposits up to 9 ft deep. Similar to the S-4 location, PCB contamination in S-5 location also increased in the depth sample when compared to the surface sample and fell below 1 mg/Kg in the 8 to 9 ft interval sample. Sample location S-6 was situated near the southwest corner of the pier and had sediment deposits up to 6-7 ft. S-6 location had the highest PCB concentration of 823 mg/kg in the second interval sample collected from 1 to 2 ft depth. The PCB contamination in this location in the last interval sample (4 to 6 ft) was observed at 1.47 mg/Kg.

Sample locations S-7, S-8, and S-9 were situated in the West Oxbow Island between the primary and secondary channels of the Milwaukee River. Sediments depths in this area ranged from 1 to 7 ft deep. Sample location S-7, situated to the north of the island, had shallower sediment deposits (up to 3 ft) and had PCB contamination of 6.2 mg/Kg all the way down to the last interval sample. Sample location S-9, situated to the south of the island, had PCB contamination in the surface interval (6.1 mg/Kg) and in the 0.5 to 1.5 ft depth interval (8.0 mg/Kg) but was below 1 mg/Kg PCBs in the 3-foot interval sample. Sample location S-8, situated to the southwest of the island, had PCB contamination in the surface sediments (22.2 mg/Kg) as well as in the 1.5-foot interval sample (28.6 mg/Kg) but decreased to 1.17 mg/Kg PCBs in the 4 to 7-foot interval sample.

Sample locations S-10 through S-13 represent the southern end of the primary channel from the Parkway until its confluence with the Milwaukee River. Sample locations S-10 and S-11 were situated on the northern side of the channel while sample locations S-12 and S-13 were situated on the southern side of the channel. Sediment deposits ranged from 0 to 7 ft on the north side while it was in the range of 0 to 1.5 ft on the south side of the channel. Sample S-10 location, which was closer to the Parkway, had very low PCB contamination (up to 1.83 mg/Kg) in the surface and 5 to 7-foot depth interval sample. Sample location S-11, located to the south of S-10 had higher PCB contamination when compared to other locations in this area. PCB contamination ranged from 29.6 mg/Kg in the surface sample to 3.39 mg/Kg in the 1.5 to 4-foot interval sample. Sample locations S-12 and S-13 also had PCB contamination in surface and in 1.5-foot depth interval samples, with S-13 location showing higher than S-11 location contamination. The contamination ranged from 2.42 mg/kg to 4.13 mg/Kg in the surface samples and from 1.53 mg/Kg to 9.2 mg/Kg in the deeper samples.

In summary, the PCB contamination was prevalent through out the West Oxbow showed greater concentrations at depth for most sample locations.

2.1.4.2 2009 Sediment Investigations

Sediment investigations in March 2009 were designed to gather PCB data within Lincoln Creek (Figure 4), the West Oxbow (Figure 5), the Blatz Pavilion and behind the fixed crest spillway for the Eastbrook Dam (Figure 6). In addition, sediment thickness data were collected in Lincoln Creek and the West Oxbow to supplement existing data. Sampling and sediment thickness surveys were conducted using sampling tubes along a pre-set 150 by 20 ft in the West Oxbow and 300 by 40 ft transects in Lincoln Creek. Seven sediment samples from the Lincoln Creek and eight sediment samples from the West Oxbow were collected for PCBs analysis (Table 2). Two duplicate and one MS/MSD sample was collected as part of QA/QC sampling. Sample locations were labeled WO-A through WO-S in the West Oxbow and LC-A through LC-G to represent samples collected from the Lincoln Creek.

Lincoln Creek Investigations

Seven sediment samples were collected for PCB analysis and 20 locations were surveyed for sediment thickness in the Lincoln Creek during the 2009 sampling event. Lincoln Creek study area stretched from Green Bay Road to the north to its confluence with the primary channel, approximately one mile downstream. The purpose of Lincoln Creek sampling was refine the boundaries of an area to verify and delineate historically reported PCB concentrations and to ascertain if the Lincoln Creek is currently transporting PCBs in to the West Oxbow.

Sample locations in transects A and B were situated in the northern section of the creek just south of the Green Bay Road. Sample location LC-B-N, in the vicinity of historically reported PCB area, had the maximum PCB contamination observed in the creek (0 to 1 foot at 5.4 mg/Kg PCBs). The historical PCB concentration reported in this area was at 41 mg/Kg. Sediment samples collected from 0 to 1-foot depth interval locations approximately 40 ft (LC-B-2) and 80 ft (LC-B-2-S) downstream of LC-B-N location were detected at 0.97 mg/Kg and 0.91 mg/Kg of PCBs, respectively.

Downstream location LC-C2 also showed PCB contamination at 1.3 mg/Kg in the surface (0 to 1-foot) interval sample. PCBs in the next two downstream locations were below 1 mg/Kg in the surface sediments while in LC-F-2 location, it was observed at 1.2 mg/Kg in the surface interval (Figure 7).

RI results indicate minimal PCB contamination in the creek.

West Oxbow

Eight sediment samples and three QA/QC samples were collected from the West Oxbow during the 2009 RI investigations. Two of these sample locations (WO-A and WO-C) were situated to the north of the fishing pier and represented northern section of the West Oxbow study area. The WO-A sample location was immediately west of the Parkway bridge and WO-C was midway between WO-A and the pier. Both these sample locations were closer to the banks and had surface (0 to 1-foot interval) sediment contamination of 7 and 7.9 mg/Kg PCBs, respectively. Sediment deposits in this area were shallow and did not extend below 1-foot depth. Sample location WO-F was west of the pier on the western banks of the channel and showed below 1 mg/Kg PCB contamination (Figure 8).

The sample location at the confluence of Lincoln Creek and the primary channel (WO-H) and sample location to the west of the island (WO-K) identified PCB contamination below 1 mg/Kg. A PCB concentration of 120 mg/Kg was detected in sample location WO-I in the 0 to 1.7 ft depth interval sample. WO-I location is to the southwest of Lincoln Creek and the primary channel confluence and is situated on the western bank. Sample locations WO-Q and WO-R were situated on the west and east side of the Parkway in the southern section of the primary channel. Surface sediment contamination was observed at 1.2 and 3.1 mg/Kg in WO-Q and WO-R locations, respectively. The 2009 investigation of the West Oxbow indicated one location, WO-I, contains surficial sediment contamination around the island.

Blatz Pavilion

Two samples, BP-1 and BP-2, were collected for PCB analysis from the Blatz Pavilion in the area that had been remediated during the summer of 2008 to determine if PCB contaminated sediment is being deposited from upstream. In BP-1, PCB Aroclors 1248 and 1254 were detected at 0.012J mg/Kg and 0.011J mg/Kg, respectively. PCBs were not detected in sample BP-02. The J qualifier shows that the result was detected below the reporting limit.

Milwaukee River

One sample, MRZZ-01-0-0.5, was collected for PCB analysis from behind the spillway and dam area. PCB Aroclor 1242 was detected at 41 mg/Kg (Figure 6).

2.1.5 Geological Investigations

2.1.5.1 2008 Sediment Surveys

As part of the RI, sediment thickness surveys were conducted in 2008 in areas of the West Oxbow where further delineation of PCB TSCA characterization needed to be conducted. Sediment thickness was evaluated using GeoProbe borings and manual borings spread throughout the study area. The borings were drilled until refusal and its geological information was logged along with the GPS coordinates. At every 10th boring location, a sediment core was collected for visual sediment classification. Sediment and bedrock description and classification was based upon the Unified Soil Classification System (USCS) and standard practices developed by the American Society for Testing and Materials (ASTM). The lithologic descriptions for unconsolidated materials (soils [engineering usage] or deposits) used the name of the predominant particle size (e.g. silt, fine sand, etc.). The dimensions of the predominant and secondary sizes were recorded using the metric system. The classic deposit descriptions included, as a supplement, symbols of the USCS. The color descriptions were designated by the Munsell Color System. Each sediment thickness location was also surveyed for its location information (Table 3).

2.1.5.2 2009 Sediment Surveys

Sediment thickness surveys in 2009 were conducted using manual probing equipment along a 150 ft by 40 ft grid in the Milwaukee River, 300 ft by 40 ft grid in Lincoln Creek, and 150 ft by 20 ft grid in the West Oxbow. Respective transects were labeled as LC for Lincoln Creek, MR for Milwaukee River and WO for the West Oxbow. Points along each transect were numbered from the west bank to the east bank in sequence, (i.e. 1, 2, etc). The manual probe, lined with a disposable sleeve, was pushed until refusal to determine sediment thickness. One sediment core was collected at every 3rd transect and a geologist logged in the sediment classification of the boring.

2.1.6 Human Population Surveys

The Lincoln Park area is used for recreational purposes to include canoeing, kayaking, and fishing. Other activities within Lincoln Park there are picnic areas as well as baseball and softball diamonds, football/soccer fields, a playground, a swimming pool, and walking trails. Current water supply for the Milwaukee Water Works, which supplies drinking water to the Milwaukee area, is Lake Michigan.

2.1.7 Ecological Investigations

A hazard analysis was conducted for the benthos organisms in sediment. See Section 5.0 for details on the hazard analysis.

3.0 PHYSICAL CHARACTERISTICS OF THE STUDY AREA

3.1 Regional Geology

The regional geology of the Site is dominated by the effects of multiple Wisconsinan Stage glacial advances and retreats (Schneider, 1983). In the area of the Site, coarse-grained (sand and gravel) glacial outwash deposits predominate along the Milwaukee River, which occupies the course of a former glacial outwash channel (Schneider, 2003). Numerous sand and gravel deposits adjacent to the Milwaukee River have been historically mined to the north and south of the Site. Surface and near surface deposits outside the area immediately along the Milwaukee River tend to be dominantly fine-grained (silt and clay) glacial till deposits of the Oak Creek Formation. These glacial till deposits likely underlay the outwash deposits along the Milwaukee River.

Bedrock in the Site area consists of Devonian-age dolomite and shaley dolomite of the Milwaukee and Thiensville Formations (SEWRPC, 2002). The bedrock topographic surface in the region is highly variable ranging from scattered bedrock outcrops (including just to the southeast of the Site along the Milwaukee River) to depths to bedrock of more than 150 ft. Depth to bedrock beneath the Site is mapped as being greater than 100 ft (SEWRPC, 2002).

3.1.1 Site Geology

Zone 1 – Lincoln Creek

Lincoln Creek is an originally natural stream that has been heavily impacted, either directly or indirectly, by human activity. Some stretches above Lincoln Park have been directly altered through reconstruction of the banks and channel. All of the Creek, including that in Zone 1, have been affected by urban development around Lincoln Creek. One common aspect of urban development is increased surface water runoff rates which lead to increased peak stream flows. Consequently soft sediment thicknesses in Lincoln Creek tend to be relatively thin and dominated by coarser grained sediments like sand and gravel rather than clay and silt. Sediment thicknesses and characteristics in Lincoln Creek vary depending on their relative location with respect to main channel flow and the morphology of the underlying firm substrate. For example logged borings LC-B-1N, LC-B-2, LC-B-2-S, LC-C-2, and LC-D-2 were all advanced within the same section of the stream, but encountered sediments of varying characteristics and thicknesses. Sediment thicknesses varied from approximately 0.3 foot (at LC-D-2) to 1.0 foot (at LC-B-1-N and LC-C-2). Sediment types are dominantly sandy, but varied from sand with gravel and pebbles

(LC-B-2) to sandy clay silt with organics (LC-B-1-N). Sediment thicknesses and characteristics observed in the samples from the downstream borings LC-E-2 and LC-F-2 were similar to those of the upstream borings with thicknesses ranging from 0.6 to 1.0 foot.

Sediment thicknesses in Zone 1 based on probe resistance vary more than those observed from the sampled and logged borings. Probe-derived thicknesses vary from less than 1 foot (primarily along the western side of the lower stretch of Zone 1) to as much as 5 ft (in an area near the middle of the channel in the central part of Zone 1). However this 5 ft measured thickness is based on a single probe measurement and may simply reflect filling of a local depression in the more resistant streambed substrate. Sediment thicknesses were measured at approximately 4 ft at two locations near the mouth of Lincoln Creek. However, most measured sediment thicknesses within Zone 1 ranged from less than 1 foot to approximately 2 ft.

In general, sediments tend to be thinner and coarser grained where stream flows are the highest (near the creek middle in straight stretches and along the eastern section outside of the creek where creek curves) and thicker and finer grained in other areas. Unusually thick sediment thicknesses (from 2 to 5 ft) may be encountered, but may represent areas of limited extent given how few measured thicknesses exceeded 2 ft depth.

Zone 2- West Oxbow

The shallow local geology of the Lincoln Park West Oxbow or Zone 2 has been heavily changed by man-made alterations. This area appears to have originally been occupied by an oxbow lake or filled oxbow lake that was once the main channel for the Milwaukee River. The area of the West Oxbow from Lincoln Creek downstream to the Milwaukee River (Zone 2B) was originally occupied by the lower stretch of Lincoln Creek. All of Zone 2 was excavated in the 1930's. Consequently the natural stratigraphy underlying Zone 2 has been disrupted. The investigated sediments comprise sediments transported from Lincoln Creek and the Milwaukee River that were deposited from the excavation of the impoundment.

The deposition of these sediments has been controlled by a combination of natural fluvial processes and artificial control of the Milwaukee River. Historically, the downstream dam which was constructed on the River in the 1930's, has been closed in the spring following spring runoff to raise the water level in the oxbows and nearby areas for recreational purposes. In the fall, the dam is opened allowing most of the water in the oxbows to drain away leaving many areas of the oxbows exposed or submerged below shallow water through the winter. Until the dam is closed again in the spring, most of this area only

experiences significant submersion and relatively rapid flow velocities during high water flow events associated with snow melt runoff and heavy regional precipitation events.

While Zone 2 has been subject to gradual aggradation (depositional buildup) of sediments since the 1930's excavation activities, it is still a naturally ephemeral geological system subject to alterations of at least the upper sediment stratigraphy by unusually high river flow events. Such events can erode previously stable layers or areas of sediments and replace them with completely different sequences. Such an event may have occurred in June 2008 between the March 2008 and March 2009 sediment investigation field events. During the June 2008 heavy flow event, parts of Southeastern Wisconsin experienced 100-year flood events. While it is not clear that Zone 2 was subject to a flood event of that magnitude, it can be concluded that it did experience a higher than normal annual peak flow event in June 2008. The March 2009 appearance of some areas of the sediment flats, particularly on the east side of the primary channel where Lincoln Creek joins it, was markedly changed from how it looked in March 2008. The surface topography of the exposed sediments in this area had changed with some areas being higher and other being lower than was observed in March 2008. Therefore, it is likely that sediment sequences present in the Lincoln Park impoundment in March 2009 investigation were at least somewhat altered from those present during the March 2008 investigation.

The investigated sediments are located in different areas of sediment accumulations called either sediment flats or flats for the purpose of this report or channels. The flats border shorelines and are separated from one another by two channels. The primary channel of the West Oxbow is connected to the Milwaukee River at the channel's north and south ends and is located to the east of the island located in the impoundment. The secondary channel, located to the west of the island, begins where Lincoln Creek empties into the primary channel north of the island, and connects with the primary channel southeast of the island.

Sediment thicknesses and characteristics vary somewhat from area to area. Detailed sediment descriptions are provided in sediment boring logs provided in Appendix A for those collected in 2008 and Appendix B for those collected in 2009. Overall sediment thickness was defined as the interval between the top of sediment and a point where a distinct increase in coring resistance was encountered. Materials below the point of distinct sediment resistance tended to consist of dense sand and occasionally sand and gravel, and to be distinctly denser than the overlying sediments. The top of this more dense material is interpreted as representing the top of the original impoundment surface following excavation. This

underlying denser material likely represents older sediments, fluvial materials, or glacial deposits exposed during impoundment excavation and should therefore represent relatively uncontaminated material.

Sediment thicknesses within the flats of Zone 2 vary from less than 3 ft, generally adjacent to the channels, to as much as 9.5 ft. Typical sediment thicknesses in the flats tend to be between 5 and 7 ft although some flats have thinner average sediment thicknesses. Sediments tend to be fine grained (silts and clays) in their upper interval, and sandy in their lower interval, although this relationship does not hold everywhere. Thinner interbedded units of a contrasting texture occur at a number of locations. At some locations, the uppermost sediments tend to be sandy and appear to represent accumulations of sandy material in small sand bars on top of the sediment flats. A more detailed description of sediment characteristics by different areas is provided below. It should be noted that two 2009 logged borings in flat areas had 0.5-foot thick sandy silt intervals at the top of the sediment sequence. This may reflect deposition during the high flow event of June 2008.

Sediment thicknesses within the channels of Zone 2 vary from less than 1-foot to up to 5 ft. Average sediment thicknesses in the channels in Zone 2A tend to be somewhat greater than those in the channels of Zone 2B. This may reflect higher river flow velocities in Zone 2B than Zone 2A due to the additional flow contribution from Lincoln Creek. Furthermore, sediments in the primary channel of Zone 2B are thinner than those in the secondary channel. Again this is likely because the primary channel experiences higher flow velocities than the secondary channel. Sediments in the channels tend to be sandy with some silt and little or no clay. The uppermost sediment layer (approximately 0.5-foot or less) in the channels tends to be dominantly sandy, which probably reflects the effects of the July 2008 high flow event.

Four 2008 samples were collected from texturally homogenous depth intervals from four select borings for bulk characteristic profiling, which included grain-size analyses (Table 4).

Some of the percentages in Table 4 have been corrected to match the reported raw sieve size results and do not match the final reported percentages of sand or fines reported in the laboratory report. The results of the sieve size analyses indicate a distinct difference between the fine-grained and coarse grained sediment intervals. According to the results the fine grained sample intervals tend to be predominately silts (60 to 70%) with lesser portions of clay and fine sand, while the coarse grained intervals are almost exclusively fine to medium sand (greater than 90%).

For convenience, the sediment flats are subdivided into different areas to facilitate description of sediment variability across Zone 2 (Figure 9 and Table 5).

North Flat: on north side of primary channel (Zone 2A)

This area is a very narrow zone of sediment accumulation along the northwest shore of the primary channel. The overall sediment thickness encountered at the two borings in this area is approximately 8 ft. However, encountered sediment profiles at each boring are distinctly different precluding generalization about sediment types in this area. Sediments at boring S-1 are predominantly sandy, while those at boring S-2 are predominantly fine grained. The sediment base has a consistent elevation of 606 ft above msl.

East Flat: east of primary channel and north of pier (Zone 2A)

This area is a broad zone of sediment accumulation along the east shore of the primary channel to the north of the pier. Sediment thicknesses vary from approximately 5 ft at the northern end of this area to approximately 9.5 ft at the southern end, but are dominantly between 5.5 and 7.0 ft. Encountered sediment types in this area are dominantly fine-grained with minor, interbedded sandy intervals of generally 1-foot or less in thickness. The sediment base at most boring locations has an elevation of 608.8 to 610.8 ft above msl. The sediment base at three locations in the southern portion of this area is lower with elevations ranging from 606.7 to 607.6 ft above msl.

East Flat: east of primary channel and west of pier (Zone 2A)

This area is a moderately narrow zone of sediment accumulation along the east shore of the primary channel to the west of the pier and the shoreline. Sediment thicknesses are between 6.3 and 7.9 ft. The sediment thickness at one location near the shore (boring S-6) is only 4 ft. Encountered sediment types in this area are dominantly fine-grained with minor, interbedded sandy intervals of 1-foot or less in thickness. The sediment base at all boring locations, except S-6, has an elevation ranging from 608.1 to 608.9 ft above msl. The sediment base elevation at S-6 is considerably higher (612.4 ft above msl), which is likely due to its close location to the shore.

East Flat: east of primary channel and south of pier (Zone 2B)

This area is a variably narrow zone of sediment accumulation along the east shore of the primary channel to the south of the pier. Sediment thicknesses in this area are generally thinner than those further north ranging from 2.2 to 5.3 ft. No sediment profiles were collected from borings in this area. The sediment

base in this area is highly variable ranging from 609.9 to 613.6 ft above msl. This variability is likely due to the near shore locations of these borings.

West Flat: west of secondary channel (Zone 2B)

This area is represented by a single boring (ST-22), which was the only boring that could be obtained from the west shore of the secondary channel. This shore is a cutbank due to relatively high flow velocities, and fine-grained sediment accumulation along most it is likely to be limited. This boring location was only probed and no sediment descriptions were obtained. The observed sediment thickness was 6 ft with a sediment base elevation of 608.4 ft above msl.

Island Flat, east, west and north of the island (Zone 2B)

This area consists of the zone of sediment accumulation to the east, north, and west of the small island in the impoundment. Sediment thicknesses in this area to the east of the island are fairly consistent ranging from 5.5 to 6.5 ft. Sediment thicknesses in this area to the north and west of the island are more variable ranging from 4 to 7 ft, although all locations but one (ST-25) have thicknesses between 5.5 and 7 ft. Collected sediment profiles appear to indicate that sediments in this area tend to be fine grained with interbedded sandy intervals of 1.5 ft or less. The sediment base at boring locations between the primary channel and the island has an elevation of 609.2.to 610.5 ft above msl. The sediment base at boring locations between the secondary channel and the island generally has an elevation of 607.9 to 609.5 ft above msl. One boring location (ST-25) west of the island has a higher elevation of 611.7 ft above msl.

Island Flat, south and southeast of the island (Zone 2B)

This area consists of the zone of sediment accumulation to the south and southeast of the small island in the impoundment. Sediment thicknesses in this area range from 6 to 8.5 ft. Collected sediment profiles appear to indicate that sediments in this area tend to be sandy with a thinner fine grained interval. Boring ST-30 is located on a small sand bar at the southeast end of the island. The sediment base at boring locations between the primary channel and the island has an elevation of 607.2 ft above msl near the island to 609.9 ft above msl at the far southeast end of the flat.

Northern Southeast Flat, north of primary channel and east of bridge (Zone 2B)

This area consists of the zone of sediment accumulation to the north of the primary channel between the Milwaukee River Parkway bridge and the Milwaukee River. Sediment thicknesses in this area are fairly consistent ranging from 6 to 7 ft. Collected sediment profiles indicate variable sediment types, although

dominantly fine-grained in the upper four ft or more. The sediment base elevation ranges from 609.0 to 610.3 ft above msl.

Southern Southeast Flat, south of primary channel and east of bridge (Zone 2B)

This area consists of the zone of sediment accumulation to the south of the primary channel between the Parkway bridge and the Milwaukee River. Sediment thicknesses in this area are thinner, and a little more variable then those north of the channel ranging from 3 to 5 ft. Collected sediment profiles indicate variable sediment types, although dominantly sandy in the uppermost approximately 0.5-foot. The sediment base elevation ranges from 609.3 to 611.3 ft above msl.

Primary Channel, just west of bridge (Zone 2B)

This portion of the primary channel is located just downstream from the confluence of the primary and secondary channels. The measured sediment thickness in this area was only 1.2 ft. It consisted of 0.4 foot of sand overlying 0.8-foot of sandy silt.

Primary Channel, between the bridge and the Milwaukee River (Zone 2B)

This portion of the primary channel is located between the bridge and the confluence of the primary channel and the Milwaukee River. The measured sediment thickness in this area was only 1.5 ft. It consisted of 0.5-foot of sand overlying 1.5 ft of sandy silt.

Summary

The sediment flats were created over time as periodic spring high-water flows flooded these areas and deposited sediments. Most of the deposition on the flats is likely due to uncommon high-flow events. Individual sandy units in particular are likely due to single high-flow events, such as those sandy units observed at the tops of the 2009 boring samples. Contamination would likely be relatively consistent in layers of consistent sediment type since those layers would represent single depositional events. The variability in soil profiles between nearby borings indicates that depositional units are likely limited in horizontal extent. Sediments were likely deposited as lense-like bodies. It appears unlikely that single depositional beds of more than a few inches in thickness exist across wide areas.

Channel deposits tend to be thinner than those in the sediment flats varying from less than 1-foot to locally as much as 5 ft. However, they appear to average less than 3 ft. This is due to the higher stream flow velocities in the channels, which would tend to carry most fine grained sediment downstream before

it can be deposited. Therefore, contamination would be expected to be less common or widespread in the channel sediments than in the sediment flats.

4.0 NATURE AND EXTENT OF CONTAMINATION

4.1 Result of Site Characterization

The following section discusses the nature and extent of the PCB contamination within the Lincoln Creek and the West Oxbow of the Milwaukee River area.

4.1.1 Sources

Historical information, as well as current investigations have not identified any sources of PCBs in the Lincoln Park/Milwaukee River.

4.1.2 Sediments

Lincoln Creek (Zone 1)

The Lincoln Creek study area extended from Green Bay Road on the north to its confluence with the primary channel of the Milwaukee River in the south. Of the seven sediment samples collected from this region, PCB contamination was observed above 1 mg/Kg in four locations. The highest concentration of 5.4 mg/Kg PCBs was observed in sample LC-B-1-N, in the area that was previously known to have had 41 mg/Kg PCB contamination. This location is closer to the Green Bay Road. PCB contamination was observed at 1.2 mg/Kg in LC-F-2 location, approximately 0.75 mile downstream of Green Bay Road. Sediment thickness in the Lincoln Creek ranged from 0 to 4.6 ft, with the encounter of fine sand and gravel below 1-foot in the northern 3/4th section of the creek. Sediment thickness was deeper in the shores of the creek. Based on the RI results, no identifiable upstream migration sources were observed. However, low level PCB-contaminated sediments are present in the Lincoln Creek Sediments.

West Oxbow (Zone 2)

The West Oxbow sediment investigation was accomplished through 44 samples collected from various depths and analyzed for PCBs (Figure 8). Aroclors were detected in every sample location in the West Oxbow. PCB contamination is higher in greater than 1-foot depth sediments when compared to the surface sediment contamination. Majority of the contamination was encountered up to an average 4-6 foot depth interval. The maximum PCB concentration of 143.9 mg/Kg in the top 1-foot layer of sediments was observed in the northern section of the primary channel at S-2 location west of the Parkway. Downstream PCB concentrations in the surface sediments were relatively low (less than 10 mg/Kg) except at sample

location WO-I-2, just southwest of the Lincoln Creek's entrance in to the primary channel, where it was observed at 120 mg/Kg.

The deeper interval contamination did not correlate to the locations where surface contamination was observed. PCB contamination ranged from 0.14 mg/Kg to 823 mg/Kg in the deeper sediments and was observed in sample depths up to 5.5 ft. Deeper sediment contamination was observed in 2 primary locations: in the pier area and in the island area of the West Oxbow. The higher PCB contamination was observed to the north, west, and southwest of the pier, with the highest concentration occurring to the southwest of the pier in location S-6. In the West Oxbow Island, the highest PCB contaminated sediment was observed in WO-I-2 location which was situated southwest of the Lincoln Creek's confluence with the primary channel. Historical sampling to the east and south of the West Oxbow Island had PCB contamination ranging from 1 to as much as 870 mg/Kg. Sample results in the channel between the Parkway and its confluence with the Milwaukee River on the south also indicated PCB contamination in depths up to 5-7 ft.

In general, the vertical extent of contamination varies in the West Oxbow, with contamination extending to over 6 ft depth in the pier area, to about 4 ft in the West Oxbow Island area, and up to 5-7 ft to the southeast of the Parkway. Five sediment samples collected at locations S-2, S-4, S-5, S-6, and WO-I-3 exceeded the Toxic Substance Control Act (TSCA) limit of 50 mg/Kg for disposal at the subtitle D landfill and thus require disposal at a subtitle C landfill. Samples S-4, S-5 and S-6 are located around the fishing pier for the largest area of TSCA-level contaminated sediment and goes down to a depth of 5.5 feet. There are several other small hot spot areas that exceed TSCA. Sample S-2 is located on the north near where the previous Lincoln Creek emptied into the West Oxbow, and is surficial at a depth of 0.5 feet. The other sample, WO-I-3, exceeds the TSCA limit is located near where the current Lincoln Creek empties into the West Oxbow, and was found at a depth of 1.7 feet.

Two disposal samples were also collected in the West Oxbow, WO-K-3 and WO-H-3. See Table 6 for disposal results. Samples were analyzed for PCBs by Method 8082, TCLP Metals by Method 1311/6020 and TCLP Mercury by Method 1311/7470A, TCLP SVOCs by Method 1311/8270C, TCLP VOCs by Method 1311/8260B, Specific Gravity, Reactive Cyanide by Method 3.3.2, Reactive Sulfide by Method 3.4.2, Flash Point by Method 1010, pH by Method 9045C and Phenolics by Method 9066. None of the results showed that the sediment was hazardous or TSCA-related waste.

Blatz Pavilion (Zone 3)

Two samples, BP-1 and BP-2, were collected from the top ½ foot for PCB analysis from the Blatz Pavilion in the area that had been remediated during the summer of 2008 (Figure 6). This sampling was conducted to verify any transport of PCBs from upstream locations in to the remediated Blatz Pavilion areas. Aroclors 1248 and 1254 were detected at 0.012J mg/Kg and 0.011J mg/Kg, respectively, in one sample (BP-01). The J flag designates a positive detection below the CLP contract required detection limit.

Milwaukee River (Zone 5)

One sediment sample (MRZZ-01-0-0.5) was collected behind the spillway next to the Estabrook Dam to depositional area behind the fixed crest spillway (Figure 6). Sediment thickness in the spillway ranged from an estimated 5.0 ft within the debris area on the south end to no measureable sediment along the northern section of the dam. The sample was collected from a depth of 0 to 0.5 ft and had Aroclor 1242 at 41 mg/Kg.

5.0 CONTAMINANT FATE AND TRANSPORT

The contaminant of concern for this focused RI is PCBs. The following section discusses the fate and transport of PCBs.

5.1 Potential Routes of Migration

PCBs were detected in the sediments of the Lincoln Creek and in the area where the Lincoln Creek converges with the Milwaukee River. PCBs are mixtures of different congeners of chlorobiphenyls and the relative importance of the environmental fate mechanisms generally depends on the degree of chlorination. In river areas, PCBs tend to absorb to sediment particles and do not tend to dissolve into the water. PCBs can to volatize rapidly from water, when the water temperature is warm enough.

5.2 Contaminant Persistence

PCBs do not readily break down and may remain in the environment for long periods of time. The persistence of PCBs increases with the degree of chlorination. The persistence of PCBs increases with an increase in the degree of chlorination. Mono-, di- and trichlorinated biphenyls biodegrade relatively rapidly, tetrachlorinated biphenyls biodegrade slowly, and higher chlorinated biphenyls are resistant to biodegradation. The PCBs in water tend to adsorb to suspended matter. PCBs are also known to bioaccumulate in organisms and humans. PCBs have shown to bioconcentrate significantly in aquatic organisms through the food chain, increasing in concentration as they move up the chain. The main exposure route to humans is through fish ingestion of contaminated fish and drinking contaminated water. The current BUIs and the restrictions for the Milwaukee Estuary are in place by taking these exposure routes into consideration for the human exposure at the Lincoln Park.

5.3 Contaminant Migration

In sediment environments, PCBs tend to attach to sediment particles. The migration of the PCBs in sediment will tend to depend on the migration of the sediment particles themselves. The water solubility is greater for the lower chlorinated PCBs, the higher chlorinated PCBs tends to remain adsorbed to sediment particles. Due to Estabrook Dam opening and closing every year, sediment transportation to downstream locations is very likely. With sediment transportation, contaminant migration is also very likely to occur.

6.0 FOCUSED ECOLOGICAL HAZARD EVALUATION

6.1 Ecological Evaluation

The Wisconsin Water Program staff developed and published a set of consensus-based sediment quality guidelines [(CBSQG)(WDNR, 2003)]. The CBSQG numbers are the geometric means from several sets of sediment quality guidelines (SQG) that had been previously developed independently by several states, Canadian provinces, U.S. EPA, the National Oceanic and Atmospheric Agency (NOAA) and several researchers (Persaud et al. 1993; Long and Morgan, 1991; Ingersoll et al. 1996a, 1996b; MacDonald et al. 2000a, 2000b; Swartz, 1999). These SQG were generally developed using empirical approaches based on databases which related a range of observed effects (e.g. reduced survival, growth or reproduction of benthic macroinvertebrate organisms) to a range of increasing concentration of individual sediment-associated contaminants. The guidelines establish two concentration levels based on effects–a lower threshold effect concentration (TEC) at which no or minimal effects are predicted and a probable effect concentration (PEC) at which adverse effects are highly probable or will frequently be seen. The focus of the CBSQG was primarily on developing concentrations of chemicals that would be protective of the majority of bottom dwelling species that reside on or in the sediment and sediment port water.

6.1.1 Uses of Sediment Quality Guidelines

The effects-based CBSQG are intended as screening level concentrations for commonly found contaminants that will help identify the need for further actions. They are used to assess the quality of prospectively dredged materials (NR 347 dredging projects); to screen site concentrations for evaluation of the relative potential risks to sediment dwelling species; to evaluate the need to collect additional sediment chemistry data; as toxicity benchmarks in a screening level ecological risk assessment; and as one line of evidence among multiple lines of evidence used to support decision-making. The CBSQG should not be used on a stand-alone basis to establish cleanup levels or for sediment management decision making.

6.2 Ecological Evaluation

6.2.1 Calculation of PEC-Q and estimated mean PEC-Q values

During 2008, START collected a number of sediment core samples from the West Oxbow area. The samples were analyzed only for PCB Aroclor mixtures. Following the WDNR (2003) guidelines on Consensus-Based Sediment Quality Guidelines (CBSQG), the results are compared to probable effects

concentration (PEC) for PCBs. The observed PCB concentrations were first adjusted to a 1% total organic carbon (TOC) basis and then were divided by the CBSQG PEC value for total PCBs (676 µg/kg) to determine the PEC-Quotient (PEC-Q). The WDNR (2003) guidelines also indicates that a mean overall PEC-Q for metals, total PAHs, and total PCBs combined, can be calculated which gives additional confidence in the evaluation of the probability of adverse effects on benthic macroinvertebrate communities. Because analyses for metals and PAHs were not performed during the 2008 samples, historical data from a 2003 sampling event as described in WDNR (2005) were used to provide an estimate of the PEC-Q values for metals and PAHs.

6.2.2 Details of 2003 Sampling Event; Definition of Zones

The samples analyzed for metals from the 2003 sampling event (WDNR, 2005) were composite samples from five zones sized according to the amount of soft sediment found in a 1993 survey as defined in the QAPP for this sampling event (WDNR, 2001). Zone 5 included Lincoln Creek up to its confluence with the west oxbow and Zone 1 extended down to Estabrook Dam. Samples for NR347 (i.e. metals, pesticides) were composite samples prepared for each zone. A uniformly-sized portion of each surficial core was set aside and blended with samples from other cores taken in each zone (WDNR, 2001).

The zones as defined in the QAPP (WDNR, 2001) were different from the zones defined in the final report from the 2003 sampling event (WDNR, 2005). Due to the composite samples analyzed for metal concentrations were collected based on the zones as defined in the QAPP, that definition of the borders and numbering of the zones was retained during the evaluation of the 2008 sampling event. The PCB results from the 2008 sampling event were grouped by these zones for calculation of overall mean PEC-Q values that combine the PEC-Q values for metals, total PAHs, and total PCBs.

6.2.3 Historical Data Evaluation

Data for the TOC percent and PAHs are not available for the surface horizons (0 to 0.6 ft and 0.6 to 1.2 ft) for several of the core samples collected in the 2003 sampling event (WDNR, 2005). However, results for PCB analysis for these samples were listed in the Data Appendix to WDNR (2005). Therefore, these samples are listed in Table 7 of this evaluation, but the cells for TOC and PAH results in this table have the entry "nd" for no data, but the PCB results are presented for completeness. Because the TOC data are not available for these samples, the PCB values could not be adjusted to 1%TOC to be comparable to the basis for the CBSQG PEC value for PCBs. Therefore, PEC-Q values for PCBs in the surface horizons were not calculated. Because of the limited number of PAHs data points for the top 40 centimeters (cm)

of sediment, the highest PEC-Q for total PAHs in each of the zones (as defined in the QAPP, 2001) was selected for combination with the metals and PCB data to calculate the mean overall PEC-Q.

6.2.4 Biologically Active Zone

The CBSQG numerical values apply to the biologically active zone associated with deposited sediments in flowing (streams and rivers) and static (lakes and ponds) water bodies (WDNR, 2003). The biologically active zone typically encompasses the top 20 to 40 cm of sediment in freshwater environments (Clarke et al. 2001). The majority of benthic organisms are usually associated with the top 15 cm, although certain invertebrate and/or amphibian species can use sediment down to 100 cm below the surface during certain portions of their life history. For the purposes of this evaluation, the biologically active zone was defined as the first 40 cm (1.3 ft) of sediment, and any horizon sampled with a starting depth of 40 cm or less was included in the analysis. This limitation to the upper 40 cm was based on the fact that the available metals data were limited only to surficial layers.

6.2.5 PCB Non-detects, 2008 sampling event

The PCB data from the 2008 sampling event were reported as concentrations of individual Aroclor mixtures. The Aroclor mixtures 1242, 1248, and 1254 were positively detected and identified in at least one of the samples. Other Aroclor mixtures that were not positively detected in any of the samples were not carried through the evaluation. For those samples where Aroclor mixtures 1242, 1248, or 1254 were not detected, the detection limit was carried through the analysis, because these Aroclor mixtures could have been present at or below the detection limit.

6.3 Results

6.3.1 Metals

The mean PEC-Q_{metals} values ranged from a low of 0.4 for the Zone 2 and Zone 5 surface sediment samples to 1.2 for Zone 3 (Table 8). There were no samples taken from Zone 5 in the 2008 sampling event, therefore Zone 5 was not considered further. The highest mean PEC-Q_{metals} of 1.2 was for Zone 3, which includes the sediments in the western oxbow of the Estabrook Impoundment from just north of the island in the oxbow south to the Parkway Bridge.

6.3.2 PAHs

The PEC-Q_{PAH} values ranged from a low of 0.1 in Zone 1, (Lincoln Creek before the confluence with Estabrook Impoundment) to 1.4 at sampling point 4X5 (located just south of the island in the western oxbow) in Zone 3. The PAH concentration, adjusted to 1% TOC of 1,478 is below the threshold effects concentration for total PAHs of 1,670 (WDNR, 2003). Therefore, no adverse effects on benthic macroinvertebrate communities would be expected. The PEC-Q_{PAH} of 1.4, however, indicates that the PAH concentration adjusted to 1% TOC is above the concentration where adverse affects are probable. A PEC-Q_{PAH} value in excess of 1.0 was only observed at one sampling point. Because of the limited number of surface sediment sampling points with complete PAH and TOC data, the highest PEC-Q_{PAH} value observed in each zone was selected to carry forward in the overall mean PEC-Q calculation for the 2008 sampling event. The selected PEC-Q_{PAH} values are presented in Table 9.

6.3.3 PCBs

The PEC-Q_{PCB} values for the 2003 sampling event (WDNR, 2005) ranged from a low of 0.1 to a high of 34.1 for samples that had a starting depth of 40 cm or less (Table 9). Out of the 16 samples, 50% had PEC-Q_{PCB} values that exceeded 1, which indicates that adverse effects on benthic macroinvertebrates are probable.

The PEC-Q_{PCB} values for the 2008 sampling event (Table 7) ranged from a low of 0.2 to a high of 121.7 for samples that had a starting depth of 40 cm or less. Out of the 23 samples that met these criteria, 65% had PEC-Q_{PCB} values that exceeded 1, which indicates that adverse effects on benthic macroinvertebrates are probable.

6.3.4 Overall Mean PEC-Q

Overall mean PEC-Q values were calculated for the results of the 2008 sampling event. Overall mean PEC-Q values were calculated by summing the PEC-Q values for metals, total PAHs, and total PCBs, and dividing by three. The metals PEC-Q for each composite sample from the zone was used for all STN 2008 sampling points within a given zone. The highest PAH PEC-Q from each zone was also used in order to be conservative. Dividing by the number of PEC-Q values included in the overall mean normalizes the value to provide comparable indices of contamination among samples for which different numbers of contaminants were analyzed (WDNR, 2003). The equation [$Y= 101.48(1-0.36^{X})$] presented in Appendix A (WDNR, 2003) was used to estimate the probability of observing sediment toxicity at a given overall mean PEC-Q based on the results of MacDonald et al. (2000a). The overall mean PEC-Q

values ranged from a low of 0.4 to a high of 40.9. The estimated average incidence of toxicity exceeded 95% for 28% of the samples for which data were available (Table 7).

6.4 Discussion of Ecological Hazard Evaluation

The CBSQG were developed to identify concentrations of chemicals that would be protective of the majority of bottom dwelling species that reside on or in the sediment and sediment port water. The guidelines establish two concentration levels: the TEC, at which no or minimal effects are predicted and the PEC at which adverse effects are highly probable (WDNR, 2003).

The limited available data for metals in the Estabrook Impoundment sediments indicated that the combined concentrations of cadmium, chromium, copper, lead, nickel and zinc in Zone 2 were high enough that adverse toxic effects on sediment dwelling species are probable. The concentrations of chromium and lead exceeded the PEC for the individual metals. The concentration of lead also exceeded its PEC in Zone 3 but the mean PEC-Q for all metals combined did not exceed 1 for Zone 3. Due to the sediment samples analyzed for metals were composite samples collected only from the surface layers, it is not possible to identify hot spots of contamination that could be remediated to reduce the risk to benthic macroinvertebrates. It is also not possible to evaluate the depth of sediment that would need to be treated or removed to reduce the risks.

The data for PAHs are more extensive than for metals, however, the data for total PAH concentrations for several surface sediment samples are missing from the WDNR (2005) report and the data appendices. The total PAH concentration, adjusted to 1% TOC, exceeded the PEC level for only one surface, sediment sample. None of the total PAH concentrations found in subsurface sediment samples exceeded the PEC level. These results suggest that the concentrations of PAHs in the Estabrook Impoundment sediments are below the levels where adverse effects on sediment dwelling species are probable.

The data from both the 2003 sampling event (WDNR, 2005) and the 2008 sampling event described in this report show that the total PCB concentrations in the biologically active zone exceeded the PEC in more than 50% of the samples analyzed. This suggests that adverse effect on sediment dwelling organisms due to elevated total PCB concentrations are probable in much of the surface sediment in the Estabrook Impoundment. When combined with reasonable estimates of concentrations of metals and PAHs, the overall mean PEC-Q values show an estimated average incidence of toxicity that exceeds 95% for 28% of the samples from the 2008 sampling event. Therefore, the probability of adverse effects to

sediment dwelling species is high over large portions of the western oxbow of the Estabrook Impoundment.

Note that the CBSQG generally do not consider the food chain aspects of such bioaccumulative compounds as methyl mercury and the nonpolar organic compounds (e.g. PCBs) in terms of effects to humans or wildlife (WDNR, 2003). Where necessary, other approaches such as food chain modeling and back calculating from acceptable fish tissue levels should be used to establish protective levels of bioaccumulative contaminants in sediments for ecological receptors and humans.

7.0 SUMMARY AND CONCLUSIONS

7.1 Summary

7.1.1 Nature and extent of Contamination

Historical information, as well as current investigation has not identified any discrete sources in Lincoln Creek/West Oxbow of the Milwaukee River. The RI sampling and historical sampling indicates that the sediments in the study area are contaminated with PCBs at levels that present a significant ecological risk. The fish consumption advisory issued by the Wisconsin Division of Public Health is evidence of significant human health risk.

Lincoln Creek (Zone 1)

The RI activities in the creek included investigating the historical hot spot, EST5-7, with 41 mg/Kg PCBs, and determining if contamination is being transported to the West Oxbow. The highest PCB concentration of 5.4 mg/Kg PCBs was observed in sample LC-B-1-N in the area that was previously known to have had 41 mg/Kg PCB contamination. This location is closer to the Green Bay Road. Sediment thickness in Lincoln Creek ranged from 0 to 4.6 ft, with of fine sand and gravel below 1-foot in the northern 3/4th section of the creek. Sediment thickness was deeper in the shores of the creek and towards the creek's confluence with the primary channel. Low level PCB-contaminated sediments are present in the Lincoln Creek.

West Oxbow (Zone 2)

West Oxbow investigations were conducted through 44 sediment sample analyses for PCBs. Sediment thickness survey through probing/polling occurred at over 300 locations, with some of these locations being collocated with chemical sample locations. Sediment thickness in the West Oxbow ranged from 0 to 9.5 ft in depth.

PCBs were detected in all sediment samples collected from the West Oxbow. The highest PCB concentration in the top 1-foot section of the sediments (surface sediments), was observed in the northern section of the primary channel, in S-2 location (143.9 mg/Kg) west of the Parkway and north of the pier. Downstream PCB concentrations in the surface sediments were relatively low (less than 10 mg/Kg)

except at sample location WO-I-2, just southwest of the Lincoln Creek's entrance in to the primary channel, where it was observed at 120 mg/Kg.

PCB concentrations in deep sediments (i.e. greater than 1 foot) are higher than surficial concentrations, with the majority of the contamination at an average 4 to 6-foot depth interval. The deeper contamination did not correlate to the locations where surface contamination was observed. PCB contamination ranged from 0.14 mg/Kg to 823 mg/Kg in the deeper sediments and was observed in sample depths up to 5.5 ft. Deeper sediment contamination was observed in 2 primary locations: in the pier area and in the island area of the West Oxbow. The higher PCB contamination was observed to the north, west, and southwest of the pier, with the highest concentration occurring to the southwest of the pier in location S-6. In the West Oxbow Island, the highest PCB contaminated sediment was observed in WO-I-2 location, which was situated southwest of the Lincoln Creek's confluence with the primary channel. Historical sampling to the east and south of the West Oxbow Island had PCB contamination ranging from 1 to as much as 870 mg/Kg in sediment depths up to 5 ft.

7.1.2 Fate and Transport

PCBs found in the Site sediments are most likely to adsorb to the sediments and transport with the migration of the sediments. PCBs are known to bioaccumulate in organisms and humans and bioconcentrate significantly in aquatic organisms. The fish advisory already in effect in the Site area indicates the documented exposure pathway to humans.

7.1.3 Hazard Evaluation

Because of the fish consumption advisory in the Site area, a focused ecological hazard evaluation for the bottom dwelling species was conducted. The CBSQG were developed to identify concentrations of chemicals that would be protective of the majority of bottom dwelling species that reside on or in the sediment and sediment pore water. The guidelines establish two concentration levels: the TEC, below which no or minimal effects are predicted and the PEC above which adverse effects are highly probable (WDNR, 2003).

The limited available data for metals in the Estabrook Impoundment sediments indicated that the combined concentrations of cadmium, chromium, copper, lead, nickel and zinc in Zone 2 were high enough that adverse toxic effects on sediment dwelling species are probable. The concentrations of chromium and lead exceeded the PEC for the individual metals.

The total PAH concentration, adjusted to 1% TOC, exceeded the PEC level for only one surface sediment sample and did not exceed the PEC level in any subsurface samples. These results suggest that the concentrations of PAHs in the sediments are below the levels where adverse effects on sediment dwelling species are probable.

The data from both the 2003 sampling event (WDNR, 2005) and the 2008 START sampling event show that the total PCB concentrations in the biologically active zone exceeded the PEC in more than 50% of the samples analyzed. This suggests that adverse effect on sediment dwelling organisms due to elevated total PCB concentrations are probable in much of the surface sediment in the Site area. When combined with reasonable estimates of concentrations of metals and PAHs, the overall mean PEC-Q values show an estimated average incidence of toxicity that exceeds 95% for 28% of the samples from the 2008 START sampling event. Therefore, the probability of adverse effects to sediment dwelling species is high over large portions of the West Oxbow in Zone 2.

7.2 Conclusions

7.2.1 Data Limitations

The Estabrook Dam influences the flow conditions in the study area. The opening and closing of the dam greatly influences the transport of contaminated sediments in the study area. The sediment survey data collected during this RI is subject to these influences in the study area.

7.2.2 Recommended Remedial Action Objectives

Based on the scope of work assigned under this RI, no formal risk assessment was conducted for the Site and hence, no remedial action objectives (RAOs) were developed.

8.0 REFERENCES

Baird and Associates. 1997. Milwaukee River PCB Mass Balance Project WI DNR. September 4, 1997

Clarke, D.G., M.R. Palermo, and T.C. Sturgis. 2001. Subaqueous cap design: Selection of bioturbation profiles, depths, and rates. DOER Technical Notes Collection. ERDC TN-DOER-C21. U.S. Army Engineers Research and Development Center, Vicksburg, MS.

Ingersoll, C.G., P.S. Haverland, E.L. Brunson, T.J. Canfield, F.J. Dwyer, C.E. Henke, N.E. Kemble, and D.R. Mount. 1996a. Calculation and evaluation of sediment effect concentrations for the amphipod *Hyalella azteca* and the midge *Chironomus riparius*. Assessment and Remediation of contaminated Sediments (ARCS) Program U.S. EPA Great Lakes National Program Office. Region 5. EPA 905-R96-008.

Ingersoll, C.G., P.S. Haverland, E.L. Brunson, T.J. Canfield, F.J. Dwyer, C.E. Henke, N.E. Kemble, D.R. Mount, and R.G. Fox. 1996b. Calculation and evaluation of sediment effect concentrations for the amphipod *Hyalella azteca* and the midge *Chironomus riparius*. J. Great Lakes Res. 22(3)602-623.

Long, E.R. and L.G. Morgan. 1991. The potential for biological effects of sediment-sorbed contaminants tested in the National Status and Trends Program. NOAA Technical Memorandum NOS OMA 52. National Oceanic and Atmospheric Administration. Seattle, Washington.

MacDonald, D.D., C.G. Ingersoll, and T.A. Berger. 2000a. Development and evaluation of consensus-based sediment quality guidelines for freshwater ecosystems. Arch. Environ. Contam. Toxicol. 39:20-31.

MacDonald, D.D., L.M. Dipinto, J. Field, C.G. Ingersoll, and E.R. Long. 2000b. Development and evaluation of consensus-based sediment effect concentrations for polychlorinated biphenyls. Environ. Toxicol. Chem. 19:1403-1413.

Natural Resource Technology. "Remedial Investigation/Feasibility Study Lincoln Park/Blatz Pavilion Site." March 29, 2007.

Persaud, D.R., R. Jaagumagi, and A. Hayton. 1993. Guidelines for the protection and management of aquatic sediments in Ontario. Standards Development Branch. Ontario Ministry of Environment and Energy Toronto, Canada.

Schneider, Allan F., 1983, Wisconsinan stratigraphy and glacial sequence in Southeastern Wisconsin, *Geoscience Wisconsin*, Volume 7, July 1983, pp. 59-85.

Schneider, Morgan A., Michelle A. Lutz, and Others, 2003, *Water-Resources-Related Information for the Milwaukee Metropolitan Sewerage District Planning Area, Wisconsin, 1970-2002*, United States Geological Survey in cooperation with the Milwaukee Metropolitan Sewerage District, Water-Resources Investigations Report 03-4240, 288 pp.

Steuer, Jeffery S., Sharon A. Fitzgerald, and David W. Hall, 1999. Distribution and Transport of Polychlorinated Biphenlys and Associated Particulates in the Milwaukee River System, Wisconsin, 1993-95. U. S. Geological Survey Water Resources Investigation Report 99-4100.

STN Environmental JV. Final Field Sampling Plan for the Focused Remedial Investigation and Study, Lincoln Creek/Milwaukee River Channel Sediments, Milwaukee, Wisconsin. February 22, 2008

Southeastern Wisconsin Regional Planning Commission (SEWRPC), 2002, *Groundwater Resources of Southeastern Wisconsin*, Technical Report No. 37, June 2002, 203 pp.

Swartz, R.C. 1999. Consensus sediment quality guidelines for polycyclic aromatic hydrocarbon mixtures. Environ. Toxicol. Chem. 18:780-787.

United States Environmental Protection Agency. Office of Solid Waste and Emergency Response. "Contaminated Sediment Remediation Guidance for Hazardous Waste Sites." December 2005.

United States Environmental Protection Agency. Office of Water. "Selecting Remediation Techniques For Contaminated Sediment." June 1993.

United States Environmental Protection Agency. "Guidance on Remedial Actions for Superfund Sites with PCB Contamination." August 1990.

United States Environmental Protection Agency. "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final." October 1988.

Wisconsin Department of Natural Resources (WDNR). 2001. Quality Assurance Project Plan Estabrook Impoundment Remediation Pre-Design Study, Revision 2 September, 2001. Great Lakes National Program Office Grant Agreement number GL2000-082 Prepared by Steve Westenbroek, Southeast Region Wisconsin Department of Natural Resources.

WDNR. 2003. Consensus-Based Sediment Quality Guidelines. Recommendations for Use & Application. Interim Guidance. WT-732-2003.

WDNR. 2005. Estabrook Impoundment Sediment Remediation Pre-Design Study Project Completion Report to USEPA GLNPO Grant ID GL2000-082. PUBL-WT 826.

TABLE 1

TOTAL ORGANIC CARBON AND BULK PROPERTY SAMPLING RESULTS

FEBRUARY 27 - 29, 2008

LINCOLN PARK/MILWAUKEE RIVER CHANNEL SEDIMENTS

FOCUSED REMEDIAL INVESTIGATION

MILWAUKEE, WISCONSIN

SAMPLE ID	TOC Result (weight %)	Specific Gravity	Moisture Content (weight %)	Atterberg Limits		
				Liquid Limit	Plastic Limit	Plasticity Index
LPMR-S-1-0-0.5	1.9	NA	NA	NA	NA	NA
LPMR-S-1-0.5-2	0.52	2.67	27.7	Non plastic		
LPMR-S-2-0-0.5	8.3	NA	NA	NA	NA	NA
LPMR-S-2-2.5-7	0.7	NA	NA	NA	NA	NA
LPMR-S-3-0-0.5	9.8	NA	NA	NA	NA	NA
LPMR-S-3-0.5-2	6.4	NA	NA	NA	NA	NA
LPMR-S-3-4-6	1.8	NA	NA	NA	NA	NA
LPMR-S-4-0-0.5	7.3	NA	NA	NA	NA	NA
LPMR-S-4-4.5-5.5X	6.8	NA	NA	NA	NA	NA
LPMR-S-4-4.5-5.5	7.3	NA	NA	NA	NA	NA
LPMR-S-4-7.5-9	1.5	NA	NA	NA	NA	NA
LPMR-S-5-0-0.5	4.2	NA	NA	NA	NA	NA
LPMR-S-5-1-2.5	9.96	2.41	62.7	39	28	11
LPMR-S-5-8-9	0.5	NA	NA	NA	NA	NA
LPMR-S-6-0-0.5	10.9	NA	NA	NA	NA	NA
LPMR-S-6-1-2	10	NA	NA	NA	NA	NA
LPMR-S-6-4-6	0.7	NA	NA	NA	NA	NA
LPMR-S-6-4-6X	0.9	NA	NA	NA	NA	NA
LPMR-S-7-0-0.5	9.7	NA	NA	NA	NA	NA
LPMR-S-7-1-3	4.3	NA	NA	NA	NA	NA
LPMR-S-7-1-3X	4.1	NA	NA	NA	NA	NA
LPMR-S-8-0-0.5	5.6	NA	NA	NA	NA	NA
LPMR-S-8-0.5-2.5	5.48	2.52	55.7	35	29	6
LPMR-S-8-4-7	0.6	NA	NA	NA	NA	NA
LPMR-S-9-0-0.5	4.5	NA	NA	NA	NA	NA
LPMR-S-9-0.5-2.5	4.2	NA	NA	NA	NA	NA
LPMR-S-9-3-8	1.2	2.7	27.1	Non plastic		
LPMR-S-9-3-8X	0.7	NA	NA	NA	NA	NA
LPMR-S-10-0-0.5	7.6	NA	NA	NA	NA	NA
LPMR-S-10-5-7	3.3	NA	NA	NA	NA	NA
LPMR-S-11-0-0.5	8	NA	NA	NA	NA	NA
LPMR-S-11-0.5-1.5	3.6	NA	NA	NA	NA	NA
LPMR-S-11-1.5-4	2.9	NA	NA	NA	NA	NA
LPMR-S-12-0-0.5	4.1	NA	NA	NA	NA	NA
LPMR-S-12-0.5-1.5	2.5	NA	NA	NA	NA	NA
LPMR-S-13-0-0.5	4.9	NA	NA	NA	NA	NA
LPMR-S-13-0.5-1.5	6.7	NA	NA	NA	NA	NA

Work conducted under START TDD S05-0801-002

Analytical conducted under STAT Analytical Corporation, Chicago, IL

TABLE 2
POLYCHLORINATED BIPHENYLS SAMPLING RESULTS
LINCOLN PARK/MILWAUKEE RIVER CHANNEL SEDIMENTS
FOCUSED REMEDIAL INVESTIGATION
MILWAUKEE, WISCONSIN

Sample ID	Sampling Date	GPS Location[(1)] NORTHING	GPS Location[(1)] EASTING	Ortho ht (ft)	Depth (ft)	Total Aroclors (mg/kg)	Location
LPMR-S-1-0-0.5	2/27-29/2008	968504.364	2259441.538	613.66007	0 - 0.5	0.292	Zone 2
LPMR-S-1-0.5-2	2/27-29/2008	968504.364	2259441.538	613.66007	0.5 - 2.0	U	Zone 2
LPMR-S-2-0-0.5	2/27-29/2008	968389.8113	2259242.542	614.23296	0 - 0.5	143.9	Zone 2
LPMR-S-2-2.5-7	2/27-29/2008	968389.8113	2259242.542	614.23296	5.0 -7.0	0.56J	Zone 2
LPMR-S-3-0-0.5	2/27-29/2008	968342.8434	2259335.377	614.18893	0 - 0.5	2.9J	Zone 2
LPMR-S-3-0.5-2	2/27-29/2008	968342.8434	2259335.377	614.18893	0.5 - 2.0	30.5J	Zone 2
LPMR-S-3-4-6	2/27-29/2008	968342.8434	2259335.377	614.18893	4.0 -6.0	3.29J	Zone 2
LPMR-S-4-0-0.5	2/27-29/2008	968021.8949	2259213.728	615.90897	0 - 0.5	1.74J	Zone 2
LPMR-S-4-4.5-5.5	2/27-29/2008	968021.8949	2259213.728	615.90897	5.0 - 5.5	87.5J	Zone 2
LPMR-S-4-4.5-5.5X	2/27-29/2008	968021.8949	2259213.728	615.90897	5.0 - 5.5	202J	Zone 2
LPMR-S-4-7.5-9	2/27-29/2008	968021.8949	2259213.728	615.90897	5.0 - 9.0	0.038J	Zone 2
LPMR-S-5-0-0.5	2/27-29/2008	967988.6157	2258957	614.69959	0 - 0.5	4.15J	Zone 2
LPMR-S-5-1-2.5	2/27-29/2008	967988.6157	2258957	614.69959	1.0 - 2.5	135J	Zone 2
LPMR-S-5-8-9	2/27-29/2008	967988.6157	2258957	614.69959	8.0 - 9.0	0.113J	Zone 2
LPMR-S-6-0-0.5	2/27-29/2008	967887.1198	2258955.67	615.96934	0 - 0.5	8.8J	Zone 2
LPMR-S-6-1-2	2/27-29/2008	967887.1198	2258955.67	615.96934	1.0 - 2.0	823J	Zone 2
LPMR-S-6-4-6	2/27-29/2008	967887.1198	2258955.67	615.96934	4.0 - 6.0	1.19J	Zone 2
LPMR-S-6-4-6X	2/27-29/2008	967887.1198	2258955.67	615.96934	4.0 - 6.0	1.47J	Zone 2
LPMR-S-7-0-0.5	2/27-29/2008	967475.4513	2258577.911	615.13081	0 - 0.5	4.4J	Zone 2
LPMR-S-7-1-3	2/27-29/2008	967475.4513	2258577.911	615.13081	1.0 - 3.0	6.8J	Zone 2
LPMR-S-7-1-3X	2/27-29/2008	967475.4513	2258577.911	615.13081	1.0 - 3.0	6.2J	Zone 2
LPMR-S-8-0-0.5	2/27-29/2008	967195.6656	2258551.306	614.89216	0 - 0.5	22.2J	Zone 2
LPMR-S-8-0.5-2.5	2/27-29/2008	967195.6656	2258551.306	614.89216	0.5 - 2.5	38.6J	Zone 2
LPMR-S-8-4-7	2/27-29/2008	967195.6656	2258551.306	614.89216	4.0 - 7.0	1.17J	Zone 2
LPMR-S-9-0-0.5	2/27-29/2008	967140.6726	2258681.922	615.27393	0 - 0.5	6.1J	Zone 2
LPMR-S-9-0.5-1.5	2/27-29/2008	967140.6726	2258681.922	615.27393	0.5 - 1.5	8J	Zone 2
LPMR-S-9-3-8	2/27-29/2008	967140.6726	2258681.922	615.27393	3.0 - 8.0	0.31J	Zone 2
LPMR-S-9-3-8X	2/27-29/2008	967140.6726	2258681.922	615.27393	3.0 - 8.0	0.14J	Zone 2
LPMR-S-10-0-0.5	2/27-29/2008	966995.4285	2259336.634	615.80769	0 - 0.5	1.12J	Zone 2
LPMR-S-10-5-7	2/27-29/2008	966995.4285	2259336.634	615.80769	5.0 - 7.0	1.83J	Zone 2
LPMR-S-11-0-0.5	2/27-29/2008	966952.0046	2259484.517	615.91959	0 - 0.5	29.6J	Zone 2
LPMR-S-11-0.5-1.5	2/27-29/2008	966952.0046	2259484.517	615.91959	0.5 - 1.5	19J	Zone 2
LPMR-S-11-1.5-4	2/27-29/2008	966952.0046	2259484.517	615.91959	1.5 - 4	3.39J	Zone 2
LPMR-S-12-0-0.5	2/27-29/2008	966730.5273	2259549.599	614.19703	0 - 0.5	2.42J	Zone 2
LPMR-S-12-0.5-1.5	2/27-29/2008	966730.5273	2259549.599	614.19703	0.5 - 1.5	1.53J	Zone 2
LPMR-S-13-0-0.5	2/27-29/2008	966653.2221	2259606.282	613.95042	0 - 0.5	4.13J	Zone 2
LPMR-S-13-0.5-1.5	2/27-29/2008	966653.2221	2259606.282	613.95042	0.5 - 1.5	9.2J	Zone 2
LC-B-1-N	3/2-6/2009	969453.6	2258101.2	613.7	0- 1.0	5.4	Zone 1
LC-B-2	3/2-6/2009	969440.5	2258122.5	613.7	0- 0.5	0.97	Zone 1
LC-B-2-S	3/2-6/2009	969427.5	2258143.9	613.7	0- 1.0	0.91	Zone 1
LC-C-2	3/2-6/2009	969159.5	2258281.6	613.612	0- 1.0	1.3	Zone 1
LC-D-2	3/2-6/2009	968859.8	2258318.5	613.137	0- 0.3	0.82	Zone 1
LC-E-2	3/2-6/2009	968539.1	2258635	612.96	0- 0.6	0.272J	Zone 1
LC-F-2	3/2-6/2009	968231.8	2258431	613	0- 1.0	1.2	Zone 1
WO-AA-2	3/2-6/2009	968445.948	2259638.412	613.464	0- 1.0	7	Zone 2

TABLE 2
POLYCHLORINATED BIPHENYLS SAMPLING RESULTS
LINCOLN PARK/MILWAUKEE RIVER CHANNEL SEDIMENTS
FOCUSED REMEDIAL INVESTIGATION
MILWAUKEE, WISCONSIN

Sample ID	Sampling Date	GPS Location[(1)] NORTHING	GPS Location[(1)] EASTING	Ortho ht (ft)	Depth (ft)	Total Aroclors (mg/kg)	Location
WO-C-2-top	3/2-6/2009	968302.96	2259239.02	613.366	0- 0.5	2.2	Zone 2
WO-F-1-top half	3/2-6/2009	968003.57	2258900.31	613.114	0- 0.5	0.91	Zone 2
WO-F-1 middle	3/2-6/2009	968003.57	2258900.31	613.114	0.5 - 1.5	U	Zone 2
WO-F-1-bottom half	3/2-6/2009	968003.57	2258900.31	613.114	1.5 - 2.0	U	Zone 2
WO-I-2-top half	3/2-6/2009	967665.159	2258542.522	613.503	0 -1.5	120	Zone 2
WO-I-2-bottom half	3/2-6/2009	967665.159	2258542.522	613.503	1.5 - 3.0	15	Zone 2
WO-O-2- top half	3/2-6/2009	966982.6	2259106.4	612.351	0- 0.5	1.2	Zone 2
WO-O-2- bottom half	3/2-6/2009	966982.6	2259106.4	612.351	0.5- 1.5	0.98	Zone 2
WO-R-2-top half	3/2-6/2009	966822.92	2259516.24	611.847	0- 0.5	3.1	Zone 2
WO-R-2-top half-dup	3/2-6/2009	966822.92	2259516.24	611.847	0- 0.5	3.2	Zone 2
WO-R-2-bottom	3/2-6/2009	966822.92	2259516.24	611.847	0.5- 2.0	1.9	Zone 2
WO-R-2-bottom-dup	3/2-6/2009	966822.92	2259516.24	611.847	0.5- 2.0	3	Zone 2
WO-K-3-top	3/2-6/2009	967221.361	2258475.202	614.026	0 - 2.0	0.75	Zone 2
WO-H-3-top	3/2-6/2009	967759.22	2258664.93	612.888	0 - 2.0	0.086	Zone 2
BP-01	3/2-6/2009	965869.593	2259631.599	614.35	0- 0.5	0.023J	Zone 3
BP-02	3/2-6/2009	965661.304	2259620.187	615.474	0- 0.5	U	Zone 3
MRZZ-01-0-0_5	3/2-6/2009	965141.565	2263515.329	611.945	0- 0.5	41	Zone 5

Work conducted under START TDD: S05-0801-002
Analytical conducted under CLP by Liberty Analytical Corp. Cary, NC
Key

[1] - The coordinates are Milwaukee County Coordinates as defined by the WI DoT and determined by GPS observation. The two elevations are ortho heights defined from Geoid03 and a translation to NGVD1929. These samples were collected during February 2008.
"X" marking on the sample identification means duplicate sample
U - Below the detection limit
shaded means exceeds TSCA limit of 50 mg/Kg

TABLE 3
SEDIMENT THICKNESS SURVEY RESULTS
LINCOLN PARK/MILWAUKEE RIVER CHANNEL SEDIMENTS
FOCUSED REMEDIAL INVESTIGATION
MILWAUKEE,WISCONSIN

Sample ID	Date Sampled	GPS Information[1] Easting	GPS Information[1] Northing	Ortho Ht (Ft)	Location	Sediment Thickness (ft)	Target
S-1	2/27-29/2008	968504.364	2259441.538	613.66007	Zone 2	8.0	Prod/Chem
S-2	2/27-29/2008	968389.8113	2259242.542	614.23296	Zone 2	9.0	Prod/Chem
S-3	2/27-29/2008	968342.8434	2259335.377	614.18893	Zone 2	6.5	Prod/Chem
S-4	2/27-29/2008	968021.8949	2259213.728	615.90897	Zone 2	9.5	Prod/Chem
S-5	2/27-29/2008	967988.6157	2258957	614.69959	Zone 2	9.0	Prod/Chem
S-6	2/27-29/2008	967887.1198	2258955.67	615.96934	Zone 2	6.0	Prod/Chem
S-7	2/27-29/2008	967475.4513	2258577.911	615.13081	Zone 2	7.0	Prod/Chem
S-8	2/27-29/2008	967195.6656	2258551.306	614.89216	Zone 2	7.0	Prod/Chem
S-9	2/27-29/2008	967140.6726	2258681.922	615.27393	Zone 2	8.0	Prod/Chem
S-10	2/27-29/2008	966995.4285	2259336.634	615.80769	Zone 2	7.0	Prod/Chem
S-11	2/27-29/2008	966952.0046	2259484.517	615.91959	Zone 2	6.0	Prod/Chem
S-12	2/27-29/2008	966730.5273	2259549.599	614.19703	Zone 2	4.0	Prod/Chem
S-13	2/27-29/2008	966653.2221	2259606.282	613.95042	Zone 2	3.0	Prod/Chem
ST-1	2/27-29/2008	968408.6903	2259503.349	614.19908	Zone 2	5.0	Prod
ST-2	2/27-29/2008	968365.2735	2259377.409	614.50864	Zone 2	5.5	Prod
ST-3	2/27-29/2008	968313.3496	2259434.401	615.88933	Zone 2	5.5	Prod
ST-4	2/27-29/2008	968298.2807	2259264.713	614.12551	Zone 2	5.5	Prod
ST-5	2/27-29/2008	968206.6841	2259320.949	615.2184	Zone 2	6.8	Prod
ST-6	2/27-29/2008	968191.6376	2259174.261	615.13038	Zone 2	7.9	Prod
ST-7	2/27-29/2008	968122.7483	2259102.676	615.5688	Zone 2	7.0	Prod
ST-8	2/27-29/2008	968051.004	2259029.089	614.95703	Zone 2	8.6	Prod
ST-9	2/27-29/2008	968000.0832	2259065.256	615.4729	Zone 2	8.0	Prod
ST-10	2/27-29/2008	967891.8638	2258879.371	614.75504	Zone 2	6.9	Prod
ST-11	2/27-29/2008	967838.3254	2258942.09	615.74572	Zone 2	7.9	Prod
ST-12	2/27-29/2008	967840.6162	2258742.496	613.38482	Zone 2	6.3	Prod
ST-13	2/27-29/2008	967781.7281	2258802.059	614.86037	Zone 2	6.0	Prod
ST-15	2/27-29/2008	967621.3597	2258608.85	614.79763	Zone 2	4.0	Prod
ST-16	2/27-29/2008	967528.3605	2258925.125	614.59439	Zone 2	5.0	Prod
ST-17	2/27-29/2008	967419.1151	2258744.748	615.14767	Zone 2	5.3	Prod
ST-18	2/27-29/2008	967392.0583	2259005.13	614.81639	Zone 2	6.5	Prod
ST-19	2/27-29/2008	967314.8821	2258860.086	615.19475	Zone 2	2.2	Prod
ST-20	2/27-29/2008	967293.8657	2259059.489	615.39939	Zone 2	7.0	Prod
ST-21	2/27-29/2008	967214.5874	2258919.561	615.66865	Zone 2	6.0	Prod
ST-22	2/27-29/2008	967552.4434	2258443.364	613.99637	Zone 2	5.5	Prod
ST-23	2/27-29/2008	967386.6598	2258433.808	614.6529	Zone 2	4.0	Prod
ST-25	2/27-29/2008	967277.6481	2258531.031	615.27277	Zone 2	6.5	Prod
ST-28	2/27-29/2008	967145.9535	2258734.572	615.13525	Zone 2	6.0	Prod
ST-30	2/27-29/2008	967118.7426	2258985.068	615.49687	Zone 2	3.5	Prod
ST-31	2/27-29/2008	967165.183	2259091.176	613.74391	Zone 2	7.0	Prod
ST-34	2/27-29/2008	967001.4342	2259293.202	615.65398	Zone 2	6.0	Prod
ST-36	2/27-29/2008	966968.9172	2259436.023	615.78109	Zone 2	6.4	Prod
ST-38	2/27-29/2008	966900.6054	2259553.976	615.4821	Zone 2	3.7	Prod
ST-39	2/27-29/2008	966755.7074	2259514.068	613.98781	Zone 2	3.7	Prod
ST-40	2/27-29/2008	966683.4487	2259587.068	613.96093	Zone 2	7.0	Prod
TP-1	2/27-29/2008	968390.0891	2259418.187	614.19982	Zone 2	5.8	Prod
TP-2	2/27-29/2008	968054.944	2259148.442	615.84789	Zone 2	6.5	Prod
TP-3	2/27-29/2008	967386.2109	2258409.587	614.56157	Zone 2	7.0	Prod

TABLE 3
SEDIMENT THICKNESS SURVEY RESULTS
LINCOLN PARK/MILWAUKEE RIVER CHANNEL SEDIMENTS
FOCUSED REMEDIAL INVESTIGATION
MILWAUKEE,WISCONSIN

Sample ID	Date Sampled	GPS Information[1] Easting	GPS Information[1] Northing	Ortho Ht (Ft)	Location	Sediment Thickness (ft)	Target
TP-4	2/27-29/2008	967202.34	2258818.084	615.38142	Zone 2	6.5	Prod
LC-A-1	3/2-6/2009	969525.11	2257847.501	613.478	Zone 1	1.8	Prod
LC-A-2	3/3-6/2009	969561.2	2257849	613.5	Zone 1	0.7	Prod/Chem
LC-A-3	3/3-6/2010	969597.3	2257850	613.5	Zone 1	0.0	Prod
LC-B-1	3/3-6/2011	969408.338	2258102.9	613.666	Zone 1	1.6	Prod
LC-B-1-N	3/3-6/2012	969453.6	2258101.2	613.7	Zone 1	1.6	Prod/Chem
LC-B-2	3/3-6/2013	969440.5	2258122.5	613.7	Zone 1	1.3	Prod/Chem
LC-B-2-S	3/3-6/2014	969427.5	2258143.9	613.7	Zone 1	1.3	Prod/Chem
LC-B-3	3/3-6/2015	969472.792	2258142.255	613.7	Zone 1	0.0	Prod
LC-C-1	3/3-6/2016	969152.162	2258252.644	613.612	Zone 1	2.9	Prod
LC-C-2	3/3-6/2017	969159.5	2258281.6	613.612	Zone 1	1.5	Prod/Chem
LC-C-3	3/3-6/2018	969166.9	2258310.6	613.612	Zone 1	NA	Prod
LC-D-1	3/3-6/2019	968851.856	2258281.097	613.137	Zone 1	1.6	Prod
LC-D-2	3/3-6/2020	968859.8	2258318.5	613.137	Zone 1	4.6	Prod/Chem
LC-D-3	3/3-6/2021	968867.7	2258355.6	613.137	Zone 1	2.0	Prod
LC-D-4	3/3-6/2022	968875.585	2258392.814	613.137	Zone 1	1.7	Prod
LC-E-1	3/3-6/2023	968536.427	2258332.771	612.967	Zone 1	1.7	Prod
LC-E-2	3/3-6/2024	968539.1	2258635	612.96	Zone 1	0.2	Prod/Chem
LC-E-3	3/3-6/2025	968541.8	2258397.7	612.95	Zone 1	0.7	Prod
LC-E-4	3/3-6/2026	968544.492	2258429.067	612.944	Zone 1	2.0	Prod
LC-F-1	3/3-6/2027	968222.424	2258397.377	619.692	Zone 1	0.0	Prod
LC-F-2	3/3-6/2028	968231.8	2258431	613	Zone 1	0.2	Prod/Chem
LC-F-3	3/3-6/2029	968241.2	2258464.7	613	Zone 1	1.7	Prod
LC-F-4	3/3-6/2030	968250.63	2258498.323	612.997	Zone 1	1.8	Prod
LC-G-1	3/3-6/2031	967973.601	2258516.926	613.048	Zone 1	0.2	Prod
LC-G-2	3/3-6/2032	967989.7	2258545.6	613.25	Zone 1	0.3	Prod
LC-G-3	3/3-6/2033	968005.8	2258574.4	613.4	Zone 1	0.9	Prod
LC-G-4	3/3-6/2034	968021.936	2258603.084	613.542	Zone 1	3.6	Prod
WO-AA-1	3/3-6/2035	968464.78	2259644.583	613.202	Zone 2	0.9	Prod
WO-AA-2	3/3-6/2036	968445.948	2259638.412	613.464	Zone 2	5.2	Prod/Chem
WO-AA-3	3/3-6/2037	968427.787	2259632.731	613.605	Zone 2	3.3	Prod
WO-AA-4	3/3-6/2038	968410.773	2259627.907	614.54	Zone 2	3.5	Prod
WO-A-00	3/3-6/2039	968491.993	2259506.659	613.3	Zone 2	0.8	Prod
WO-A-1	3/3-6/2040	968470.793	2259510.87	613.3	Zone 2	2.3	Prod
WO-A-2	3/3-6/2041	968449.593	2259515.079	613.293	Zone 2	0.6	Prod
WO-A-3	3/3-6/2042	968428.393	2259519.293	613.743	Zone 2	2.4	Prod
WO-A-4	3/3-6/2043	968408.217	2259525.151	614.299	Zone 2	4.8	Prod
WO-A-5	3/3-6/2044	968387.177	2259528.273	615.108	Zone 2	2.3	Prod
WO-B-1	3/3-6/2045	968418.9	2259336.95	613.47	Zone 2	1.8	Prod
WO-B-2	3/3-6/2046	968403.79	2259349.92	613.47	Zone 2	2.1	Prod
WO-B-3	3/3-6/2047	968388.626	2259362.895	613.469	Zone 2	3.3	Prod
WO-B-4	3/3-6/2048	968373.466	2259375.867	614.24	Zone 2	4.9	Prod
WO-B-5	3/3-6/2049	968358.477	2259388.954	614.509	Zone 2	3.3	Prod
WO-B-6	3/3-6/2050	968343.299	2259402.118	614.895	Zone 2	4.6	Prod
WO-B-7	3/3-6/2051	968328.433	2259415.395	615.219	Zone 2	3.0	Prod
WO-C-00	3/3-6/2052	968332.42	2259211.98	613.366	Zone 2	5.0	Prod
WO-C-1	3/3-6/2053	968317.69	2259225.5	613.366	Zone 2	2.4	Prod

TABLE 3
SEDIMENT THICKNESS SURVEY RESULTS
LINCOLN PARK/MILWAUKEE RIVER CHANNEL SEDIMENTS
FOCUSED REMEDIAL INVESTIGATION
MILWAUKEE,WISCONSIN

Sample ID	Date Sampled	GPS Information[1] Easting	GPS Information[1] Northing	Ortho Ht (Ft)	Location	Sediment Thickness (ft)	Target
WO-C-2	3/3-6/2054	968302.96	2259239.02	613.366	Zone 2	2.3	Prod/Chem
WO-C-3	3/3-6/2055	968287.894	2259252.348	614.061	Zone 2	6.3	Prod
WO-C-4	3/3-6/2056	968273.498	2259266.056	614.929	Zone 2	4.2	Prod
WO-C-5	3/3-6/2057	968258.676	2259279.505	615.24	Zone 2	4.3	Prod
WO-C-6	3/3-6/2058	968244.069	2259293.181	615.076	Zone 2	5.8	Prod
WO-C-7	3/3-6/2059	968229.406	2259306.641	615.109	Zone 2	8.0	Prod
WO-C-8	3/3-6/2060	968214.572	2259320.132	615.244	Zone 2	5.8	Prod
WO-C-9	3/3-6/2061	968200.089	2259333.559	614.88	Zone 2	4.0	Prod
WO-D-1	3/3-6/2062	968317.7	2259225.5	613.366	Zone 2	2.4	Prod
WO-D-2	3/3-6/2063	968303	2259239	613.366	Zone 2	1.2	Prod
WO-D-3	3/3-6/2064	968288.2	2259252.5	613.366	Zone 2	1.0	Prod
WO-D-4	3/3-6/2065	968182.559	2259145.23	614.679	Zone 2	3.2	Prod
WO-D-5	3/3-6/2066	968169.091	2259159.907	615.247	Zone 2	3.6	Prod
WO-D-6	3/3-6/2067	968155.282	2259174.62	615.415	Zone 2	5.2	Prod
WO-D-7	3/3-6/2068	968141.763	2259188.984	615.512	Zone 2	4.1	Prod
WO-D-8	3/3-6/2069	968128.252	2259203.843	615.608	Zone 2	4.2	Prod
WO-D-9	3/3-6/2070	968114.816	2259218.708	615.597	Zone 2	5.8	Prod
WO-D-10	3/3-6/2071	968101.37	2259233.533	615.603	Zone 2	6.8	Prod
WO-D-11	3/3-6/2072	968088.013	2259248.357	615.563	Zone 2	5.3	Prod
WO-D-12	3/3-6/2073	968074.775	2259263.266	615.428	Zone 2	1.3	Prod
WO-D-13	3/3-6/2074	968061.238	2259277.94	615.154	Zone 2	2.4	Prod
WO-E-1	3/3-6/2075	968114.434	2258994.046	613.54	Zone 2	2.5	Prod
WO-E-2	3/3-6/2076	968092.899	2259018.257	612.698	Zone 2	4.8	Prod
WO-E-3	3/3-6/2077	968073.497	2259040.846	614.651	Zone 2	5.8	Prod
WO-E-4	3/3-6/2078	968060.779	2259056.474	615.314	Zone 2	4.4	Prod
WO-E-5	3/3-6/2079	968048.061	2259071.949	615.557	Zone 2	3.9	Prod
WO-E-6	3/3-6/2080	968035.227	2259087.273	615.565	Zone 2	4.5	Prod
WO-E-7	3/3-6/2081	968022.259	2259102.404	615.627	Zone 2	2.9	Prod
WO-E-8	3/3-6/2082	968009.484	2259117.858	615.768	Zone 2	3.4	Prod
WO-E-9	3/3-6/2083	967996.75	2259133.15	615.774	Zone 2	7.2	Prod
WO-E-10	3/3-6/2084	967983.844	2259148.405	615.731	Zone 2	7.4	Prod
WO-E-11	3/3-6/2085	967970.991	2259163.821	616.103	Zone 2	6.0	Prod
WO-E-12	3/3-6/2086	967958.018	2259179.011	615.787	Zone 2	5.6	Prod
WO-E-13	3/3-6/2087	967945.298	2259194.318	615.75	Zone 2	4.8	Prod
WO-E-14	3/3-6/2088	967932.098	2259209.647	615.758	Zone 2	1.1	Prod
WO-E-15	3/3-6/2089	967919.721	2259224.71	615.72	Zone 2	2.0	Prod
WO-F-1	3/3-6/2090	968003.57	2258900.31	613.114	Zone 2	4.2	Prod/Chem
WO-F-2	3/3-6/2091	967990.38	2258913.21	613.114	Zone 2	5.2	Prod
WO-F-3	3/3-6/2092	967977.199	2258926.103	613.114	Zone 2	6.8	Prod
WO-F-4	3/3-6/2093	967964.016	2258938.997	614.793	Zone 2	7.7	Prod
WO-F-5	3/3-6/2094	967949.241	2258953.974	615.227	Zone 2	3.4	Prod
WO-F-6	3/3-6/2095	967934.683	2258968.069	615.653	Zone 2	3.8	Prod
WO-F-7	3/3-6/2096	967920.45	2258981.987	615.854	Zone 2	6.9	Prod
WO-F-8	3/3-6/2097	967906.025	2258996.073	615.236	Zone 2	2.9	Prod
WO-F-9	3/3-6/2098	967892.121	2259009.829	614.948	Zone 2	3.0	Prod
WO-F-10	3/3-6/2099	967877.719	2259024.219	614.945	Zone 2	3.7	Prod
WO-G-00	3/3-6/2100	967892.14	2258793.61	613.01	Zone 2	2.9	Prod

TABLE 3
SEDIMENT THICKNESS SURVEY RESULTS
LINCOLN PARK/MILWAUKEE RIVER CHANNEL SEDIMENTS
FOCUSED REMEDIAL INVESTIGATION
MILWAUKEE,WISCONSIN

Sample ID	Date Sampled	GPS Information[1] Easting	GPS Information[1] Northing	Ortho Ht (Ft)	Location	Sediment Thickness (ft)	Target
WO-G-1	3/3-6/2101	967878.9	2258823.69	613.01	Zone 2	1.5	Prod
WO-G-2	3/3-6/2102	967852.43	2258838.74	613.01	Zone 2	4.4	Prod
WO-G-3	3/3-6/2103	967852.358	2258838.934	613.983	Zone 2	3.9	Prod
WO-G-4	3/3-6/2104	967839.19	2258853.779	615.133	Zone 2	6.4	Prod
WO-G-5	3/3-6/2105	967825.888	2258868.881	615.535	Zone 2	5.7	Prod
WO-G-6	3/3-6/2106	967812.906	2258884.071	615.942	Zone 2	4.1	Prod
WO-G-7	3/3-6/2107	967800.159	2258899.439	615.991	Zone 2	3.3	Prod
WO-G-8	3/3-6/2108	967786.243	2258913.951	616.324	Zone 2	3.5	Prod
WO-G-9	3/3-6/2109	967773.594	2258928.871	615.475	Zone 2	3.8	Prod
WO-G-10	3/3-6/2110	967761.181	2258943.705	614.873	Zone 2	2.7	Prod
WO-H-1	3/3-6/2111	967771.17	2258626.42	612.888	Zone 2	1.3	Prod
WO-H-2	3/3-6/2112	967765.19	2258645.68	612.888	Zone 2	0.9	Prod
WO-H-3	3/3-6/2113	967759.22	2258664.93	612.888	Zone 2	1.1	Prod/Chem
WO-H-4	3/3-6/2114	967753.241	2258684.188	612.888	Zone 2	0.8	Prod
WO-H-5	3/3-6/2115	967747.635	2258704.053	612.951	Zone 2	0.8	Prod
WO-H-6	3/3-6/2116	967741.33	2258723.095	612.841	Zone 2	2.1	Prod
WO-H-7	3/3-6/2117	967735.315	2258741.952	613.033	Zone 2	1.1	Prod
WO-H-8	3/3-6/2118	967729.137	2258761.185	612.917	Zone 2	3.9	Prod
WO-H-9	3/3-6/2119	967722.86	2258779.994	613.61	Zone 2	4.0	Prod
WO-H-10	3/3-6/2120	967716.418	2258799.142	613.819	Zone 2	2.3	Prod
WO-H-11	3/3-6/2121	967711.126	2258818.179	613.556	Zone 2	1.3	Prod
WO-H-12	3/3-6/2122	967705.386	2258837.331	614.924	Zone 2	1.3	Prod
WO-H-13	3/3-6/2123	967699.606	2258856.28	616.868	Zone 2	1.6	Prod
WO-H-14	3/3-6/2124	967694.023	2258875.385	617.372	Zone 2	2.3	Prod
WO-I-1	3/3-6/2125	967682.26	2258532	613.5	Zone 2	4.7	Prod
WO-I-2	3/3-6/2126	967665.159	2258542.522	613.503	Zone 2	5.3	Prod/Chem
WO-I-3	3/3-6/2127	967648.063	2258553.045	614.314	Zone 2	5.3	Prod
WO-I-4	3/3-6/2128	967631.152	2258563.756	614.445	Zone 2	5.3	Prod
WO-I-5	3/3-6/2129	967614.464	2258574.617	614.523	Zone 2	5.5	Prod
WO-I-6	3/3-6/2130	967597.745	2258585.63	614.619	Zone 2	6.0	Prod
WO-I-7	3/3-6/2131	967581.101	2258596.768	614.69	Zone 2	5.1	Prod
WO-I-8	3/3-6/2132	967564.364	2258607.696	614.803	Zone 2	4.9	Prod
WO-I-9	3/3-6/2133	967547.859	2258618.771	614.977	Zone 2	4.8	Prod
WO-I-10	3/3-6/2134	967531.041	2258629.932	614.946	Zone 2	5.4	Prod
WO-I-11	3/3-6/2135	967514.421	2258640.978	615.095	Zone 2	5.6	Prod
WO-I-12	3/3-6/2136	967497.841	2258651.843	615.089	Zone 2	2.5	Prod
WO-I-13	3/3-6/2137	967481.158	2258663.121	615.01	Zone 2	1.5	Prod
WO-I-14	3/3-6/2138	967464.704	2258674.6	615.342	Zone 2	4.3	Prod
WO-I-15	3/3-6/2139	967473.253	2258692.394	615.078	Zone 2	4.3	Prod
WO-I-16	3/3-6/2140	967482.306	2258710.276	614.856	Zone 2	2.3	Prod
WO-I-17	3/3-6/2141	967491.438	2258728.661	613.101	Zone 2	0.4	Prod
WO-I-18	3/3-6/2142	967499.7	2258746.61	612.92	Zone 2	1.2	Prod
WO-I-19	3/3-6/2143	967508.39	2258764.77	612.92	Zone 2	3.3	Prod
WO-I-20	3/3-6/2144	967517.088	2258782.935	613.4	Zone 2	4.1	Prod
WO-I-21	3/3-6/2145	967525.934	2258801.146	614.191	Zone 2	2.8	Prod
WO-I-22	3/3-6/2146	967534.698	2258819.249	615.002	Zone 2	4.8	Prod
WO-I-23	3/3-6/2147	967542.934	2258837.316	615.453	Zone 2	5.3	Prod

TABLE 3
SEDIMENT THICKNESS SURVEY RESULTS
LINCOLN PARK/MILWAUKEE RIVER CHANNEL SEDIMENTS
FOCUSED REMEDIAL INVESTIGATION
MILWAUKEE,WISCONSIN

Sample ID	Date Sampled	GPS Information[1] Easting	GPS Information[1] Northing	Ortho Ht (Ft)	Location	Sediment Thickness (ft)	Target
WO-I-24	3/3-6/2148	967551.765	2258855.356	615.147	Zone 2	5.0	Prod
WO-I-25	3/3-6/2149	967560.436	2258873.284	615.156	Zone 2	5.1	Prod
WO-I-26	3/3-6/2150	967568.936	2258891.336	614.875	Zone 2	3.1	Prod
WO-I-27	3/3-6/2151	967577.607	2258909.372	614.324	Zone 2	2.8	Prod
WO-I-28	3/3-6/2152	967586.194	2258927.544	614.926	Zone 2	3.8	Prod
WO-J-1	3/3-6/2153	967417.111	2258387.38	614.417	Zone 2	5.2	Prod
WO-J-2	3/3-6/2154	967412.515	2258406.737	613.76	Zone 2	5.8	Prod
WO-J-3	3/3-6/2155	967408.002	2258426.084	613.803	Zone 2	6.0	Prod
WO-J-4	3/3-6/2156	967403.117	2258445.495	614.393	Zone 2	5.7	Prod
WO-J-5	3/3-6/2157	967398.288	2258464.711	614.747	Zone 2	4.7	Prod
WO-J-6	3/3-6/2158	967393.667	2258484.604	614.692	Zone 2	3.9	Prod
WO-J-7	3/3-6/2159	967388.783	2258503.783	614.921	Zone 2	1.8	Prod
WO-J-8	3/3-6/2160	967384.116	2258523.051	615.013	Zone 2	4.8	Prod
WO-K-1	3/3-6/2161	967198.905	2258441.788	614.87	Zone 2	9.4	Prod
WO-K-2	3/3-6/2162	967210.135	2258458.784	614.323	Zone 2	4.9	Prod
WO-K-3	3/3-6/2163	967221.361	2258475.202	614.026	Zone 2	4.9	Prod/Chem
WO-K-4	3/3-6/2164	967232.807	2258491.687	614.171	Zone 2	5.3	Prod
WO-K-5	3/3-6/2165	967243.255	2258508.906	614.447	Zone 2	5.3	Prod
WO-K-6	3/3-6/2166	967252.996	2258526.24	615.017	Zone 2	2.3	Prod
WO-K-7	3/3-6/2167	967264.19	2258545.613	612.566	Zone 2	1.9	Prod
WO-K-8	3/3-6/2168	967350.236	2258747.493	614.862	Zone 2	4.0	Prod
WO-K-9	3/3-6/2169	967360.483	2258764.546	615.024	Zone 2	4.4	Prod
WO-K-10	3/3-6/2170	967368.874	2258783.073	614.994	Zone 2	4.4	Prod
WO-K-11	3/3-6/2171	967379.228	2258799.975	615.02	Zone 2	2.9	Prod
WO-K-12	3/3-6/2172	967386.936	2258817.963	613.163	Zone 2	1.4	Prod
WO-K-13	3/3-6/2173	967396.836	2258835.43	612.591	Zone 2	1.5	Prod
WO-K-14	3/3-6/2174	967406.736	2258852.89	612.591	Zone 2	3.0	Prod
WO-K-15	3/3-6/2175	967416.631	2258870.355	612.591	Zone 2	4.1	Prod
WO-K-16	3/3-6/2176	967426.466	2258887.707	614.847	Zone 2	2.8	Prod
WO-K-17	3/3-6/2177	967436.116	2258905.153	615.093	Zone 2	3.6	Prod
WO-K-18	3/3-6/2178	967446.406	2258922.52	614.886	Zone 2	4.6	Prod
WO-K-19	3/3-6/2179	967456.314	2258940.012	614.459	Zone 2	4.0	Prod
WO-K-20	3/3-6/2180	967466.147	2258957.488	614.048	Zone 2	3.8	Prod
WO-K-21	3/3-6/2181	967475.451	2258974.918	614.943	Zone 2		Prod
WO-L-1	3/3-6/2182	967115.798	2258539.524	614.447	Zone 2	4.6	Prod
WO-L-2	3/3-6/2183	967129.546	2258553.717	614.003	Zone 2	4.4	Prod
WO-L-3	3/3-6/2184	967143.798	2258567.765	614.13	Zone 2	3.8	Prod
WO-L-4	3/3-6/2185	967158.433	2258581.151	614.386	Zone 2	1.8	Prod
WO-L-5	3/3-6/2186	967173.514	2258593.989	615.238	Zone 2	8.1	Prod
WO-M-1	3/3-6/2187	967061.614	2258728.38	614.07	Zone 2	7.0	Prod
WO-M-2	3/3-6/2188	967082.423	2258727.267	614.004	Zone 2	6.0	Prod
WO-M-3	3/3-6/2189	967102.3	2258725.633	614.412	Zone 2	3.8	Prod
WO-M-4	3/3-6/2190	967122.826	2258724.235	614.863	Zone 2	3.8	Prod
WO-M-5	3/3-6/2191	967141.734	2258722.441	615.069	Zone 2	3.0	Prod
WO-M-6	3/3-6/2192	967158.287	2258719.151	615.31	Zone 2	2.8	Prod
WO-M-7	3/3-6/2193	967204.327	2258756.761	615.062	Zone 2	3.8	Prod
WO-M-8	3/3-6/2194	967217.718	2258772.61	614.982	Zone 2	4.8	Prod

TABLE 3
SEDIMENT THICKNESS SURVEY RESULTS
LINCOLN PARK/MILWAUKEE RIVER CHANNEL SEDIMENTS
FOCUSED REMEDIAL INVESTIGATION
MILWAUKEE,WISCONSIN

Sample ID	Date Sampled	GPS Information[1] Easting	GPS Information[1] Northing	Ortho Ht (Ft)	Location	Sediment Thickness (ft)	Target
WO-M-9	3/3-6/2195	967228.688	2258789.067	614.963	Zone 2	5.1	Prod
WO-M-10	3/3-6/2196	967239.848	2258805.718	614.606	Zone 2	2.3	Prod
WO-M-11	3/3-6/2197	967251.184	2258822.061	615.301	Zone 2	5.2	Prod
WO-M-12	3/3-6/2198	967262.484	2258838.471	615.452	Zone 2	4.8	Prod
WO-M-13	3/3-6/2199	967273.606	2258855.199	615.514	Zone 2	5.0	Prod
WO-M-14	3/3-6/2200	967285.107	2258871.635	615.379	Zone 2	4.9	Prod
WO-M-15	3/3-6/2201	967296.63	2258887.91	614.85	Zone 2	1.6	Prod
WO-M-16	3/3-6/2202	967307.74	2258904.3	612.5	Zone 2	2.6	Prod
WO-M-17	3/3-6/2203	967318.85	2258920.69	612.5	Zone 2	3.1	Prod
WO-M-18	3/3-6/2204	967329.96	2258937.08	612.5	Zone 2	1.7	Prod
WO-M-19	3/3-6/2205	967340.837	2258954.094	613.99	Zone 2	2.0	Prod
WO-M-20	3/3-6/2206	967352.139	2258969.81	614.743	Zone 2	3.2	Prod
WO-M-21	3/3-6/2207	967363.521	2258986.33	614.349	Zone 2	4.4	Prod
WO-M-22	3/3-6/2208	967374.54	2259003.007	614.173	Zone 2	4.8	Prod
WO-M-23	3/3-6/2209	967385.171	2259019.957	615.024	Zone 2	3.0	Prod
WO-M-24	3/3-6/2210	967308.216	2259041.151	665.76	Zone 2	5.6	Prod
WO-N-1	3/3-6/2211	967037.748	2258865.229	614.255	Zone 2	3.0	Prod
WO-N-2	3/3-6/2212	967057.329	2258870.256	614.086	Zone 2	6.0	Prod
WO-N-3	3/3-6/2213	967076.312	2258875.374	614.77	Zone 2	6.5	Prod
WO-N-4	3/3-6/2214	967086.092	2258892.801	614.988	Zone 2	6.8	Prod
WO-N-5	3/3-6/2215	967095.902	2258910.094	615.29	Zone 2	7.0	Prod
WO-N-6	3/3-6/2216	967105.74	2258927.489	615.588	Zone 2	4.9	Prod
WO-N-7	3/3-6/2217	967115.442	2258945.016	615.794	Zone 2	4.9	Prod
WO-N-8	3/3-6/2218	967125.296	2258962.433	615.653	Zone 2	5.3	Prod
WO-N-9	3/3-6/2219	967135.775	2258979.278	615.238	Zone 2	2.9	Prod
WO-N-10	3/3-6/2220	967144.611	2258997.046	612.893	Zone 2	1.2	Prod
WO-N-11	3/3-6/2221	967154.33	2259014.44	612.428	Zone 2	4.1	Prod
WO-N-12	3/3-6/2222	967164.05	2259031.82	612.428	Zone 2	3.3	Prod
WO-N-13	3/3-6/2223	967173.76	2259049.21	612.428	Zone 2	1.1	Prod
WO-N-14	3/3-6/2224	967183.48	2259066.6	612.428	Zone 2	2.2	Prod
WO-N-15	3/3-6/2225	967195.747	2259082.654	613.741	Zone 2	1.4	Prod
WO-O-1	3/3-6/2226	966968.238	2259092.557	612.988	Zone 2	1.9	Prod
WO-O-2	3/3-6/2227	966982.6	2259106.4	612.351	Zone 2	1.8	Prod/Chem
WO-O-3	3/3-6/2228	966996.96	2259120.3	612.351	Zone 2	2.1	Prod
WO-O-4	3/3-6/2229	967011.32	2259134.2	612.351	Zone 2	0.0	Prod
WO-O-5	3/3-6/2230	967025.679	2259148.196	613.096	Zone 2	0.1	Prod
WO-P-1	3/3-6/2231	966935.16	2259246.02	612.235	Zone 2	1.8	Prod
WO-P-2	3/3-6/2232	966971.66	2259262.39	612.235	Zone 2	0.5	Prod
WO-Q-1	3/3-6/2233	966856.44	2259381.24	612.35	Zone 2	2.5	Prod
WO-Q-2	3/3-6/2234	966884.99	2259394.81	612.35	Zone 2	3.0	Prod
WO-Q-3	3/3-6/2235	966915.16	2259409.14	612.35	Zone 2	1.7	Prod
WO-R-1	3/3-6/2236	966793.29	2259495.08	611.847	Zone 2	1.7	Prod
WO-R-2	3/3-6/2237	966822.92	2259516.24	611.847	Zone 2	2.3	Prod/Chem
WO-R-3	3/3-6/2238	966859.68	2259542.49	611.847	Zone 2	1.6	Prod
WO-S-00	3/3-6/2239	966690.85	2259620.5	611.547	Zone 2	1.6	Prod
WO-S-1	3/3-6/2240	966721.16	2259638	611.547	Zone 2	1.6	Prod
WO-S-2	3/3-6/2241	966747.14	2259653	611.547	Zone 2	2.0	Prod

TABLE 3
SEDIMENT THICKNESS SURVEY RESULTS
LINCOLN PARK/MILWAUKEE RIVER CHANNEL SEDIMENTS
FOCUSED REMEDIAL INVESTIGATION
MILWAUKEE,WISCONSIN

Sample ID	Date Sampled	GPS Information[1] Easting	GPS Information[1] Northing	Ortho Ht (Ft)	Location	Sediment Thickness (ft)	Target
WO-S-3	3/3-6/2242	966761.86	2259661.5	611.547	Zone 2	2.1	Prod
WO-S-4	3/3-6/2243	966787.84	2259676.5	611.547	Zone 2	3.5	Prod
BP-1	3/3-6/2244	965869.593	2259631.599	614.35	Zone 3	0.5	Chem
BP-2	3/3-6/2245	965661.304	2259620.187	615.474	Zone 3	0.5	Chem
MR-ZZ-1	3/3-6/2246	965141.565	2263515.329	611.945	Zone 5	5	Prod/Chem
MR-ZZ-2	3/3-6/2247	965162.326	2263447.31	611.682	Zone 5	1.9	Prod
MR-ZZ-3	3/3-6/2248	965180.916	2263417.138	611.814	Zone 5	1.1	Prod
MR-ZZ-4	3/3-6/2249	965206.366	2263389.383	611.599	Zone 5	0.8	Prod
MR-ZZ-5	3/3-6/2250	965233.432	2263363.513	611.543	Zone 5	1	Prod
MR-ZZ-6	3/3-6/2251	965265.795	2263350.005	611.492	Zone 5	0.2	Prod
MR-ZZ-7	3/3-6/2252	965307.629	2263349.098	611.543	Zone 5	0	Prod
MR-ZZ-8	3/3-6/2253	965376.635	2263378.266	609.398	Zone 5	0	Prod
MR-ZZ-9	3/3-6/2254	965409.252	2263355.451	608.009	Zone 5	0	Prod
MR-ZZ-10	3/3-6/2255	965423.211	2263348.023	609.11	Zone 5	0	Prod
MR-ZZ-11	3/3-6/2256	965433.363	2263343.494	608.389	Zone 5	0	Prod

Work conducted by START under TDD: S05-0801-002

Key

Prod - depth was determined using manually using a rod.

Chem - Conducted PCBs analysis

Zone 1 - Lincoln Creek Area

Zone 2 - West Oxbow Area

Zone 3 - Blatz Pavilion Area

Zone 5 - Near dam and impoundment area

TABLE 4
GRAIN SIZE ANALYSIS SUMMARY
FEBRUARY 27-29, 2008
LINCOLN PARK/MILWAUKEE RIVER CHANNEL SEDIMENTS
FOCUSED REMEDIAL INVESTIGATION
MILWAUKEE, WISCONSIN

Sample	Boring	Depth Interval (ft)	% Gravel	% Sand	% Silt	% Clay
LPMR-S-1-0.5-2	S-1	0.5-2	0.4	97.2	2.4 (fines)	
LPMR-S-5-1-2.5	S-5	1-2.5	0	20.5	69.5	10
LPMR-S-8-0.5-2.5	S-8	0.5-2.5	0	20.2	59.8	20
LPMR-S-9-3-8	S-9	3.0 - 8.0	1.3	93.4	5.3 (fines)	

Work conducted by START under TDD: S05-0801-002

Laboratory analysis conducted under CLP by Liberty Analytical Corp. Cary, NC

Key

LPMR-S-1-0.5-2 = Lincoln Park Milwaukee River/Sample 1/at depth of 0.5 to 2 ft

TABLE 5
SEDIMENT BORING and FLATS LOCATIONS (ZONE 2)
FEBRUARY 27-29, 2008
LINCOLN PARK/MILWAUKEE RIVER CHANNEL SEDIMENTS
FOCUSED REMEDIAL INVESTIGATION
MILWAUKEE, WISCONSIN

Description of Area	Zone	Borings
North Flat: on north side of primary channel	Zone 2	S-1, S-2 (2008)
East Flat: east of primary channel and north of pier	Zone 2	ST-1, TP-1, ST-2, S-3, ST-3, ST-4, ST-5, ST-6, ST-7, TP-2, ST-8, S-4 (2008)
East Flat: east of primary channel and west of pier	Zone 2	ST-9, S-5, ST-10, S-6, ST-11, ST-13 (2008); WO-F-1 (2009)
East Flat: east of primary channel and south of pier	Zone 2	ST-16, ST-18, ST-20, ST-31 (2008)
West Flat: west of secondary channel	Zone 2	ST-22 (2008)
Island Flat, east, west, and north of the island	Zone 2	ST-15, ST-17, ST-19, ST-21, TP-4, S-7, ST-23, TP-3, ST-25, S-8 (2008)
Island Flat, south and southeast of the island	Zone 2	S-9, ST-28, ST-30 (2008); WO-L-2 (2009)
Northern Southeast Flat, north of primary channel and east of bridge	Zone 2	ST-34, S-10, ST-36, S-11, ST-38 (2008)
Southern Southeast Flat, south of primary channel and east of bridge	Zone 2	ST-39, S-12, ST-40, S-13 (2008)
Primary Channel just west of bridge (Zone 2B)	Zone 2	WO-O-2 (2009)
Primary Channel between bridge and Milwaukee River (Zone 2B)	Zone 2	WO-R-2 (2009)

TABLE 6
DISPOSAL SAMPLING RESULTS
LINCOLN PARK/MILWAUKEE RIVER CHANNEL SEDIMENTS
FOCUSED REMEDIAL INVESTIGATION
MILWAUKEE, WISCONSIN

Analyte	Units	Sample IDs	
		WO-K-3	WO-H-3
Total PCBs	mg/Kg	0.75	0.086
TCLP Metals			
Arsenic	mg/L	0.01 U	0.015
Barium	mg/L	0.52	1.1
Cadmium	mg/L	0.005 U	0.0053
Chromium	mg/L	0.02 U	0.02 U
Copper	mg/L	0.05 U	0.05 U
Lead	mg/L	0.014	0.024
Mercury	mg/L	0.00025 U	0.00025 U
Nickel	mg/L	0.036	0.081
Selenium	mg/L	0.01 U	0.01 U
Silver	mg/L	0.01 U	0.01 U
Zinc	mg/L	0.51	1.1
TCLP SVOCs			
1,4-Dichlorobenzene	mg/L	0.005 U	0.005 U
2,4-Dinitrotoluene	mg/L	0.005 U	0.005 U
Hexachlorobenzene	mg/L	0.005 U	0.005 U
Hexachlorobutadiene	mg/L	0.005 U	0.005 U
Nitrobenzene	mg/L	0.005 U	0.005 U
2-Methylphenol	mg/L	0.005 U	0.005 U
3- & 4- Methylphenol	mg/L	0.005 U	0.005 U
Pentachlorophenol	mg/L	0.025 U	0.025 U
Pyridine	mg/L	0.005 U	0.005 U
2,4,5-Trichlorophenol	mg/L	0.005 U	0.005 U
2,4,6-Trichlorophenol	mg/L	0.005 U	0.005 U
TCLP VOCs			
Benzene	mg/L	0.05 U	0.05 U
2-Butanone	mg/L	0.1 U	0.1 U
Carbon Tetrachloride	mg/L	0.05 U	0.05 U
Chlorobenzene	mg/L	0.05 U	0.05 U
Chloroform	mg/L	0.05 U	0.05 U
1,2-Dichloroethane	mg/L	0.05 U	0.05 U
1,1-Dichloroethene	mg/L	0.05 U	0.05 U
Tetrachloroethene	mg/L	0.05 U	0.05 U
Trichloroethene	mg/L	0.05 U	0.05 U
Vinyl Chloride	mg/L	0.05 U	0.05 U
Specific Gravity		2.42	2.6
Reactive Cyanide	mg/kg	1 U	1 U
Reactive Sulfide	mg/Kg	10 U	10 U
Flash Point	°F	>212	>212
Paint Filter	pass/fail	PASS	PASS
pH	pH Units	7.3	7.5
Phenolics	mg/Kg	0.33	0.89

Work conducted under START TDD: S05-0801-002
Analytical conducted under STAT Analytical Corporation, Chicago, IL
Key
U - Below the detection limit

TABLE 7
PCBs AND MEAN PEC-Q VALUES
FEBRUARY 27 - 29, 2008
LINCOLN PARK/MILWAUKEE RIVER CHANNEL SEDIMENTS
FOCUSED REMEDIAL INVESTIGATION
MILWAUKEE, WISCONSIN

SAMPLE ID	TOC (%)	Aroclor 1242[1]	Aroclor 1248	Aroclor 1254	Total PCB (mg/kg)	Total PCB @ 1% TOC (ug/kg)	PEC (ug/kg)	PEC-Q: PCB	QAPP Zone	Metals PEC-Q[2]	PAH PEC-Q[3]	Overall Mean PEC-Q	Estimated Average Incidence of Toxicity
LPMR-S-1-0-0.5	1.9	0.041	**0.22**	**0.072**	0.3	175	676	0.3	na	nd	nd	na	na
LPMR-S-1-0.5-2	0.52	0.073	0.073	0.073	0.2	421	676	0.6	na	nd	nd	na	na
LPMR-S-2-0-0.5	8.3	0.11	**140**	**3.9**	144.0	17351	676	25.7	na	nd	nd	na	na
LPMR-S-3-0-0.5	9.8	0.073	**2**	**0.9**	3.0	303	676	0.4	na	nd	nd	na	na
LPMR-S-3-0.5-2	6.4	**21**	**7.8**	**1.7**	30.5	4766	676	7.0	na	nd	nd	na	na
LPMR-S-4-0-0.5	7.3	0.069	**1.2**	**0.54**	1.8	248	676	0.4	4	0.7	0.2	0.4	36
LPMR-S-5-0-0.5	4.2	0.056	**3.2**	**0.95**	4.2	1001	676	1.5	4	0.7	0.2	0.8	56
LPMR-S-5-1-2.5	9.96	**68**	**53**	**14**	135.0	13554	676	20.1	4	0.7	0.2	7.0	100
LPMR-S-6-0-0.5	10.9	0.088	**6.9**	**1.9**	8.9	815	676	1.2	4	0.7	0.2	0.7	52
LPMR-S-6-1-2	10	**560**	**220**	**43**	823.0	82300	676	121.7	4	0.7	0.2	40.9	100
LPMR-S-7-0-0.5	9.7	0.035	**3.2**	**1.2**	4.4	457	676	0.7	3	1.2	1.4	1.1	68
LPMR-S-7-1-3	4.3	0.052	**5.2**	**1.6**	6.9	1593	676	2.4	3	1.2	1.4	1.7	83
LPMR-S-8-0-0.5	5.6	**7.9**	**11**	**3.3**	22.2	3964	676	5.9	3	1.2	1.4	2.8	96
LPMR-S-8-0.5-2.5	5.48	**17**	**19**	**2.6**	38.6	7044	676	10.4	3	1.2	1.4	4.3	100
LPMR-S-9-0-0.5	4.5	0.052	**5**	**1.1**	6.2	1367	676	2.0	3	1.2	1.4	1.5	80
LPMR-S-9-0.5-1.5	4.2	0.049	**6.2**	**1.8**	8.0	1916	676	2.8	3	1.2	1.4	1.8	86
LPMR-S-10-0-0.5	7.6	0.059	**0.44**	**0.68**	1.2	155	676	0.2	2	0.4	0.4	0.3	30
LPMR-S-11-0-0.5	8	0.32	**25**	**4.6**	29.9	3740	676	5.5	2	0.4	0.4	2.1	90
LPMR-S-11-0.5-1.5	3.6	0.25	**17**	**2**	19.3	5347	676	7.9	2	0.4	0.4	2.9	96
LPMR-S-12-0-0.5	4.1	0.051	**1.9**	**0.52**	2.5	603	676	0.9	2	0.4	0.4	0.6	44
LPMR-S-12-0.5-1.5	2.5	0.045	**1.2**	**0.33**	1.6	630	676	0.9	2	0.4	0.4	0.6	45
LPMR-S-13-0-0.5	4.9	0.056	**3.4**	**0.73**	4.2	854	676	1.3	2	0.4	0.4	0.7	51
LPMR-S-13-0.5-1.5	6.7	0.092	**6.4**	**2.8**	9.3	1387	676	2.1	2	0.4	0.4	1.0	63

nd=no data
na=not applicable

[1] Bold indicates Aroclor was positively detected, other values are detection limits.

[2] Composite samples from each zone as defined in the QAPP were analyzed for metal concentrations. Therefore the metals PEC-Q value from the composite samples were used to calculate overall mean-PEC-Q values. Data from WDNR (2005).

[3] Maximum PAH PEC-Q values for samples in QAPP Zones. Data from WDNR (2005).

TABLE 8
MEAN METAL PROBABLE EFFECTS CONCENTRATION QUOTIENT (PEC-Q)
FOR ESTABROOK IMPOUNDMENT SEDIMENTS[1]
LINCOLN PARK/MILWAUKEE RIVER CHANNEL SEDIMENTS
FOCUSED REMEDIAL INVESTIGATION
MILWAUKEE, WISCONSIN

	PEC[2]	Zone 2		Zone 3		Zone 4		Zone 5	
Analyte	mg/kg[3]	mg/kg	PEC-Q	mg/kg	PEC-Q	mg/kg	PEC-Q	mg/kg	PEC-Q
Arsenic	33	na	na	nd (<5)	<0.2	nd (<5)	<0.2	na	na
Cadmium	5	1.5	0.3	3.9	0.8	1.6	0.3	1.2	0.2
Chromium	110	38.5	0.4	140	1.3	76	0.7	37.3	0.3
Copper	150	na	na	106	0.7	na	na	na	na
Lead	130	88	0.7	322	2.5	199	1.5	104	0.8
Nickel	49	20	0.4	45	0.9	23	0.5	19	0.4
Zinc	460	207	0.5	444	1.0	222	0.5	166	0.4
Mean PEC-Q			0.4		1.2		0.7		0.4

nd=not detected above laboratory method detection limit

na=not applicable

[1]Data from Wisconsin Department of Natural Resources PUBL-WT 826 (2005)

[2]PEC-Probable effects concentration

[3]mg/kg dry weight sediment

TABLE 9
SUMMARY OF PAH AND PCB DATA FOR SEDIMENT SAMPLES FROM THE WDNR
AUGUST 2003 SAMPLING EVENT
LINCOLN PARK/MILWAUKEE RIVER CHANNEL SEDIMENTS
FOCUSED REMEDIAL INVESTIGATION
MILWAUKEE, WISCONSIN

												PAH				PCB		
Field Name	QAPP Zone	Horizon	Start	End	Include in PEC-Q	Depth Units	X	Y	%TOC	Total PAH	PAH @ 1% TOC	PEC (ug/kg)	PEC-Q	Total PCB	Aroclors	PCB @ 1% TOC	PEC (ug/kg)	PEC-Q
1X1	1	A	0	1.4	Yes	FT	689829.1	294168.8	11.6	55410 ug/kg	4777	22800	0.2	6700 ug/kg	1242/1248	578	676	0.9
1X3	1	Surface	na	na	Yes	na	689308	294399.9	16.6	26320 ug/kg	1586	22800	0.1	1200 ug/kg	1242/1248	72	676	0.1
2X4	1	Surface	na	na	Yes	na	688863.7	294322.5	10	14780 ug/kg	1478	22800	0.1	530 ug/kg	1248/1254	53	676	0.1
4X8	2	A	0	0.6	Yes	FT	688742.4	294405.5	nd	nd ug/kg	nd	22800	nd	2600 ug/kg	1248/1254	nd		nd
4X8	2	B	0.6	1.2	Yes	FT	688742.4	294405.5	nd	nd ug/kg	nd	22800	nd	42000 ug/kg	1242/1248	nd		nd
4X8	2	C	1.2	1.9	Yes	FT	688742.4	294405.5	11.6	58680 ug/kg	5059	22800	0.2	700 ug/kg	1248/1254	60	676	0.1
4X8	2	D	1.9	2.6	No	FT	688742.4	294405.5	11.6	29380 ug/kg	2533	22800	0.1	270 ug/kg	PCB	23	676	0.0
4X9	2	A	0	0.6	Yes	FT	688743.2	294372.7	nd	nd ug/kg	nd	22800	nd	1500 ug/kg	1248/1254	nd		nd
4X9	2	B	0.6	1.2	Yes	FT	688743.2	294372.7	nd	nd ug/kg	nd	22800	nd	2200 ug/kg	1248/1254	nd		nd
4X9	2	C	1.2	1.8	Yes	FT	688743.2	294372.7	9.1	80480 ug/kg	8844	22800	0.4	210000 ug/kg	1242	23077	676	34.1
4X9	2	D	1.8	2.4	No	FT	688743.2	294372.7	9.1	66280 ug/kg	7284	22800	0.3	5400 ug/kg	1248	593	676	0.9
4X9	2	E	2.4	2.7	No	FT	688743.2	294372.7	9.1	25540 ug/kg	2807	22800	0.1	840 ug/kg	1242/1248	92	676	0.1
4X10	2	A	0	0.6	Yes	FT	688754.5	294340	nd	nd ug/kg	nd	22800	nd	2500 ug/kg	1248/1254	nd		nd
4X10	2	B	0.6	1.2	Yes	FT	688754.5	294340	nd	nd ug/kg	nd	22800	nd	16000 ug/kg	1242/1248	nd		nd
4X10	2	C	1.2	1.8	Yes	FT	688754.5	294340	10.2	59210 ug/kg	5805	22800	0.3	170000 ug/kg	1242/1248	16667	676	24.7
4X10	2	D	1.8	2.4	No	FT	688754.5	294340	10.2	38210 ug/kg	3746	22800	0.2	6200 ug/kg	1248/1254	608	676	0.9
4X10	2	E	2.4	3.2	No	FT	688754.5	294340	10.2	44290 ug/kg	4342	22800	0.2	1100 ug/kg	1254	108	676	0.2
3X3	3	A	0	0.6	Yes	FT	688550	29840.6	nd	nd ug/kg	nd	22800	nd	2200 ug/kg	1248/1254	nd	nd	nd
3X3	3	B	0.6	1.2	Yes	FT	688550	29840.6	nd	nd ug/kg	nd	22800	nd	4400 ug/kg	1248/1254	nd	nd	nd
3X3	3	C	1.2	1.8	Yes	FT	688550	29840.6	9.6	70500 ug/kg	7344	22800	0.3	6200 ug/kg	1248/1254	646	676	1.0
3X3	3	D	1.8	2.2	No	FT	688550	29840.6	9.6	44470 ug/kg	4632	22800	0.2	2700 ug/kg	1242/1248	281	676	0.4
3X3	3	E	2.2	2.6	No	FT	688550	29840.6	9.6	58400 ug/kg	6083	22800	0.3	430 ug/kg	1248/1254	45	676	0.1
4X2	3	A	0	0.8	Yes	FT	688383.3	294826.1	10.5	48680 ug/kg	4636	22800	0.2	9300 ug/kg	1242/1248	886	676	1.3
4X2	3	B	0.8	1.6	Yes	FT	688383.3	294826.1	nd	nd ug/kg	nd	22800	nd	150000 ug/kg	1242/1248	nd	nd	nd
4X2	3	C	1.6	1.9	Yes	FT	688383.3	294826.1	nd	61860 ug/kg	nd	22800	nd	8100 ug/kg	1248/1254	nd	nd	nd
4X2	3	D	1.9	2.2	No	FT	688383.3	294826.1	10.1	65330 ug/kg	6468	22800	0.3	1600 ug/kg	1248/1254	158	676	0.2
4X2	3	E	2.2	2.5	No	FT	688383.3	294826.1	nd	45030 ug/kg	nd	22800	nd	350 ug/kg	1248/1254	nd	nd	nd
4X2	3	F	2.5	2.8	No	FT	688383.3	294826.1	10.1	91890 ug/kg	9098	22800	0.4	620 ug/kg	1248/1254	61	676	0.1
4X3	3	A	0	1.1	Yes	FT	688432.9	294777.7	nd	nd ug/kg	nd	22800	nd	46000 ug/kg	1242/1248	nd	nd	nd
4X3	3	B	1.1	1.6	Yes	FT	688432.9	294777.7	9.9	92000 ug/kg	9293	22800	0.4	16000 ug/kg	1248/1254	1616	676	2.4
4X3	3	C	1.6	2.2	No	FT	688432.9	294777.7	9.9	72600 ug/kg	7333	22800	0.3	1700 ug/kg	1248/1254	172	676	0.3
4X3	3	D	2.2	2.5	No	FT	688432.9	294777.7	nd	127300 ug/kg	nd	22800	nd	290 ug/kg	1248/1254	nd	nd	nd
4X4	3	A	0	0.8	Yes	FT	688481.2	294788.8	8.1	61000 ug/kg	7531	22800	0.3	79000 ug/kg	1242/1248	9753	676	14.4
4X4	3	B	0.8	1.8	Yes	FT	688481.2	294788.8	nd	67700 ug/kg	nd	22800	nd	19000 ug/kg	1242/1248	nd	nd	nd
4X4	3	C	1.8	2.3	No	FT	688481.2	294788.8	2.9	49810 ug/kg	17176	22800	0.8	1100 ug/kg	1248/1254	379	676	0.6
4X4	3	D	2.3	2.8	No	FT	688481.2	294788.8	nd	82100 ug/kg	nd	22800	nd	4600 ug/kg	1242/1248	nd	nd	nd
4X4	3	E	2.8	3.3	No	FT	688481.2	294788.8	nd	2148 ug/kg	nd	22800	nd	<800 ug/kg	na	nd	nd	nd
4X4	3	F	3.3	3.5	No	FT	688481.2	294788.8	nd	811 ug/kg	nd	22800	nd	48 ug/kg	1242/1248	nd	nd	nd
4X5	3	A	0	0.8	Yes	FT	688478.9	294791.6	10.7	333800 ug/kg	31196	22800	1.4	4000 ug/kg	1248/1254	374	676	0.6
4X5	3	B	0.8	1.8	Yes	FT	688478.9	294791.6	nd	68090 ug/kg	nd	22800	nd	42000 ug/kg	1242/1248	nd	nd	nd
4X5	3	C	1.8	2.3	No	FT	688478.9	294791.6	9.1	37170 ug/kg	4085	22800	0.2	400 ug/kg	1248/1254	44	676	0.1
4X5	3	D	2.3	2.8	No	FT	688478.9	294791.6	nd	80400 ug/kg	nd	22800	nd	620 ug/kg	1248/1254	nd	nd	nd
4X5	3	E	2.8	3.3	No	FT	688478.9	294791.6	nd	318 ug/kg	nd	22800	nd	1200 ug/kg	1242/1248	nd	nd	nd
4X5	3	F	3.3	3.5	No	FT	688478.9	294791.6	9.1	318 ug/kg	nd	22800	nd	98 ug/kg	1242/1248	nd	nd	nd
4X7	3	A	0	0.6	Yes	FT	688531.5	294784.3	8.7	66430 ug/kg	7636	22800	0.3	8700 ug/kg	1242/1248	1000	676	1.5
4X7	3	B	0.6	1.2	Yes	FT	688531.5	294784.3	nd	nd ug/kg	nd	22800	nd	72000 ug/kg	1242/1248	nd	nd	nd
4X7	3	C	1.2	1.8	Yes	FT	688531.5	294784.3	nd	83090 ug/kg	nd	22800	nd	380000 ug/kg	1242/1248	nd	676	nd
4X7	3	D	1.8	2.4	No	FT	688531.5	294784.3	nd	118800 ug/kg	nd	22800	nd	17000 ug/kg	1248/1254	nd	nd	nd
4XX1	4	A	0	0.9	Yes	FT	688430	294942.4	6.5	36220 ug/kg	5572	22800	0.2	22000 ug/kg	1248/1254	3385	676	5.0
4XX1	4	B	0.9	1.4	Yes	FT	688430	294942.4	nd	nd ug/kg	nd	22800	nd	450 ug/kg	1248/1254	nd	676	nd
5X1	nd	Surface	Petite	Ponar	Yes	na	688381.9	295123.3	3.5	49360 ug/kg	14103	22800	0.6	1900 ug/kg	1242/1248	543	676	0.8
5X2	5	A	Petite	Ponar	Yes	na	688436.1	295018.6	2.6	13700 ug/kg	5269	22800	0.2	1000 ug/kg	1242/1248	385	676	0.6
5X2	5	B	Petite	Ponar	Yes	na	688436.1	295018.6	2.6	20500 ug/kg	7885	22800	0.3	3400 ug/kg	1248/1254	1308	676	1.9

nd=no data
na=not applicable
Horizon Start, End, X and Y data are from the Data Appendix.
Data in cells with no background color are from the CBSQG spreadsheet.
Data on additional horizons from Data Appendix (PAH data from Table 4 WDNR, 2005).
Values from CBSQG spreadsheet and Data Appendix do not agree. Value from Data Appendix is presented here.
Data from CBSQG spreadsheet is identical for 4X4 and 4X5 sites. The PAH data presented here for site 4X5 and 4X7 are from Table 4 WDNR (2005)

REGION 5 RAC2

REMEDIAL ACTION CONTRACT FOR

Remedial, Enforcement Oversight, and
Non-Time Critical Removal Activities at Sites of Release
or Threatened Release of Hazardous Substances in Region 5

BASIS OF DESIGN REPORT
APPENDIX A—DESIGN SPECIFICATIONS
Lincoln Park/Milwaukee River Channel Sediments Site
Milwaukee, Wisconsin
Final Remedial Design (Phase I)

WA No. 065-RDRD-2508/Contract No. EP-S5-06-01

March 2011

PREPARED FOR

U.S. Environmental Protection Agency

PREPARED BY

CH2M HILL
Ecology and Environment, Inc.
Environmental Design International, Inc.
Teska Associates, Inc.

FOR OFFICIAL USE ONLY

TABLE OF CONTENTS

END OF SECTION

SECTION 01 11 00
SUMMARY OF WORK

PART 1 GENERAL

1.01 WORK COVERED BY CONTRACT DOCUMENTS

A. The main components of the sediment excavation are presented below:

1. Mobilization including preparation of the staging areas, decontamination areas, a TSCA dewatering pad, and temporary facilities.
2. Pre- and Post-excavation surveying.
3. Design and installation of temporary earthen and sheet pile cut-off structures.
4. Design, installation and maintenance of a temporary bypass system for Lincoln Creek.
5. Mechanical excavation, including sediment dewatering – mechanically mixed in place with a drying agent, if needed.
6. Water quality monitoring and control.
7. Construction of a TSCA-sediment dewatering pad.
8. TSCA-sediment staging and equipment decontamination.
9. Design, installation, operation and maintenance of two water treatment systems.
10. Water treatment and process monitoring.
11. Offsite disposal.
12. Streambank restoration.
13. Decontamination of personnel and equipment.
14. Restoration of temporary staging areas and demobilization.
15. Specific tasks not mentioned or not completely describes that are necessary to perform tasks describes as “Work” shall also be considered part of the work.

1.02 WORK HOURS

A. Work will be performed onsite seven days a week, 24 hours per day. Alternative work hours must be communicated and approved by the Contractor.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 29 00
PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SUBMITTALS

A. Informational Submittals:

1. Schedule of Values: Submit on Subcontractor's standard form.
2. Schedule of Estimated Progress Payments:
   a. Submit with initially acceptable Schedule of Values.
   b. Submit adjustments thereto with Application for Payment.
3. Application for Payment.
4. Final Application for Payment.

1.02 SCHEDULE OF VALUES

A. Prepare a separate Schedule of Values for each schedule of the Work under the Agreement.

B. Upon request of Contractor, provide documentation to support the accuracy of the Schedule of Values.

C. Unit Price Work: Reflect unit price quantity and price breakdown from conformed Bid Form.

D. Lump Sum Work:

1. Reflect schedule of values format included in conformed compensation schedule, specified allowances and alternates as applicable.
2. List bonds and insurance premiums, mobilization, demobilization, preliminary and detailed progress schedule preparation, equipment testing, facility startup, and contract closeout separately.
3. Break down by Division 2 through 49 with appropriate subdivision of each Specification for each Project facility.

E. An unbalanced or front-end loaded schedule will not be acceptable.

F. Summation of the complete Schedule of Values representing all the Work shall equal the Subcontract Price.

1.03 SCHEDULE OF ESTIMATED PROGRESS PAYMENTS

A. Show estimated payment requests throughout Subcontract Times aggregating initial Subcontract Price.

B. Base estimated progress payments on initially acceptable progress schedule. Adjust to reflect subsequent adjustments in progress schedule and Subcontract Price as reflected by modifications to the Subcontract Documents.

1.04 APPLICATION FOR PAYMENT

A. Transmittal Summary Form: Attach one Transmittal Summary Form (provided in Section 01 33 00, Submittal Procedures) with each detailed Application for Payment for each schedule and include Request for Payment of Materials and Equipment on Hand as applicable. Execute certification by authorized officer of Contractor. Submit to address provided in Subcontract Agreement.

B. Use detailed Payment Application and Certificate Form provided by Contractor (Exhibit 1).

C. Provide separate form for each schedule as applicable.

D. Include accepted Schedule of Values for each schedule or portion of lump sum Work and the unit price breakdown for the Work to be paid on a unit priced basis.

E. Include separate line item for each Change Order and Work Change Directive executed prior to date of submission. Provide further breakdown of such as requested by Contractor.

F. Preparation:

1. Round values to nearest dollar.
2. Submit Application for Payment, including a Transmittal Summary Form and detailed Application for Payment Form(s) for each schedule as applicable, a listing of materials on hand for each schedule as applicable, and such supporting data as may be requested by Contractor.

1.05 MEASUREMENT—GENERAL

A. Weighing, measuring, and metering devices used to measure quantity of materials for Work shall be suitable for purpose intended and conform to tolerances and specifications as specified in National Institute of Standards and Technology, Handbook 44.

B. Whenever pay quantities of material are determined by weight, material shall be weighed on scales furnished by Subcontractor and certified accurate by state agency responsible. Weight or load slip shall be obtained from weigher and delivered to Contractor at point of delivery of material.

C. If material is shipped by rail, car weights will be accepted provided that actual weight of material only will be paid for and not minimum car weight used for assessing freight tariff, and provided further that car weights will not be acceptable for material to be passed through mixing plants.

D. Vehicles used to haul material being paid for by weight shall be weighed empty daily and at such additional times as required by Contractor. Each vehicle shall bear a plainly legible identification mark.

E. Materials that are specified for measurement by the cubic yard measured in the vehicle shall be hauled in vehicles of such type and size that actual contents may be readily and accurately determined. Unless all vehicles are of uniform capacity, each vehicle must bear a plainly legible identification mark indicating its water level capacity. Vehicles shall be loaded to at least their water level capacity. Loads hauled in vehicles not meeting above requirements or loads of a quantity less than the capacity of the vehicle, measured after being leveled off as above provided, will be subject to rejection, and no compensation will be allowed for such material.

F. Where measurement of quantities depends on elevation of existing ground, elevations obtained during construction will be compared with those shown on Drawings. Variations of 1 foot or less will be ignored, and profiles shown on Drawings will be used for determining quantities.

G. Units of measure shown on Bid Form shall be as follows, unless specified otherwise.

Item	Method of Measurement
AC	Acre—Field Measure by Contractor
CY	Cubic Yard—Field Measure by Contractor within limits specified or shown
CY-VM	Cubic Yard—Measured in Vehicle by Volume
EA	Each—Field Count by Contractor
GAL	Gallon—Field Measure by Contractor
HR	Hour
LB	Pound(s)—Weight Measure by Scale
LF	Linear Foot—Field Measure by Contractor
SF	Square Foot
SY	Square Yard
TON	Ton—Weight Measure by Scale (2,000 pounds)

1.06 PAYMENT

A. Payment for Lump Sum Work covers all Work specified or shown within the limits or Specification sections as shown in Table 1 – Lump Sum Items, attached as a supplement to this section.

B. Payment for Unit Price Items covers all the labor, materials and services necessary to furnish and install the items shown in Table 2 – Unit Price Items, attached as a supplement to this section.

1.07 NONPAYMENT FOR REJECTED OR UNUSED PRODUCTS

A. Payment will not be made for following:

1. Loading, hauling, and disposing of rejected material.
2. Quantities of material wasted or disposed of in manner not called for under Subcontract Documents.
3. Rejected loads of material, including material rejected after it has been placed by reason of failure of Subcontractor to conform to provisions of Subcontract Documents.
4. Material not unloaded from transporting vehicle.
5. Defective Work not accepted by Contractor or USEPA.
6. Material remaining on hand after completion of Work.

1.08 PARTIAL PAYMENT FOR STORED MATERIALS AND EQUIPMENT

A. Partial Payment: No partial payments will be made for materials and equipment delivered or stored unless Shop Drawings and preliminary operation and maintenance data is acceptable to Contractor.

B. Final Payment: Will be made only for products incorporated in Work; remaining products, for which partial payments have been made, shall revert to Subcontractor unless otherwise agreed, and partial payments made for those items will be deducted from final payment.

1.09 SUPPLEMENTS

A. The supplements listed below, following “End of Section”, are part of this Specification.

1. Table 1 – Lump Sum Price Items.
2. Table 2 – Unit Price Items.
3. Exhibit 1 – Payment Application Certificate.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

TABLE 1
Lump Sum Items
Lincoln Park/Milwaukee River Channel Sediment Site - Milwaukee Estuary Area of Concern, Milwaukee, Wisconsin

Item	Description
Insurance Premiums	As required in General Terms & Conditions
Performance and Payment Bonds	As required in General Terms & Conditions
Mobilization	Includes all necessary labor, material, and equipment to move in personnel and equipment, set up and maintain all temporary offices (including CH2M HILL Field Trailer), parking areas, facilities, utilities, and prepare site for work. Also includes submission of all submittals required prior to start of work (as listed in Section 01 33 00). Not to exceed 7.5 percent of total bid.
Site Preparation	Includes all necessary labor, material, and equipment to perform clearing and grubbing, dispose of clearing and grubbing debris, installation, maintenance, and removal of erosion control devices, and construction of access points and decon pads as specified and shown on drawings. Includes all necessary labor to prepare, submit and revise plans described in Section 31 01 00.
Earthen Cut-off Structure Structures Install/Remove	Includes all necessary labor, materials, and equipment to install, maintain and remove the temporary earthen cut-off structures shown on the drawings.
Steel Sheet Pile Cut-off Structures Install/Remove	Includes all necessary labor, materials, and equipment to install, maintain and remove the temporary steel sheet pile cut-off structures shown on the drawings.
Haul Road Installation and Maintenance	Includes all necessary labor, materials, and equipment to install, maintain, and remove haul roads as specified.
Traffic Control Signage	Includes all necessary labor, materials, and equipment to install, maintain, and remove traffic control signs as specified.
Perimeter Fencing	Includes all necessary labor, materials, and equipment to install, maintain and remove perimeter fence as specified and shown on the drawings.
Sump and Sump Pumps	Includes all necessary labor, materials, and equipment to install, maintain, and remove pumps for dewatering.
Mob/Demob Water Treatment Systems	Includes all necessary labor, materials, and equipment to mob and demob the water treatment systems.
Record Drawings/Final Survey	Includes all necessary labor, materials, and equipment to conduct a final survey and prepare record drawings as specified.
Demobilization	Includes all necessary labor, material, and equipment to move out personnel and equipment, clean entire site, and remove all debris and rubbish related to construction activities. May not be less than 2 percent of total bid.
Contract Closeout	As required in General Terms & Conditions

TABLE 2
Unit Price Items
Lincoln Park/Milwaukee River Channel Sediment Site - Milwaukee Estuary Area of Concern, Milwaukee, Wisconsin

Item	Description	Unit of Measure
Install/Maintain/Remove Water Management Pipeline	Includes all labor, materials, and equipment necessary to install, operate, and remove the Lincoln Creek bypass system as specified.	LF
Site Security	Includes all labor, material, and equipment necessary to provide 24 hour, 7 day a week site security.	HR
Construction Survey Crew	Includes providing all labor, material, and equipment necessary to perform pre-excavation and post-excavation surveys, as specified. Also includes preparation of record documents in both hard copy and electronic deliverable format.	DAY
Site Trailers (2) and Utilities	Includes all labor, material, and equipment necessary to provide site trailers and utilities as specified.	MO
Electrical Connection Allowance	Includes all labor, material, and equipment necessary to provide electrical generators.	MO
Dust Control	Includes all labor, material, and equipment necessary to provide dust control across the site.	MO
TSCA Pad Construction	Includes all labor, material, and equipment necessary to construct the dewatering pad as specified and shown on the drawings.	SY
Decon Pad Construction and Removal	Includes all labor, material, and equipment necessary to construct and remove the decon pads as specified and shown on the drawings.	EA
Water Treatment System Rental and Operation	Includes all materials and equipment necessary to supply, operate, and maintain the water treatment systems as specified and shown on drawings. Includes mobile storage tank rental. Includes cost for utilities, chemicals and sampling.	MO
Discharge Monitoring and Reporting	Includes all labor, materials and equipment necessary to monitor the water treatment systems and document performance.	MO
Pump Out Segments	Includes all labor, materials, and equipment necessary to dewater the excavation segments as specified and shown on drawings.	DAY
Excavation	Includes all labor, materials, and equipment necessary to excavate sediment, as specified and shown on drawings.	CY
Transportation to TSCA Pad	Includes all labor, materials, and equipment necessary to transport TSCA designated sediment to the onsite TSCA dewatering plan, as specified and shown on drawings.	CY
Load Trucks with TSCA Sediment	Includes all labor, materials, and equipment necessary to load trucks with excavated sediment.	TON
Subtitle D Transportation	Includes all labor, materials, and equipment necessary to transport sediment to a Subtitle D landfill, as specified and shown on drawings.	TON

TABLE 2
Unit Price Items
Lincoln Park/Milwaukee River Channel Sediment Site - Milwaukee Estuary Area of Concern, Milwaukee, Wisconsin

Item	Description	Unit of Measure
Subtitle D Disposal	Includes all profiling fees, application fees, and disposal costs associated with the sediment at a Subtitle D landfill.	TON
Subtitle C Transportation	Includes all labor, materials, and equipment necessary to transport sediment to a Subtitle C landfill, as specified and shown on drawings.	TON
Subtitle C Disposal	Includes all profiling fees, application fees, and disposal costs associated with the sediment at a Subtitle C landfill.	TON
Subtitle D Debris Disposal	Includes all profiling fees, application fees, and disposal costs associated with non-sediment material at a Subtitle D landfill.	TON
TSCA Pad Demolition	Includes all labor, materials, and equipment necessary to demolish and remove the TSCA dewatering pad, as specified and shown on drawings.	TON
TSCA Pad Disposal	Includes all profiling fees, application fees, and disposal costs associated with non-sediment material at a Subtitle C landfill.	TON
Topsoil and Turf Grass Seed	Includes all labor, materials, and equipment necessary to spread topsoil and turf grass seed areas classified as general site restoration as specified and shown on Drawings.	AC
Streambank Restoration Detail 1	Includes all labor, materials, and equipment necessary to install structure as specified and shown on drawings except top of bank seed.	SY
Streambank Restoration Detail 1 Top of Bank Seed	Includes all labor, materials, and equipment necessary to install top of bank seed up to 50 feet inland as specified and shown on drawings.	SY
Streambank Restoration Detail 2	Includes all labor, materials, and equipment necessary to install structure as specified and shown on drawings except top of bank seed.	SY
Streambank Restoration Detail 2 Top of Bank Seed	Includes all labor, materials, and equipment necessary to install top of bank seed up to 50 feet inland as specified and shown on drawings.	SY
Streambank Restoration Detail 3	Includes all labor, materials, and equipment necessary to install structure as specified and shown on drawings except top of bank seed.	SY
Streambank Restoration Detail 3 Top of Bank Seed	Includes all labor, materials, and equipment necessary to install top of bank seed up to 50 feet inland as specified and shown on drawings.	SY
Streambank Restoration Detail 4	Includes all labor, materials, and equipment necessary to install structure as specified and shown on drawings except top of bank seed.	SY
Streambank Restoration Detail 4 Top of Bank Seed	Includes all labor, materials, and equipment necessary to install top of bank seed up to 50 feet inland as specified and shown on drawings.	SY

TABLE 2
Unit Price Items
Lincoln Park/Milwaukee River Channel Sediment Site - Milwaukee Estuary Area of Concern, Milwaukee, Wisconsin

Item	Description	Unit of Measure
Streambank Restoration Detail 5	Includes all labor, materials, and equipment necessary to install structure as specified and shown on drawings except top of bank seed.	SY
Streambank Restoration Detail 5 Top of Bank Seed	Includes all labor, materials, and equipment necessary to install top of bank seed up to 50 feet inland as specified and shown on drawings.	SY
As Needed Items[1]		
Earthen Cut-off Structure Repair Labor and Equipment	Includes all necessary labor and equipment to repair the temporary earthen cut-off structures shown on the drawings.	HR
Earthen Cut-off Structure Repair Materials	Includes all necessary materials to repair the temporary earthen cut-off structures shown on the drawings.	TON
Repair Water Management Pipeline	Includes all labor and equipment necessary to repair the Lincoln Creek bypass system as specified.	LF
Steel Sheet Pile Cut-off Structure Repair Labor and Equipment	Includes all necessary labor and equipment to repair the temporary sheet pile cut-off structures shown on the drawings.	HR
Steel Sheet Pile Cut-off Structure Repair Materials	Includes all necessary materials to repair the temporary steel sheet pile cut-off structures shown on the drawings.	LF
Additional Excavation	Includes all labor, materials, and equipment necessary to excavate additional sediment, as directed by Contractor.	CY
Perimeter Fence	Includes all necessary labor, materials, and equipment to supply, install, maintain, and remove perimeter fence.	LF
Silt Fence	Includes all necessary labor, materials, and equipment to supply, install, maintain, and remove silt fence.	LF
Sand Filter Media Changeout	Includes all necessary labor, materials, and equipment to remove spent media and supply and install new media.	EA
Granular Activated Carbon Media Changeout	Includes all necessary labor, materials, and equipment to remove spent media and supply and install new media.	EA
Drying Agent Addition[2]	Includes all labor, materials, and equipment necessary to supply drying agent.	TON
Mixing Drying Agent and Sediment In Place	Includes all labor, materials, and equipment necessary to mechanically mix drying agent additive into sediment in place.	CY
Mixing Drying Agent and Sediment on TSCA Pad	Includes all labor, materials, and equipment necessary to mechanically mix drying agent additive into sediment on TSCA Pad.	CY

TABLE 2
Unit Price Items
Lincoln Park/Milwaukee River Channel Sediment Site - Milwaukee Estuary Area of Concern, Milwaukee, Wisconsin

Item	Description	Unit of Measure

[1]As needed items will be supplied and installed by the Subcontractor at the direction of the Contractor. Unit prices will be the basis for discussion of payment for additional items, and possible –deletions for others.
[2]Unit of measure is weight, in tons, of reagent

PAYMENT APPLICATION AND CERTIFICATE

DATE: _____

SHEET 1 OF 13

APPLICATION NO: _____

PERIOD: FROM _____ TO _____ 20 _____

PROJECT: _____ PROJECT NO: _____

SUBCONTRACTOR: _____

1. Original Subcontract Sum $ _____

2. Subcontract Modifications Approved in Previous Applications:

Additions $ _____ Deductions $ _____

3. Subcontract Modifications Approved this Period (List Subcontract Modifications Nos. _____)

Additions $ _____ Deductions $ _____

4. Net Change by Subcontract Modifications (sum of Lines 2 and 3) $ _____

5. Revised Subcontract Amount (Sum of Lines 1 and 4) $ _____

6. Total Value of Work to Date (Estimate Attached) $ _____

7. Percent Project Complete (Line 6 ÷ Line 5) x 100= _____ %

8. Total Materials on Hand (Listing Attached) $ _____

9. Subtotal - Work Completed and Stored (Sum of Lines 6 and 8) $ _____

10. Total Retainage (_____ % x Line 9) $ _____

11. Total Earned to Date, Less Retainage (Line 9 less Line 10) $ _____

12. Less Previous Certificates for Payment (item 11 from Previous Application) $ _____

13. Current Payment Due (Line 11 less Line 12) $ _____

The undersigned Subcontractor certifies that the Work covered by this Application for Payment has been completed in accordance with the Subcontract Documents, that the current payment shown herein is now due, and that title for all Work, materials, and equipment covered in this Application will pass to the Owner free and clear of all liens at the time of payment.

_____ _____ _____

Subcontractor By Date

I hereby acknowledge that the material and labor involved on the above estimate is correct to the best of my knowledge, information and belief, and payment on same is due Subcontractor.

_____ _____

CH2M HILL Date

SECTION 01 31 13
PROJECT COORDINATION

PART 1 GENERAL

1.01 SUBMITTALS

A. Informational:

1. Statement of Qualification (SOQ) for land surveyor.
2. Photographs:
   a. Digital Images: Submit on compact disc within 5 days of being taken.
3. Video Recordings: Submit one copy, including updated copy of project video log, within 5 days of being taken.

1.02 UTILITY NOTIFICATION AND COORDINATION

A. Coordinate the Work with various utilities within Project limits. Notify applicable utilities prior to commencing Work, if damage occurs, or if conflicts or emergencies arise during Work.

1. Digger's Hotline:
   a. Telephone: 800-242-8511.
2. Electricity Company: WE Energies.
   a. Emergency Telephone**:** 800-662-4797.
3. Water Department:
   a. Emergency Telephone: 414-286-3710.
4. Gas Company:
   a. Emergency Telephone: 800-261-5325.
5. MKE County Utility Locate:
   a. Contact Person: Gene Andrzejak.
   b. Telephone: 414-258-2322.
6. AT&T Contact
   a. Contact Person: Carol Ann Couillard.
   b. Telephone: 414-536-2992

1.03 ADJACENT FACILITIES AND PROPERTIES

A. Examination:

1. After Effective Date of the Agreement and before Work at Site is started, Subcontractor, Contractor and affected property owners and utility owners shall make a thorough examination of pre-existing conditions including existing buildings, structures, and other

improvements in vicinity of Work, as applicable, which could be damaged by construction operations.

2. Periodic reexamination shall be jointly performed to include, but not limited to, cracks in structures, settlement, leakage, and similar conditions.

B. Documentation:

1. Record and submit documentation of observations made on examination inspections. Contractor will photo document pre-construction conditions.
2. Upon receipt, Contractor will review, sign, and return one record copy of documentation to Subcontractor to be kept on file in field office.
3. Such documentation shall be used as indisputable evidence in ascertaining whether and to what extent damage occurred as a result of Subcontractor's operations, and is for the protection of adjacent property owners, Contractor, and USEPA.

1.04 CONSTRUCTION PHOTOGRAPHS

A. Photographically document all phases of the project including preconstruction, construction progress, and post-construction.

B. Contractor shall have the right to select the subject matter and vantage point from which photographs are to be taken.

C. Preconstruction and Post-Construction:

1. After Effective Date of the Agreement and before Work at Site is started, and again upon issuance of Substantial Completion, take a minimum of 48 exposures of Construction Site and property adjacent to perimeter of Construction Site.
2. Particular emphasis shall be directed to structures both inside and outside the Site.
3. Format: Digital, minimum resolution of 756 by 504 pixels and 24 bit, millions of color.

D. Construction Progress Photos:

1. Photographically demonstrate progress of construction, showing every aspect of Site and adjacent properties as well as interior and exterior of new or impacted structures.
2. Weekly: Take 48 exposures using Digital, minimum resolution of 756 by 504 pixels and 24 bit, millions of color.

E. Digital Images:

1. Archive using a commercially available photo management system.
2. Label each disk with Project and Contractor's name, and week and year images were produced.

1.05 AUDIO-VIDEO RECORDINGS

A. Prior to beginning Work on Construction Site or of a particular area of the Work, and again within10 days following date of Substantial Completion, videograph Construction Site and property adjacent to Construction Site.

B. In the case of preconstruction recording, no Work shall begin in the area prior to Contractor's review and approval of content and quality of video for that area.

C. Particular emphasis shall be directed to physical condition of existing vegetation, structures, and pavements within the work area and areas adjacent to and within the right-of-way or easement, and on Subcontractor storage and staging areas.

D. Contractor shall have right to select subject matter and vantage point from which videos are to be taken.

E. Video Format and Quality:

1. DVD format, with sound.
2. Video:
   a. Produce bright, sharp, and clear images with accurate colors, free of distortion and other forms of picture imperfections.
   b. Electronically, and accurately display the month, day, year, and time of day of the recording.
3. Audio:
   a. Audio documentation shall be done clearly, precisely, and at a moderate pace.
   b. Indicate date, project name, and a brief description of the location of taping, including:
      1) Facility name.
      2) Street names or easements.
      3) Addresses of private property.
      4) Direction of coverage, including engineering stationing, if applicable.

F. Documentation:

1. DVD Label:
   a. DVD number (numbered sequentially, beginning with 001).
   b. Project name.
   c. Applicable location by engineering stationing.
   d. Date and time of coverage.
2. Project Video Log: Maintain an ongoing log that incorporates above noted label information for video on Project.

1.06 REFERENCE POINTS AND SURVEYS

A. Contractor's Responsibilities:

1. Establish bench marks convenient to Work and at least every 500 feet on pipelines and roads.
2. Establish horizontal reference points or coordinate system with bench marks and reference points for Subcontractor's use as necessary to lay out Work.

B. Location and elevation of bench marks are shown on Drawings.

C. Subcontractor's Responsibilities:

1. Provide additional survey and layout required to layout the Work.
2. Notify Contractor at least 3 working days in advance of time when grade and line to be provided by Contractor will be needed.
3. Check and establish exact location of existing facilities prior to construction of new facilities and any connections thereto.
4. In event of discrepancy in data or staking provided by Contractor, request clarification before proceeding with Work.
5. Retain professional land surveyor or civil engineer registered in state of Project who shall perform or supervise engineering surveying necessary for additional construction staking and layout.
6. Maintain complete accurate log of survey Work as it progresses as a Record Document.
7. On request of Contractor, submit documentation.
8. Provide competent employee(s), tools, stakes, and other equipment and materials as Contractor may require to:
   a. Establish control points, lines, and easement boundaries.
   b. Check layout, survey, and measurement Work performed by others.
   c. Measure quantities for payment purposes.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 31 19
PROJECT MEETINGS

PART 1 GENERAL

1.01 GENERAL

A. Contractor will schedule physical arrangements for meetings throughout progress of the Work, prepare meeting agenda with regular participant input and distribute with written notice of each meeting, preside at meetings, record minutes to include significant proceedings and decisions, and reproduce and distribute copies of minutes within 24 hours after each meeting to participants and parties affected by meeting decisions.

1.02 PRECONSTRUCTION CONFERENCE

A. Subcontractor shall be prepared to discuss the following subjects, as a minimum:

1. Subcontractor's safety plan and representative.
2. Required schedules.
3. Status of Bonds and insurance.
4. Sequencing of critical path work items.
5. Progress payment procedures.
6. Project changes and clarification procedures.
7. Use of Site, access, office and storage areas, security and temporary facilities.
8. Major product delivery and priorities.

B. Attendees will include:

1. USEPA's representatives.
2. WDNR's representatives.
3. Milwaukee County representatives.
4. MMSD's representatives.
5. City of Milwaukee's representatives.
6. City of Glendale's representatives.
7. Subcontractor's office representative.
8. Subcontractor's resident superintendent.
9. Subcontractor's quality control representative.
10. Subcontractors' representatives whom Subcontractor may desire or Contractor may request to attend.
11. Contractor's representatives.
12. Others as appropriate.

1.03 PRELIMINARY SCHEDULES REVIEW MEETING

A. As set forth in General Conditions and Section 01 32 00, Construction Progress Documentation.

1.04 PROGRESS MEETINGS

A. Contractor will schedule regular progress meetings at Site, conducted weekly to review the Work progress, Progress Schedule, Schedule of Submittals, Application for Payment, contract modifications, and other matters needing discussion and resolution.

B. Attendees will include:

1. USEPA's representative(s), as appropriate.
2. WDNR's representatives.
3. Milwaukee County representatives.
4. Subcontractor, Sub-Subcontractors, and Suppliers, as appropriate.
5. Contractor's representative(s).
6. Others as appropriate.

1.05 QUALITY CONTROL MEETINGS

A. Scheduled by Contractor on regular basis and as necessary to review test and inspection reports, and other matters relating to quality control of the Work and work of other Contractors.

B. Attendees will include:

1. Contractor's representatives.
2. USEPA's representative(s), as appropriate.
3. WDNR's representatives.
4. Milwaukee County representatives.
5. Subcontractor.
6. Subcontractor's designated quality control representative.
7. Sub-Subcontractors and Suppliers, as necessary.

1.06 OTHER MEETINGS

A. In accordance with Contract Documents and as may be required by USEPA, WDNR, Milwaukee County, and Contractor.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 32 00
CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 GENERAL

1.01 SUBMITTALS

A. Informational Submittals:

1. Preliminary Progress Schedule: Submit at least 7 days prior to preconstruction conference.
2. Detailed Progress Schedule:
   a. Submit initial Detailed Progress Schedule within 30 days after Effective Date of the Agreement.
   b. Submit an Updated Progress Schedule at each update, in accordance with Article Detailed Progress Schedule.
3. Submit with Each Progress Schedule Submission:
   a. Subcontractor's certification that Progress Schedule submission is actual schedule being utilized for execution of the Work.
   b. Progress Schedule: One legible copy.
   c. Narrative Progress Report: Same number of copies as specified for Progress Schedule.
4. Prior to final payment, submit a final Updated Progress Schedule.

1.02 PRELIMINARY PROGRESS SCHEDULE

A. In addition to basic requirements outlined in General Conditions, show a detailed schedule, beginning with Notice to Proceed, for minimum duration of 90 days, and a summary of balance of Project through Final Completion.

B. Show activities including, but not limited to the following:

1. Notice to Proceed.
2. Permits.
3. Submittals, with review time. Subcontractor may use Schedule of Submittals specified in Section 01 33 00, Submittal Procedures.
4. Early procurement activities for long lead equipment and materials.
5. Initial Site work.
6. Earthwork.
7. Specified Work sequences and construction constraints.
8. Contract Milestone and Completion Dates.
9. Owner-furnished products delivery dates or ranges of dates.
10. Major structural, mechanical, equipment, electrical, architectural, and instrumentation and control Work.
11. System startup summary.

12. Project close-out summary.
13. Demobilization summary.

C. Update Preliminary Progress Schedule monthly as part of progress payment process. Failure to do so may result in the Owner withholding all or part of the monthly progress payment until the Preliminary Progress Schedule is updated in a manner acceptable to Contractor.

D. Format: In accordance with Article Progress Schedule—Bar Chart.

1.03 DETAILED PROGRESS SCHEDULE

A. In addition to requirements of General Conditions, submit Detailed Progress Schedule beginning with Notice to Proceed and continuing through Final Completion.

B. Show the duration and sequences of activities required for complete performance of the Work reflecting means and methods chosen by Subcontractor.

C. When accepted by Contractor, Detailed Progress Schedule will replace Preliminary Progress Schedule and become Baseline Schedule. Subsequent revisions will be considered as Updated Progress Schedules.

D. Format: In accordance with Article Progress Schedule—Bar Chart.

E. Update biweekly to reflect actual progress and occurrences to date, including weather delays.

1.04 PROGRESS SCHEDULE—BAR CHART

A. General: Comprehensive bar chart schedule, generally as outlined in Associated General Contractors of America (AGC) 580, “Construction Project Planning and Scheduling Guidelines.” If a conflict occurs between the AGC publication and this Specification, this Specification shall govern.

B. Format:

1. Unless otherwise approved, white paper, 11-inch by 17-inch sheet size.
2. Title Block: Show name of project and USEPA, date submitted, revision or update number, and name of scheduler.
3. Identify horizontally, across the top of the schedule, the time frame by year, month, and day.
4. Identify each activity with a unique number and a brief description of the Work associated with that activity.
5. Legend: Describe standard and special symbols used.

C. Contents: Identify, in chronological order, those activities reasonably required to complete the Work, including as applicable, but not limited to:

1. Obtaining permits, submittals for early product procurement, and long lead time items.
2. Mobilization and other preliminary activities.
3. Initial Site work.
4. Specified Work sequences, constraints, and Milestones, including Substantial Completion date(s).
5. Subcontract Work.
6. Major equipment design, fabrication, factory testing, and delivery dates.
7. Sitework.
8. Concrete Work.
9. Structural steel Work.
10. Architectural features Work.
11. Conveying systems Work.
12. Equipment Work.
13. Mechanical Work.
14. Electrical Work.
15. Instrumentation and control Work.
16. Other important Work for each major facility.
17. Equipment and system startup and test activities.
18. Project closeout and cleanup.
19. Demobilization.

1.05 PROGRESS OF THE WORK

A. Updated Progress Schedule shall reflect:

1. Progress of Work to within 5 working days prior to submission.
2. Approved changes in Work scope and activities modified since submission.
3. Delays in Submittals or resubmittals, deliveries, or Work.
4. Adjusted or modified sequences of Work.
5. Other identifiable changes.
6. Revised projections of progress and completion.
7. Report of changed logic.

B. Produce detailed sub-schedules during Project, upon request of USEPA or Contractor, to further define critical portions of the Work such as facility shutdowns.

C. If Subcontractor fails to complete activity by its latest scheduled completion date and this Failure is anticipated to extend Contract Times (or Milestones), Subcontractor shall, within 7 days of such failure, submit a written statement

as to how Subcontractor intends to correct nonperformance and return to acceptable current Progress Schedule. Actions by Subcontractor to complete the Work within Contract Times (or Milestones) will not be justification for adjustment to Contract Price or Contract Times.

D. Contractor may order Subcontractor to increase plant, equipment, labor force or working hours if Subcontractor fails to:

1. Complete a Milestone activity by its completion date.
2. Satisfactorily execute Work as necessary to prevent delay to overall completion of Project, at no additional cost to Contractor.

1.06 NARRATIVE PROGRESS REPORT

A. Format:

1. Organize same as Progress Schedule.
2. Identify, on a cover letter, reporting period, date submitted, and name of author of report.

B. Contents:

1. Number of days worked over the period, work force on hand, construction equipment on hand (including utility vehicles such as pickup trucks, maintenance vehicles, stake trucks).
2. General progress of Work, including a listing of activities started and completed over the reporting period, mobilization/demobilization of subcontractors, and major milestones achieved.
3. Subcontractor’s plan for management of Site (e.g., lay down and staging areas, construction traffic), utilization of construction equipment, buildup of trade labor, and identification of potential Contract changes.
4. Identification of new activities and sequences as a result of executed Contract changes.
5. Documentation of weather conditions over the reporting period, and any resulting impacts to the work.
6. Description of actual or potential delays, including related causes, and the steps taken or anticipated to mitigate their impact.
7. Changes to activity logic.
8. Changes to the critical path.
9. Identification of, and accompanying reason for, any activities added or deleted since the last report.
10. Steps taken to recover the schedule from Subcontractor-caused delays.

1.07 SCHEDULE ACCEPTANCE

A. Contractor's acceptance will demonstrate agreement that:

1. Proposed schedule is accepted with respect to:
   a. Contract Times, including Final Completion and all intermediate Milestones are within the specified times.
   b. Specified Work sequences and constraints are shown as specified.
   c. Specified Owner-furnished Equipment or Material arrival dates, or range of dates, are included.
   d. Access restrictions are accurately reflected**.**
   e. Startup and testing times are as specified.
   f. Submittal review times are as specified.
2. In all other respects, Contractor's acceptance of Subcontractor's schedule indicates that, in Contractor's judgment, schedule represents reasonable plan for constructing Project in accordance with the Contract Documents. Contractor's review will not make any change in Contract requirements. Lack of comment on any aspect of schedule that is not in accordance with the Contract Documents will not thereby indicate acceptance of that change, unless Subcontractor has explicitly called the nonconformance to Contractor's attention in submittal. Schedule remains Subcontractor's responsibility and Subcontractor retains responsibility for performing all activities, for activity durations, and for activity sequences required to construct Project in accordance with the Contract Documents.

B. Unacceptable Preliminary Progress Schedule:

1. Make requested corrections; resubmit within 10 days.
2. Until acceptable to Contractor as Baseline Progress Schedule, continue review and revision process, during which time Subcontractor shall update schedule on a monthly basis to reflect actual progress and occurrences to date.

C. Unacceptable Detailed Progress Schedule:

1. Make requested corrections; resubmit within 10 days.
2. Until acceptable to Contractor as Baseline Progress Schedule, continue review and revision process.

D. Narrative Report: All changes to activity duration and sequences, including addition or deletion of activities subsequent to Contractor's acceptance of Baseline Progress Schedule, shall be delineated in Narrative Report current with proposed Updated Progress Schedule.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 33 00
SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 DEFINITIONS

A. Action Submittal: Written and graphic information submitted by Subcontractor that requires Contractor's approval.

B. Informational Submittal: Information submitted by Subcontractor that requires Contractor's review and determination that submitted information is in accordance with the Conditions of the Contract.

1.02 PROCEDURES

A. Direct submittals, except samples, in electronic format to Contractor at SharePoint website to be supplied by Contractor.

B. Direct sample submittals to the Contractor at the following, unless specified otherwise.

1. CH2M HILL
   135 South 84th Street, Suite 400
   Milwaukee, WI 53214
   Attn: Margaret Dombrowski

C. Transmittal of Submittal:

1. Subcontractor shall:
   a. Review each submittal and check for compliance with Contract Documents.
   b. Stamp each submittal with uniform approval stamp before submitting to Contractor.
      1) Stamp to include Project name, submittal number, Specification number, Subcontractor's reviewer name, date of Subcontractor's approval, and statement certifying submittal has been reviewed, checked, and approved for compliance with Contract Documents.
      2) Contractor will not review submittals that do not bear Subcontractor's approval stamp and will return them without action.
2. Complete, sign, and transmit with each submittal package, one Transmittal of Subcontractor's Submittal form attached at end of this section.

3. Identify each submittal with the following:
   a. Numbering and Tracking System:
      1) Sequentially number each submittal.
      2) Resubmission of submittal shall have original number with sequential alphabetic suffix.
   b. Specification section and paragraph to which submittal applies.
   c. Project title and Contractor's project number.
   d. Date of transmittal.
   e. Names of Subcontractor or Supplier, and manufacturer as appropriate.
4. Identify and describe each deviation or variation from Contract Documents.
5. All action and information submittals will be submitted electronically on a SharePoint site. SharePoint site address will be provided by Contractor.

D. Format:

1. Do not base Shop Drawings on reproductions of Contract Documents.
2. Package submittal information by individual Specification section. Do not combine different Specification sections together in submittal package, unless otherwise directed in Specification.
3. Present in a clear and thorough manner and in sufficient detail to show kind, size, arrangement, and function of components, materials, and devices, and compliance with Contract Documents.
4. Index with labeled tab dividers in orderly manner.

E. Timeliness: Schedule and submit in accordance Schedule of Submittals, and requirements of individual Specification sections.

F. Processing Time:

1. Time for review shall commence on Contractor's receipt of submittal.
2. Contractor will act upon Subcontractor's submittal and transmit response to Subcontractor not later than 30 days after receipt, unless otherwise specified.
3. Resubmittals will be subject to same review time.
4. No adjustment of Contract Times or Price will be allowed due to delays in progress of Work caused by rejection and subsequent resubmittals.

G. Resubmittals: Clearly identify each correction or change made.

H. Incomplete Submittals:

1. Contractor will return entire submittal for Subcontractor's revision if preliminary review deems it incomplete.
2. When any of the following are missing, submittal will be deemed incomplete:
   a. Subcontractor's review stamp; completed and signed.
   b. Transmittal of Subcontractor's Submittal; completed and signed.
   c. Insufficient number of copies.

I. Submittals not required by Contract Documents:

1. Will not be reviewed and will be returned stamped "Not Subject to Review."
2. Contractor will keep one copy and return submittal to Subcontractor.

1.03 ACTION SUBMITTALS

A. Prepare and submit Action Submittals required by individual Specification sections.

B. Shop Drawings:

1. Identify and Indicate:
   a. Applicable Contract Drawing and Detail number, products, units and assemblies, and system or equipment identification or tag numbers.
   b. Equipment and Component Title: Identical to title shown on Drawings.
   c. Critical field dimensions and relationships to other critical features of Work. Note dimensions established by field measurement.
   d. Project-specific information drawn accurately to scale.
2. Manufacturer's standard schematic drawings and diagrams as follows:
   a. Modify to delete information that is not applicable to the Work.
   b. Supplement standard information to provide information specifically applicable to the Work.
3. Product Data: Provide as specified in individual Specifications.
4. Foreign Manufacturers: When proposed, include following additional information:
   a. Names and addresses of at least two companies that maintain technical service representatives close to Project.
   b. Complete list of spare parts and accessories for each piece of equipment.

C. Samples:

1. Copies: Two, unless otherwise specified in individual Specifications.
2. Preparation: Mount, display, or package Samples in manner specified to facilitate review of quality. Attach label on unexposed side that includes the following:
   a. Manufacturer name.
   b. Model number.
   c. Material.
   d. Sample source.
3. Manufacturer's Color Chart: Units or sections of units showing full range of colors, textures, and patterns available.
4. Full-size Samples:
   a. Size as indicated in individual Specification section.
   b. Prepared from same materials to be used for the Work.
   c. Cured and finished in manner specified.
   d. Physically identical with product proposed for use.

D. Action Submittal Dispositions: Contractor will review, mark, stamp, and distribute as noted:

1. Approved:
   a. Subcontractor may incorporate product(s) or implement Work covered by submittal.
   b. Distribution:
      1) One file retained by Contractor.
      2) One file furnished to Contractor's onsite Representative.
      3) One file returned to Subcontractor appropriately annotated.
2. Approved as Noted:
   a. Subcontractor may incorporate product(s) or implement Work covered by submittal, in accordance with Contractor's notations.
   b. Distribution:
      1) One file retained by Contractor.
      2) One file furnished to Contractor's onsite Representative.
      3) One file returned to Subcontractor appropriately annotated.
3. Partial Approval, Resubmit as Noted:
   a. Make corrections or obtain missing portions, and resubmit.
   b. Except for portions indicated, Subcontractor may begin to incorporate product(s) or implement Work covered by submittal, in accordance with Contractor's notations.
   c. Distribution:
      1) One file retained by Contractor.
      2) One file furnished to Contractor's onsite Representative.
      3) One file returned to Subcontractor appropriately annotated.

4. Revise and Resubmit:
    a. Subcontractor may not incorporate product(s) or implement Work covered by submittal.
    b. Distribution:
        1) One file retained by Contractor.
        2) One file furnished to Contractor's onsite Representative.
        3) One file returned to Subcontractor appropriately annotated.

1.04 INFORMATIONAL SUBMITTALS

A. General:

1. Refer to individual Specification sections for specific submittal requirements.
2. Contractor will review each submittal. If submittal meets conditions of the Contract, Contractor will forward copy to appropriate parties. If Contractor determines submittal does not meet conditions of the Contract and is therefore considered unacceptable, Contractor will retain one file and return one file with review comments to Subcontractor, and require that submittal be corrected and resubmitted.

B. Application for Payment: In accordance with Section 01 29 00, Payment Procedures.

C. Certificates:

1. General:
    a. Provide notarized statement that includes signature of entity responsible for preparing certification.
    b. Signed by officer or other individual authorized to sign documents on behalf of that entity.
2. Welding: In accordance with individual Specification sections.
3. Installer: Prepare written statements on manufacturer's letterhead certifying installer complies with requirements as specified in individual Specification section.
4. Material Test: Prepared by qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements.
5. Certificates of Successful Testing or Inspection: Submit when testing or inspection is required by Laws and Regulations or governing agency or specified in individual Specification sections.

D. Construction Photographs: In accordance with Section 01 31 13, Project Coordination, and as may otherwise be required in Contract Documents.

E. Closeout Submittals: In accordance with Section 01 77 00, Closeout Procedures.

F. Subcontractor-design Data (related to temporary construction):

1. Written and graphic information.
2. List of assumptions.
3. List of performance and design criteria.
4. Summary of loads or load diagram, if applicable.
5. Calculations.
6. List of applicable codes and regulations.
7. Name and version of software.
8. Information requested in individual Specification section.

G. Manufacturer's Instructions: Written or published information that documents manufacturer's recommendations, guidelines, and procedures in accordance with individual Specification section.

H. Schedules:

1. Schedule of Submittals: Prepare separately or in combination with Progress Schedule as specified in Section 01 32 00, Construction Progress Documentation.
   a. Show for each, at a minimum, the following:
      1) Specification section number.
      2) Identification by numbering and tracking system as specified under Paragraph Transmittal of Submittal.
      3) Estimated date of submission to Contractor, including reviewing and processing time.
   b. On a weekly and monthly basis, submit updated schedule to Contractor if changes have occurred or resubmittals are required.
2. Schedule of Values: In accordance with Section 01 29 00, Payment Procedures.
3. Schedule of Estimated Progress Payments: In accordance with Section 01 29 00, Payment Procedures.

I. Special Guarantee: Supplier's written guarantee as required in individual Specification sections.

J. Statement of Qualification: Evidence of qualification, certification, or registration as required in Contract Documents to verify qualifications of professional land surveyor, engineer, materials testing laboratory, specialty Subcontractor, trade, Specialist, consultant, installer, and other professionals.

K. Submittals Required by Laws, Regulations, and Governing Agencies:

1. Promptly submit promptly notifications, reports, certifications, payrolls, and otherwise as may be required, directly to the applicable federal, state, or local governing agency or their representative.
2. Transmit to Contractor one copy of correspondence and transmittals (to include enclosures and attachments) between Subcontractor and governing agency.

L. Test, Evaluation, and Inspection Reports:

1. General: Shall contain signature of person responsible for test or report.
2. Factory:
   a. Identification of product and Specification section, type of inspection or test with referenced standard or code.
   b. Date of test, Project title and number, and name and signature of authorized person.
   c. Test results.
   d. If test or inspection deems material or equipment not in compliance with Contract Documents, identify corrective action necessary to bring into compliance.
   e. Provide interpretation of test results, when requested by Contractor.
   f. Other items as identified in individual Specification sections.
3. Field:
   a. As a minimum, include the following:
      1) Project title and number.
      2) Date and time.
      3) Record of temperature and weather conditions.
      4) Identification of product and Specification section.
      5) Type and location of test, Sample, or inspection, including referenced standard or code.
      6) Date issued, testing laboratory name, address, and telephone number, and name and signature of laboratory inspector.
      7) If test or inspection deems material or equipment not in compliance with Contract Documents, identify corrective action necessary to bring into compliance.
      8) Provide interpretation of test results, when requested by Contractor.
      9) Other items as identified in individual Specification sections.

1.05 SUPPLEMENTS

A. The supplements listed below, following “End of Section”, are part of this Specification.

1. Form: Transmittal of Subcontractor’s Submittal.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

TRANSMITTAL OF SUBCONTRACTOR'S SUBMITTAL

(ATTACH TO EACH SUBMITTAL)

CH2MHILL

DATE: _____

TO: _____

_____

_____

_____

_____

Submittal No.: _____

☐ New Submittal ☐ Resubmittal

Project: _____

Project No.: _____

Specification Section No.: _____

(Cover only one section with each transmittal)

Schedule Date of Submittal:

_____

FROM: _____

Subcontractor

_____

_____

_____

SUBMITTAL TYPE: ☐ Shop Drawing ☐ Sample ☐ Informational ☐ Deferred

The following items are hereby submitted:

Number of Copies	Description of Item Submitted (Type, Size, Model Number, Etc.)	Spec. and Para. No.	Drawing or Brochure Number	Contains Variation to Contract	
				No	Yes

Subcontractor hereby certifies that (i) Subcontractor has complied with the requirements of Contract Documents in preparation, review, and submission of designated Submittal and (ii) the Submittal is complete and in accordance with the Contract Documents and requirements of laws and regulations and governing agencies.

By: _____

Subcontractor (Authorized Signature)

SECTION 01 42 13
ABBREVIATIONS AND ACRONYMS

PART 1 GENERAL

1.01 REFERENCE TO STANDARDS AND SPECIFICATIONS OF TECHNICAL SOCIETIES

A. Reference to standards and specifications of technical societies and reporting and resolving discrepancies associated therewith shall be as provided in Article 3 of the General Conditions, and as may otherwise be required herein and in the individual Specification sections.

B. Work specified by reference to published standard or specification of government agency, technical association, trade association, professional society or institute, testing agency, or other organization shall meet requirements or surpass minimum standards of quality for materials and workmanship established by designated standard or specification.

C. Where so specified, products or workmanship shall also meet or exceed additional prescriptive or performance requirements included within Contract Documents to establish a higher or more stringent standard of quality than required by referenced standard.

D. Where two or more standards are specified to establish quality, product and workmanship shall meet or exceed requirements of most stringent.

E. Where both a standard and a brand name are specified for a product in Contract Documents, proprietary product named shall meet or exceed requirements of specified reference standard.

F. Copies of standards and specifications of technical societies:

1. Copies of applicable referenced standards have not been bound in these Contract Documents.
2. Where copies of standards are needed by Subcontractor, obtain a copy or copies directly from publication source and maintain in an orderly manner at the Site as Work Site records, available to Contractor’s personnel, Subcontractors, and Owner.

1.02 ABBREVIATIONS

A. Following is a list of abbreviations to which references may be made in the Contract Documents.

1.	AA	Aluminum Association
2.	AABC	Associated Air Balance Council
3.	AAMA	American Architectural Manufacturers Association
4.	AASHTO	American Association of State Highway and Transportation Officials
5.	ABMA	American Bearing Manufacturers' Association
6.	ACI	American Concrete Institute
7.	AEIC	Association of Edison Illuminating Companies
8.	AGA	American Gas Association
9.	AGMA	American Gear Manufacturers' Association
10.	AI	Asphalt Institute
11.	AISC	American Institute of Steel Construction
12.	AISI	American Iron and Steel Institute
13.	AITC	American Institute of Timber Construction
14.	ALS	American Lumber Standards
15.	AMCA	Air Movement and Control Association
16.	ANSI	American National Standards Institute
17.	APA	APA – The Engineered Wood Association
18.	API	American Petroleum Institute
19.	APWA	American Public Works Association
20.	AHRI	Air-Conditioning, Heating, and Refrigeration Institute
21.	ASA	Acoustical Society of America
22.	ASABE Biological	American Society of Agricultural and Engineers
23.	ASCE	American Society of Civil Engineers
24.	ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
25.	ASME	American Society of Mechanical Engineers
26.	ASNT	American Society for Nondestructive Testing
27.	ASSE	American Society of Sanitary Engineering
28.	ASTM	ASTM International
29.	AWI	Architectural Woodwork Institute
30.	AWPA	American Wood Preservers' Association
31.	AWPI	American Wood Preservers' Institute
32.	AWS	American Welding Society
33.	AWWA	American Water Works Association
34.	BHMA	Builders Hardware Manufacturers' Association

35.	CBM	Certified Ballast Manufacturer
36.	CDA	Copper Development Association
37.	CGA	Compressed Gas Association
38.	CISPI	Cast Iron Soil Pipe Institute
39.	CMAA	Crane Manufacturers' Association of America
40.	CRSI	Concrete Reinforcing Steel Institute
41.	CS	Commercial Standard
42.	CSA	Canadian Standards Association
43.	CSI	Construction Specifications Institute
44.	CY	Cubic Yard
45.	DIN	Deutsches Institut für Normung e.V.
46.	DIPRA	Ductile Iron Pipe Research Association
47.	EIA	Electronic Industries Alliance
48.	EJCDC	Engineers Joint Contract Documents' Committee
49.	ETL	Electrical Test Laboratories
50.	FAA	Federal Aviation Administration
51.	FCC	Federal Communications Commission
52.	FDA	Food and Drug Administration
53.	FEMA	Federal Emergency Management Agency
54.	FIPS	Federal Information Processing Standards
55.	FM	FM Global
56.	Fed. Spec.	Federal Specifications (FAA Specifications)
57.	FS	Federal Specifications and Standards (Technical Specifications)
58.	GA	Gypsum Association
59.	GANA	Glass Association of North America
60.	GLNPO	Great Lakes National Program Office
61.	HI	Hydraulic Institute
62.	HMI	Hoist Manufacturers' Institute
63.	IBC	International Building Code
64.	ICBO	International Conference of Building Officials
65.	ICC	International Code Council
66.	ICEA	Insulated Cable Engineers' Association
67.	IFC	International Fire Code
68.	IEEE	Institute of Electrical and Electronics Engineers, Inc.
69.	IESNA	Illuminating Engineering Society of North America
70.	IFI	Industrial Fasteners Institute
71.	IGMA	Insulating Glass Manufacturer's Alliance
72.	IMC	International Mechanical Code
73.	INDA	Association of the Nonwoven Fabrics Industry
74.	IPC	International Plumbing Code

75.	ISA	Instrumentation, Systems, and Automation Society
76.	ISO	International Organization for Standardization
77.	ITL	Independent Testing Laboratory
78.	JIC	Joint Industry Conferences of Hydraulic Manufacturers
79.	MIA	Marble Institute of America
80.	MIL	Military Specifications
81.	MMA	Monorail Manufacturers' Association
82.	MMSD	Milwaukee Metropolitan Sewerage District
83.	MSS	Manufacturer's Standardization Society
84.	NAAMM	National Association of Architectural Metal Manufacturers
85.	NACE	NACE International
86.	NBGQA	National Building Granite Quarries Association
87.	NEBB	National Environmental Balancing Bureau
88.	NEC	National Electrical Code
89.	NECA	National Electrical Contractors Association
90.	NEMA	National Electrical Manufacturers' Association
91.	NESC	National Electrical Safety Code
92.	NETA	InterNational Electrical Testing Association
93.	NFPA	National Fire Protection Association
94.	NHLA	National Hardwood Lumber Association
95.	NICET	National Institute for Certification in Engineering Technologies
96.	NIST	National Institute of Standards and Technology
97.	NRCA	National Roofing Contractors Association
98.	NRTL	Nationally Recognized Testing Laboratories
99.	NSF	NSF International
100.	NSPE	National Society of Professional Engineers
101.	NTMA	National Terrazzo and Mosaic Association
102.	NWWDA	National Wood Window and Door Association
103.	OSHA	Occupational Safety and Health Act (both Federal and State)
104.	PCB	Polychlorinated Biphenyl
105.	PCI	Precast/Prestressed Concrete Institute
106.	PEI	Porcelain Enamel Institute
107.	PPI	Plastic Pipe Institute
108.	PS	Product Standards Section-U.S. Department of Commerce
109.	RMA	Rubber Manufacturers' Association
110.	RUS	Rural Utilities Service
111.	SAE	SAE International
112.	SDI	Steel Deck Institute

113. SDI	Steel Door Institute
114. SJI	Steel Joist Institute
115. SMACNA	Sheet Metal and Air Conditioning Contractors National Association
116. SPI	Society of the Plastics Industry
117. SSPC	The Society for Protective Coatings
118. STI/SPFA	Steel Tank Institute/Steel Plate Fabricators Association
119. SWI	Steel Window Institute
120. TEMA	Tubular Exchanger Manufacturers' Association
121. TCA	Tile Council of North America
122. TIA	Telecommunications Industry Association
123. TSCA	Toxic Substance Control Act
124. UBC	Uniform Building Code
125. UFC	Uniform Fire Code
126. UL	Underwriters Laboratories Inc.
127. UMC	Uniform Mechanical Code
128. USBR	U.S. Bureau of Reclamation
129. USEPA	U.S. Environmental Protection Agency
130. WCLIB	West Coast Lumber Inspection Bureau
131. WDNR	Wisconsin Department of Natural Resources
132. WI	Wood Institute
133. WWPA	Western Wood Products Association

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 43 33
MANUFACTURERS' FIELD SERVICES

PART 1 GENERAL

1.01 DEFINITIONS

A. Person-Day: One person for 8 hours within regular Subcontractor working hours.

1.02 SUBMITTALS

A. Informational Submittals:

1. Training Schedule: Submit, in accordance with requirements of this Specification, not less than 21 days prior to start of equipment installation and revise as necessary for acceptance.
2. Lesson Plan: Submit, in accordance with requirements of this Specification, proposed lesson plan not less than 21 days prior to scheduled training and revise as necessary for acceptance.
3. Training Session Recordings: Furnish Contractor with two complete sets of recordings fully indexed and cataloged with printed label stating session and date recorded.

1.03 QUALIFICATION OF MANUFACTURER'S REPRESENTATIVE

A. Authorized representative of the manufacturer, factory trained, and experienced in the technical applications, installation, operation, and maintenance of respective equipment, subsystem, or system, with full authority by the equipment manufacturer to issue the certifications required of the manufacturer. Additional qualifications may be specified in the individual specification section.

B. Representative subject to acceptance by Contractor. No substitute representatives will be allowed unless prior written approval by such has been given.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 FULFILLMENT OF SPECIFIED MINIMUM SERVICES

A. Furnish manufacturers' services, when required by an individual specification section, to meet the requirements of this section.

B. Where time is necessary in excess of that stated in the Specifications for manufacturers' services, or when a minimum time is not specified, time required to perform specified services shall be considered incidental.

C. Schedule manufacturer' services to avoid conflict with other onsite testing or other manufacturers' onsite services.

D. Determine, before scheduling services, that conditions necessary to allow successful testing have been met.

E. Only those days of service approved by Contractor will be credited to fulfill specified minimum services.

F. When specified in individual specification sections, manufacturer's onsite services shall include:

1. Assistance during product (system, subsystem, or component) installation to include observation, guidance, instruction of Subcontractor's assembly, erection, installation or application procedures.
2. Inspection, checking, and adjustment as required for product (system, subsystem, or component) to function as warranted by manufacturer and necessary to furnish Manufacturer's Certificate of Proper Installation.
3. Providing, on a daily basis, copies of manufacturers' representatives field notes and data to Contractor.
4. Revisiting the Site as required to correct problems and until installation and operation are acceptable to Contractor.
5. Resolution of assembly or installation problems attributable to or associated with respective manufacturer's products and systems.
6. Assistance during functional and performance testing, and facility startup and evaluation.
7. Training of Subcontractor's personnel in the operation and maintenance of respective product as required.

3.02 MANUFACTURER'S CERTIFICATE OF COMPLIANCE

A. When so specified, a Manufacturer's Certificate of Compliance, a copy of which is attached to this section, shall be completed in full, signed by entity supplying the product, material, or service, and submitted prior to shipment of product or material or execution of the services.

B. Contractor may permit use of certain materials or assemblies prior to sampling and testing if accompanied by accepted certification of compliance.

C. Such form shall certify proposed product, material, or service complies with that specified. Attach supporting reference data, affidavits, and certifications as appropriate.

D. May reflect recent or previous test results on material or product, if acceptable to Contractor.

3.03 MANUFACTURER'S CERTIFICATE OF PROPER INSTALLATION

A. When so specified, a Manufacturer's Certificate of Proper Installation form, a copy of which is attached to this section, shall be completed and signed by equipment manufacturer's representative.

B. Such form shall certify signing party is a duly authorized representative of manufacturer, is empowered by manufacturer to inspect, approve, and operate their equipment and is authorized to make recommendations required to ensure equipment is complete and operational.

3.04 TRAINING

A. General:

1. Furnish manufacturers' representatives for detailed classroom and hands-on training to Contractor's personnel on operation and maintenance of specified product (system, subsystem, component) and as may be required in applicable Specifications.
2. Furnish trained, articulate personnel to coordinate and expedite training, to be present during training coordination meetings with Subcontractor, and familiar with operation and maintenance.
3. Manufacturer's representative shall be familiar with facility operation and maintenance requirements as well as with specified equipment.
4. Furnish complete training materials, to include operation and maintenance data, to be retained by each trainee.

B. Training Schedule:

1. List specified equipment and systems that require training services and show:
   a. Respective manufacturer.
   b. Estimated dates for installation completion.
   c. Estimated training dates.
2. Allow for multiple sessions when several shifts are involved.

3. Adjust schedule to ensure training of appropriate personnel as deemed necessary by Contractor, and to allow full participation by manufacturers' representatives. Adjust schedule for interruptions in operability of equipment.

C. Prestartup Training:

1. Coordinate training sessions with Contractor and Manufacturer's Representatives, and with submission of operation and maintenance manuals.
2. Complete at least 14 days prior to beginning of facility startup.

D. Post-startup Training: If required in the Specifications, furnish and coordinate training of Contractor's operating personnel by respective manufacturer's representatives.

3.05 SUPPLEMENTS

A. The supplements listed below, following "End of Section", are part of this Specification.

1. Form: Manufacturer's Certificate of Compliance.
2. Form: Manufacturer's Certificate of Proper Installation.

END OF SECTION

MANUFACTURER'S CERTIFICATE OF COMPLIANCE

OWNER: USEPA_____

PROJECT NAME: _____

PROJECT NO: _____

PRODUCT, MATERIAL, OR SERVICE SUBMITTED: _____

Comments: _____

_____

_____

_____

_____

_____

I hereby certify that the above-referenced product, material, or service called for by the Contract for the named Project will be furnished in accordance with all applicable requirements. I further certify that the product, material, or service are of the quality specified and conform in all respects with the Contract requirements, and are in the quantity shown.

Date of Execution: _____, 20___

Manufacturer: _____

Manufacturer's Authorized Representative *(print)*: _____

_____

(Authorized Signature)

MANUFACTURER'S CERTIFICATE OF PROPER INSTALLATION

OWNER: USEPA_____ EQPT SERIAL NO: _____

EQPT TAG NO: _____ EQPT/SYSTEM: _____

PROJECT NO: _____ SPEC. SECTION: _____

I hereby certify that the above-referenced equipment/system has been:

(Check Applicable)

☐ Installed in accordance with Manufacturer's recommendations.

☐ Inspected, checked, and adjusted.

☐ Serviced with proper initial lubricants.

☐ Electrical and mechanical connections meet quality and safety standards.

☐ All applicable safety equipment has been properly installed.

☐ Functional tests.

☐ System has been performance tested, and meets or exceeds specified performance requirements. (When complete system of one manufacturer)

Note: Attach any performance test documentation from manufacturer.

Comments: _____

_____

_____

_____

I, the undersigned Manufacturer's Representative, hereby certify that I am (i) a duly authorized representative of the manufacturer, (ii) empowered by the manufacturer to inspect, approve, and operate their equipment and (iii) authorized to make recommendations required to ensure equipment furnished by the manufacturer is complete and operational, except as may be otherwise indicated herein. I further certify that all information contained herein is true and accurate.

Date: _____, 20___

Manufacturer:_____

By Manufacturer's Authorized Representative: _____

(Authorized Signature)

SECTION 01 45 16.13
SUBCONTRACTOR QUALITY CONTROL

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this Section:

1. ASTM International (ASTM):
   a. D3740, Evaluation of Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
   b. E329, Use in the Evaluation of Testing and Inspection Agencies as Used in Construction.

1.02 DEFINITIONS

A. Subcontractor Quality Control (SQC): The means by which Subcontractor ensures that the construction, to include that performed by subcontractors and suppliers, complies with the requirements of the Contract.

1.03 SUBMITTALS

A. Informational Submittals:

1. SQC Plan: Submit, not later than 30 days after receipt of Notice to Proceed.
2. SQC Report: Submit, weekly, an original and one copy in report form.

1.04 CONTRACTOR'S QUALITY ASSURANCE

A. All Work is subject to Contractor's quality assurance inspection and testing at all locations and at all reasonable times before acceptance to ensure strict compliance with the terms of the Contract Documents.

B. Contractor's quality assurance inspections and tests are for the sole benefit of Contractor and do not:

1. Relieve Subcontractor of responsibility for providing adequate quality control measures;
2. Relieve Subcontractor of responsibility for damage to or loss of the material before acceptance;
3. Constitute or imply acceptance; or
4. Affect the continuing rights of USEPA after acceptance of the completed Work.

C. The presence or absence of a quality assurance inspector does not relieve Subcontractor from any Contract requirement.

D. Promptly furnish all facilities, labor, and material reasonably needed for performing such safe and convenient inspections and tests as may be required by Contractor.

E. Contractor may charge Subcontractor for any additional cost of inspection or test when Work is not ready at the time specified by Subcontractor for inspection or test, or when prior rejection makes re-inspection or retest necessary. Quality assurance inspections and tests will be performed in a manner that will not unnecessarily delay the Work.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. Maintain an adequate inspection system and perform such inspections as will ensure that the Work conforms to the Contract Documents.

B. Maintain complete inspection records and make them available at all times to USEPA, WDNR, Milwaukee County and Contractor.

C. The quality control system shall consist of plans, procedures, and organization necessary to produce an end product that complies with the Contract Documents. The system shall cover all construction and demolition operations, both onsite and offsite, including Work by subcontractors, fabricators, suppliers and purchasing agents, and shall be keyed to the proposed construction sequence.

3.02 COORDINATION MEETING

A. After the Preconstruction Conference, but before start of construction, and prior to acceptance of the SQC Plan, schedule a meeting with USEPA, WDNR, Milwaukee County and Contractor to discuss the quality control system.

B. Develop a mutual understanding of the system details, including the forms for recording the SQC operations, control activities, testing, administration of the system for both onsite and offsite Work, and the interrelationship of Subcontractor’s management and control with the Contractor’s Quality Assurance.

C. There may be occasions when subsequent conferences may be called by either party to reconfirm mutual understandings and/or address deficiencies in the SQC system or procedures that may require corrective action by Subcontractor.

3.03 QUALITY CONTROL ORGANIZATION

A. SQC System Manager:

1. Designate an individual within Subcontractor's organization who will be responsible for overall management of SQC and have the authority to act in SQC matters for the Subcontractor.
2. SQC System Manager may perform other duties on the Project.
3. SQC System Manager shall be an experienced construction person, with a minimum of 3 years construction experience on similar type Work.
4. SQC System Manager shall report to the Subcontractor's project manager or someone higher in the organization. Project manager in this context shall mean the individual with responsibility for the overall quality and production management of the Project.
5. SQC System Manager shall be onsite during construction; periods of absence may not exceed 2 weeks at any one time.
6. Identify an alternate for SQC System Manager to serve with full authority during the System Manager's absence. The requirements for the alternate will be the same as for designated SQC System Manager.

B. SQC Staff:

1. Designate a SQC staff, available at the Site at all times during progress, with complete authority to take any action necessary to ensure compliance with the Contract. SQC staff members shall be subject to acceptance by Contractor.
2. SQC staff shall take direction from SQC System Manager in matters pertaining to QC.
3. SQC staff must be of sufficient size to ensure adequate QC coverage of Work phases, work shifts, and work crews involved in the construction. These personnel may perform other duties, but must be fully qualified by experience and technical training to perform their assigned QC responsibilities and must be allowed sufficient time to carry out these responsibilities.
4. The actual strength of the SQC staff may vary during any specific Work period to cover the needs of the Project. Add additional staff when necessary for a proper SQC organization.

C. Organizational Changes: Obtain Contractor's acceptance before replacing any member of the SQC staff. Requests for changes shall include name, qualifications, duties, and responsibilities of the proposed replacement.

3.04 QUALITY CONTROL PHASING

A. SQC shall include at least three phases of control to be conducted by SQC System Manager for all definable features of Work, as follows:

1. Preparatory Phase:
   a. Notify Contractor at least 48 hours in advance of beginning any of the required action of the preparatory phase.
   b. This phase shall include a meeting conducted by the SQC System Manager and attended by the superintendent, other SQC personnel (as applicable), and the foreman responsible for the definable feature. The SQC System Manager shall instruct applicable SQC staff as to the acceptable level of workmanship required in order to meet Contract requirements.
   c. Document the results of the preparatory phase meeting by separate minutes prepared by the SQC System Manager and attached to the QC report.
   d. Perform prior to beginning Work on each definable feature of Work:
      1) Review applicable Contract Specifications.
      2) Review applicable Contract Drawings.
      3) Verify that all materials and/or equipment have been tested, submitted, and approved.
      4) Verify that provisions have been made to provide required control inspection and testing.
      5) Examine the Work area to verify that all required preliminary Work has been completed and is in compliance with the Contract.
      6) Perform a physical examination of required materials, equipment, and sample Work to verify that they are on hand, conform to approved Shop Drawing or submitted data, and are properly stored.
      7) Review the appropriate activity hazard analysis to verify safety requirements are met.
      8) Review procedures for constructing the Work, including repetitive deficiencies.
      9) Document construction tolerances and workmanship standards for that phase of the Work.
      10) Check to verify that the plan for the Work to be performed, if so required, has been accepted by Contractor.

2. Initial Phase:
   a. Accomplish at the beginning of a definable feature of Work:
      1) Notify Contractor at least 48 hours in advance of beginning the initial phase.
      2) Perform prior to beginning Work on each definable feature of Work:
         a) Review minutes of the preparatory meeting.
         b) Check preliminary Work to verify compliance with Contract requirements.
         c) Verify required control inspection and testing.
         d) Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Comparison with sample panels is appropriate.
         e) Resolve all differences.
         f) Check safety to include compliance with and upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.
      3) Separate minutes of this phase shall be prepared by the SQC System Manager and attached to the QC report. Exact location of initial phase shall be indicated for future reference and comparison with follow-up phases.
      4) The initial phase should be repeated for each new crew to work onsite, or any time acceptable specified quality standards are not being met.
3. Follow-up Phase:
   a. Perform daily checks to verify continuing compliance with Contract requirements, including control testing, until completion of the particular feature of Work.
   b. Daily checks shall be made a matter of record in the SQC documentation and shall document specific results of inspections for all features of Work for the day or shift.
   c. Conduct final follow-up checks and correct all deficiencies prior to the start of additional features of Work that will be affected by the deficient Work. Constructing upon or concealing nonconforming Work will not be allowed.
4. Additional Preparatory and Initial Phases: Additional preparatory and initial phases may be conducted on the same definable features of Work as determined by Contractor if the quality of ongoing Work is unacceptable; or if there are changes in the applicable QC staff or in the onsite production supervision or work crew; or if work on a definable feature is resumed after a substantial period of inactivity, or if other problems develop.

3.05 CONTRACTOR QUALITY CONTROL PLAN

A. General:

1. Plan shall identify personnel, procedures, control, instructions, test, records, and forms to be used.
2. An interim plan for the first 30 days of operation will be considered.
3. Construction will be permitted to begin only after acceptance of the SQC Plan or acceptance of an interim plan applicable to the particular feature of Work to be started.
4. Work outside of the features of Work included in an accepted interim plan will not be permitted to begin until acceptance of a SQC Plan or another interim plan containing the additional features of Work to be started.

B. Content:

1. Plan shall cover the intended SQC organization for the entire Contract and shall include the following, as a minimum:
   a. Organization: Description of the quality control organization, including a chart showing lines of authority and acknowledgment that the SQC staff will implement the three-phase control system (see Paragraph QC Phasing) for all aspects of the Work specified.
   b. SQC Staff: The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a QC function.
   c. Letters of Authority: A copy of a letter to the SQC System Manager signed by an authorized official of the firm, describing the responsibilities and delegating sufficient authorities to adequately perform the functions of the SQC System Manager, including authority to stop Work which is not in compliance with the Contract. The SQC System Manager shall issue letters of direction to all other various quality control representatives outlining duties, authorities and responsibilities. Copies of these letters will also be furnished to Contractor.
   d. Submittals: Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, offsite fabricators, suppliers and purchasing agents.
   e. Testing: Control, verification and acceptance testing procedures for each specific test to include the test name, frequency, specification paragraph containing the test requirements, the personnel and laboratory responsible for each type of test, and an estimate of the number of tests required.

f. Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests, including documentation.
g. Procedures for tracking deficiencies from identification through acceptable corrective action. These procedures will establish verification that identified deficiencies have been corrected.
h. Reporting procedures, including proposed reporting formats; include a copy of the SQC report form.

C. Acceptance of Plans: Acceptance of the Subcontractor's basic and addendum SQC plans is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction. Contractor reserves the right to require Subcontractor to make changes in the SQC plan and operations including removal of personnel, as necessary, to obtain the quality specified.

D. Notification of Changes: After acceptance of the SQC plan, Subcontractor shall notify Contractor, in writing, a minimum of 7 calendar days prior to any proposed change. Proposed changes are subject to acceptance by Contractor.

3.06 SUBCONTRACTOR QUALITY CONTROL REPORT

A. As a minimum, prepare a SQC report for every 7 calendar days. Account for all days throughout the life of the Contract. Reports shall be signed and dated by SQC System Manager. Include copies of test reports and copies of reports prepared by QC staff.

B. Maintain current records of quality control operations, activities, and tests performed, including the Work of subcontractors and suppliers.

C. Records shall be on an acceptable form and shall be a complete description of inspections, the results of inspections, daily activities, tests, and other items, including but not limited to the following:

1. Subcontractor/sub-subcontractor and their areas of responsibility.
2. Operating plant/equipment with hours worked, idle, or down for repair.
3. Work performed today, giving location, description, and by whom. When a network schedule is used, identify each phase of Work performed each day by activity number.
4. Test and/or control activities performed with results and references to specifications/plan requirements. The control phase should be identified (Preparatory, Initial, Follow-up). List deficiencies noted along with corrective action.
5. Material received with statement as to its acceptability and storage.
6. Identify submittals reviewed, with Contract reference, by whom, and action taken.

7. Offsite surveillance activities, including actions taken.
8. Job safety evaluations stating what was checked, results, and instructions or corrective actions.
9. List instructions given/received and conflicts in Drawings and/or Specifications.
10. Contractor's verification statement.
11. Indicate a description of trades working on the Project; the number of personnel working; weather conditions encountered; and any delays encountered.
12. These records shall cover both conforming and deficient features and shall include a statement that equipment and materials incorporated in file work and workmanship comply with the Contract.

3.07 SUBMITTAL QUALITY CONTROL

A. Submittals shall be as specified in Section 01 33 00, Submittal Procedures. The SQC organization shall be responsible for certifying that all submittals are in compliance with the Contract requirements. Contractor will furnish copies of test report forms upon request by Subcontractor. Subcontractor may use other forms as approved.

3.08 TESTING QUALITY CONTROL

A. Testing Procedure:

1. Perform tests specified or required to verify that control measures are adequate to provide a product which conforms to Contract requirements. Perform the following activities and record the following data:
   a. Verify testing procedures comply with contract requirements.
   b. Verify facilities and testing equipment are available and comply with testing standards.
   c. Check test instrument calibration data against certified standards.
   d. Verify recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.
   e. Documentation:
      1) Record results of all tests taken, both passing and failing, on the SQC report for the date taken.
      2) Include specification paragraph reference, location where tests were taken, and the sequential control number identifying the test.
      3) Actual test reports may be submitted later, if approved by Contractor, with a reference to the test number and date taken.

4) Provide directly to Contractor an information copy of tests performed by an offsite or commercial test facility. Test results shall be signed by an engineer registered in the state where the tests are performed.
5) Failure to submit timely test reports, as stated, may result in nonpayment for related Work performed and disapproval of the test facility for this Contract.

B. Testing Laboratories: Laboratory facilities, including personnel and equipment, utilized for testing soils, concrete, asphalt and steel shall meet criteria detailed in ASTM D3740 and ASTM E329, and be accredited by the American Association of Laboratory Accreditation (AALA), National Institute of Standards and Technology (NIST), National Voluntary Laboratory Accreditation Program (NVLAP), the American Association of State Highway and Transportation Officials (AASHTO), or other approved national accreditation authority. Personnel performing concrete testing shall be certified by the American Concrete Institute (ACI).

3.09 COMPLETION INSPECTION

A. SQC System Manager shall conduct an inspection of the Work at the completion of all Work or any milestone established by a completion time stated in the Contract.

B. Punchlist:

1. SQC System Manager shall develop a punchlist of items which do not conform to the Contract requirements.
2. Include punchlist in the SQC report, indicating the estimated date by which the deficiencies will be corrected.
3. SQC System Manager or staff shall make a second inspection to ascertain that all deficiencies have been corrected and so notify the Contractor.
4. These inspections and any deficiency corrections required will be accomplished within the time stated for completion of the entire Work or any particular increment thereof if the Project is divided into increments by separate completion dates.

END OF SECTION

SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Nursery and Landscape Association (ANLA): American Standards for Nursery Stock.
2. Federal Emergency Management Agency (FEMA).
3. National Fire Prevention Association (NFPA): 241, Standard for Safeguarding Construction, Alteration, and Demolition Operations.
4. Telecommunications Industry Association (TIA): 568-C, Commercial Building Telecommunications Cabling Standard.
5. U.S. Department of Agriculture (USDA): Urban Hydrology for Small Watersheds.
6. U.S. Weather Bureau: Rainfall-Frequency Atlas of the U.S. for Durations from 30 Minutes to 24 Hours and Return Periods from 1 to 100 Years.

1.02 SUBMITTALS

A. Informational Submittals:

1. Copies of permits and approvals for construction as required by Laws and Regulations and governing agencies. Permits to be obtained by Contractor include:
   a. USACE Section 404/401.
   b. WDNR Chapter 30.
   c. WDNR WPDES Individual Wastewater Permit.
   d. WDNR WPDES General Stormwater Permit.
   e. City of Milwaukee Stormwater Permit.
   f. City of Glendale Stormwater Permit.
   g. Milwaukee County Construction / Right of Entry Permit.
2. Temporary Utility Submittals: Electric power supply and distribution plans.
3. Temporary Construction Submittals:
   a. Access Roads: Routes, cross-sections, and drainage facilities.
   b. Parking area plans.
   c. Subcontractor’s field office, storage yard, and storage building plans, including gravel surfaced area.
   d. Fencing and protective barrier locations and details.

e. Staging and a contamination area location plan.
f. Traffic and Routing Plan: As specified herein, and proposed revisions thereto.

4. Temporary Control Submittals:
   a. Dust control plan.
   b. Noise control plan.
   c. Plan for disposal of waste materials and intended haul routes.

1.03 MOBILIZATION

A. Mobilization shall include, but not be limited to, these principal items:

1. Obtaining required permits.
2. Moving Subcontractor's field office and equipment required for first month operations onto Site.
3. Installing temporary construction power, wiring, and lighting facilities.
4. Providing onsite communication facilities, including telephones.
5. Providing onsite sanitary facilities and potable water facilities as specified and as required by Laws and Regulations, and governing agencies.
6. Arranging for and erection of Subcontractor's work and staging areas.
7. Posting OSHA required notices and establishing safety programs and procedures.
8. Having Subcontractor's superintendent at Site full time.

B. Use area designated for Subcontractor's temporary facilities as shown on Drawings.

1.04 PROTECTION OF WORK AND PROPERTY

A. Keep Contractor informed of serious onsite accidents and related claims.

B. Use of Explosives: No blasting or use of explosives will be allowed onsite.

C. Subcontractor shall provide 24-hour site security.

1.05 VEHICULAR TRAFFIC

A. Traffic Routing Plan: Show sequences of construction affecting use of roadways, time required for each phase of the Work, provisions for decking over excavations and phasing of operations to provide necessary access, and plans for signing, barricading, and striping to provide passages for pedestrians and vehicles.

PART 2 PRODUCTS

2.01 CONTRACTOR'S FIELD OFFICE

A. Furnish equipment specified for exclusive use of Contractor and its representatives.

B. Ownership of equipment furnished under this article will remain, unless otherwise specified, that of Subcontractor.

C. Equipment furnished shall be new or like new in appearance and function.

D. Minimum Features:

1. 110-volt lighting and wall plugs.
2. Fluorescent ceiling lights.
3. Electric heating and self-contained air conditioning unit, properly sized for Project locale and conditions. Provide ample electric power to operate installed systems.
4. Railed stairways and landings at entrances.
5. Sign on entrance door reading CH2M HILL, INC., letter height 4 inches minimum.
6. Exterior Door(s):
   a. Number: Two.
   b. Type: Solid core.
   c. Lock(s): Cylindrical; keyed alike.
7. Number of Windows: At least seven.
8. Minimum Interior Height: 8 feet.

E. Trailer Type Mobile Structure: One.

F. Floor Space: Minimum 720 square feet.

G. All-metal frame; all-metal exterior, sides, and roof; and insulated double walls, floor, and roof.

H. Security guard screens on windows.

I. Number of Private Offices: Two, 12 feet by 12 feet.

J. Storage Room: One, 6 feet by 8 feet, with door with cylinder lock, keyed differently than exterior door locks. Provide two sets of keys.

K. Shelving in Storage Room: 72 linear feet, 18 inches deep.

L. Blinds or drapes on windows.

M. Work Surface: Two, one in each office, 30 inches by 12 feet at desk height of 29 inches from floor.

N. Office Equipment—General:

1. Bottled Water Service: One, with cooler capable of producing cold water.
2. Paper Towel Dispenser with Towels: One.
3. Desk Chair: Six, with the following characteristics:
   a. Five castor base.
   b. Adjustable height.
   c. Swivels.
   d. Locking Back.
   e. Adjustable seat back for height and angle.
   f. Adjustable arms.
4. Folding Table: Two, 36 inches by 96 inches.
5. Steel Folding Chairs: Ten.
6. Drafting Table: One, 3 feet by 6 feet.
7. Drafting Stool: One, swivel, with back support.
8. Wastepaper Basket: Three.
9. Dry Erase Whiteboard: One, 48 inches wide by 72 inches long.
10. Dry Erase Markers: Twelve, various colors with two erasers.
11. First-Aid Kit: One.
12. Tri-Class (ABC), Dry Chemical Fire Extinguisher, 10-Pound: Three.
13. Telephone: Two, with one intercom line and two incoming/outgoing lines, Touch-Tone, with conference speaker, and 12-foot coiled handset cord.
14. Digital Answering Machine: AT&T; Model 1739.
15. Facsimile (Fax) Machine: Brother 1030E with connecting cables.
16. Konica Minolta Bizhub 420 Digital Copier System (b/w only):
   a. Reversing Automatic Document Feeder.
   b. Image Controller.
   c. 50-Sheet Stapling/Sorting Finisher.
   d. Large Capacity Paper Tray.
   e. Super G3 Fax Kit.
   f. Power Line/Fax Line Surge Protection.
   g. Include 2 Black Toners.

2.02 USEPA/WDNR'S FIELD OFFICE

A. Furnish equipment specified for exclusive use of Contractor and its representatives.

B. Ownership of equipment furnished under this article will remain, unless otherwise specified, that of Subcontractor.

C. Equipment furnished shall be new or like new in appearance and function.

D. Minimum Features:

1. 110-volt lighting and wall plugs.
2. Fluorescent ceiling lights.
3. Electric heating and self-contained air conditioning unit, properly sized for Project locale and conditions. Provide ample electric power to operate installed systems.
4. Railed stairways and landings at entrances.
5. Sign on entrance door reading CH2M HILL, INC., letter height 4 inches minimum.
6. Exterior Door(s):
   a. Number: Two.
   b. Type: Solid core.
   c. Lock(s): Cylindrical ; keyed alike.
7. Number of Windows: At least seven.
8. Minimum Interior Height: 8 feet.

E. Trailer Type Mobile Structure: One.

F. Floor Space: Minimum 720 square feet.

G. All-metal frame; all-metal exterior, sides, and roof; and insulated double walls, floor, and roof.

H. Security guard screens on windows.

I. Number of Private Offices: Two, 12 feet by 12 feet.

J. Storage Room: One, 6 feet by 8 feet, with door with cylinder lock, keyed differently than exterior door locks. Provide two sets of keys.

K. Shelving in Storage Room: 72 linear feet, 18 inches deep.

L. Blinds or drapes on windows.

M. Work Surface: Two, one in each office, 30 inches by 12 feet at desk height of 29 inches from floor.

N. Office Equipment—General:

1. Bottled Water Service: One, with cooler capable of producing cold water.
2. Paper Towel Dispenser with Towels: One.
3. Desk Chair: Six, with the following characteristics:

a. Five castor base.
b. Adjustable height.
c. Swivels.
d. Locking Back.
e. Adjustable seat back for height and angle.
f. Adjustable arms.

4. Folding Table: Two, 36 inches by 96 inches.
5. Steel Folding Chairs: Ten.
6. Drafting Table: One, 3 feet by 6 feet.
7. Drafting Stool: One, swivel, with back support.
8. Wastepaper Basket: Three.
9. Dry Erase Whiteboard: One, 48 inches wide by 72 inches long.
10. Dry Erase Markers: Twelve, various colors with two erasers.
11. First-Aid Kit: One.
12. Tri-Class (ABC), Dry Chemical Fire Extinguisher, 10-Pound: Three.
13. Telephone: Two, with one intercom line and two incoming/outgoing lines, Touch-Tone, with conference speaker, and 12-foot coiled handset cord.
14. Digital Answering Machine: AT&T; Model 1739.

2.03 PROJECT SIGN

A. Provide and maintain one, 8-foot-wide by 4-foot-high sign constructed of 3/4-inch exterior high density overlaid plywood. Sign shall bear name of Project, Owner, Subcontractor, Contractor, and other participating agencies. Lettering shall be blue applied on a white background by an experienced sign painter. Paint shall be exterior type enamel. Information to be included will be provided by Contractor.

PART 3 EXECUTION

3.01 CONTRACTOR'S AND USEPA/WDNR'S FIELD OFFICE

A. Locate where directed by Contractor; level, block, tie down, skirt, provide stairways, and relocate when necessary and approved. Construct on proper foundations, and provide proper surface drainage and connections for utility services.

B. Provide minimum 100 square feet of gravel or crushed rock base, minimum depth of 4 inches, at each entrance.

C. Raise grade under field office, as necessary, to elevation adequate to avoid flooding.

D. Provide sanitary facilities in compliance with state and local health authorities.

E. Exterior Door Keys: Furnish two sets of keys.

F. Telephone:

1. Provide number of incoming lines equal to that specified for telephone type.
2. Provide separate analog fax line.
3. Provide appropriate jacks; locate as directed by Contractor.
4. Provide wiring necessary for complete telephone system.

G. Telecommunications:

1. Provide broad band internet connection with minimum of five live portable computer (PC) ports.
2. Provide appropriate jacks, CAT-5 patch cords, wiring, and equipment required for a complete telecommunications system.
3. Arrange and provide for telecommunication service for use during construction. Pay costs of installation, maintenance, and monthly service of internet connection until contract closeout.

H. Maintain in good repair and appearance, and provide weekly cleaning service and replenishment, as required, of paper towels, paper cups, hand soap, toilet paper, first-aid kit supplies, and bottled water.

I. Replenish, as needed, facsimile paper, duplicator paper and toner, computer paper, and printer toner.

J. Setup and provide monthly electric, telephone and internet service to Contractor’s trailer for the duration of the contract period. Telephone service shall include local and long distance.

3.02 TEMPORARY UTILITIES

A. Power:

1. No electric power is available at Site. Make arrangements to obtain and pay for electrical power used until final payment and acceptance by Contractor, unless otherwise recommended by Contractor at Substantial Completion.
2. Cost of electric power will be borne by Subcontractor.

B. Lighting: Provide temporary lighting to meet applicable safety requirements to allow erection, application, or installation of materials and equipment, and observation or inspection of the Work.

C. Water:

1. No construction or potable water is available at Site. Make arrangements for and bear costs of providing water required for construction purposes and for drinking by construction personnel during construction.
2. Hydrant Water:
    a. Is available from nearby hydrants. Secure written permission for connection and use from water department and meet requirements for use. Notify fire department before obtaining water from fire hydrants.
    b. Use only special hydrant-operating wrenches to open hydrants. Make certain hydrant valve is open full, since cracking valve causes damage to hydrant. Repair damaged hydrants and notify appropriate agency as quickly as possible. Hydrants shall be completely accessible to fire department at all times.
    c. Include costs to connect and transport water to construction areas in Contract Price.

D. Sanitary and Personnel Facilities:

1. Provide and maintain facilities for Contractor's employees, Subcontractors, and other onsite employers' employees. Service, clean, and maintain facilities and enclosures.
2. Provide in Compliance with State and Local Health Authorities: Sanitary facilities to include a portable hand-wash station.

E. Electric, Telephone and Internet Service:

1. Subcontractor: Arrange and provide onsite electric, telephone and internet service for Owner and Contractor use during construction. Pay costs of installation and removal and monthly bills until contract closeout.

F. Fire Protection: Furnish and maintain on Site adequate firefighting equipment capable of extinguishing incipient fires. Comply with applicable parts of NFPA 241.

3.03 PROTECTION OF WORK AND PROPERTY

A. General:

1. Perform Work within right-of-way and easements in a systematic manner that minimizes inconvenience to property owners and the public.
2. Maintain in continuous service existing oil and gas pipelines, underground power, telephone or communication cable, water mains, irrigation lines, sewers, poles and overhead power, and other utilities encountered a long line of the Work, unless other arrangements satisfactory to owners of said utilities have been made.
3. Where completion of the Work requires temporary or permanent removal or relocation of existing utility, coordinate activities with owner of said utility and perform work to their satisfaction.
4. Protect, shore, brace, support, and maintain underground pipes, conduits, drains, and other underground utility construction uncovered or otherwise affected by construction operations.
5. Keep fire hydrants and water control valves free from obstruction and available for use at all times.
6. In areas where Subcontractor's operations are adjacent to or near a utility, such as gas, telephone, television, electric power, water, sewer, or irrigation system, and such operations may cause damage or inconvenience, suspend operations until arrangements necessary for protection have been made by Subcontractor.
7. Notify property owners and utility offices that may be affected by construction operation at least 2 days in advance: Before exposing a utility, obtain utility owner's permission. Should service of utility be interrupted due to Subcontractor's operation, notify proper authority immediately. Cooperate with said authority in restoring service as promptly as possible and bear costs incurred.
8. Do not impair operation of existing sewer system. Prevent construction material, pavement, concrete, earth, volatile and corrosive wastes, and other debris from entering sewers, pump stations, or other sewer structures.

B. Site Security:

1. Erect a temporary security (plastic orange safety) fence at locations shown on Drawings.
2. 24-hour site security shall patrol entire project area.

C. Barricades and Lights:

1. Provided by the City of Glendale and to be maintained by the Subcontractor for closure of Milwaukee River Parkway during construction activities.
2. Maintain as necessary to prevent unauthorized entry to construction areas and affected roads, streets, and alleyways, inside and outside of

fenced area, and as required to ensure public safety and the safety of Subcontractor's employees, other employer's employees, and others who may be affected by the Work.

3. Protect streets, roads, highways, and other public thoroughfares that are closed to traffic by effective barricades with acceptable warning signs.
4. Locate barricades at the nearest intersecting public thoroughfare on each side of blocked section.
5. Illuminate barricades and obstructions with warning lights from sunset to sunrise.

D. Existing Structures:

1. Where Subcontractor contemplates removal of small structures such as mailboxes, signposts, and culverts that interfere with Subcontractor's operations, obtain approval of property owner and Contractor.
2. Replace items removed in their original location and a condition equal to or better than original.

E. Archaeological Finds:

1. General: Should finds of an archaeological or paleontological nature be made within Site limits, immediately notify Contractor and proceed in accordance with General Conditions. Continue the Work in other areas without interruption.
2. Archaeological Finds: Evidence of human occupation or use of an area within contract limits.
3. Paleontological Finds: Evidence of prehistoric plant or animal life, such as skeletons, bones, fossils, or casts and other indications such as pictographs.
4. Contractor may order the Work stopped in other areas if, in Contractor's opinion, find is more extensive than may appear from uncovered material.
5. Protection of Finds:
    a. Cover, fence, or otherwise protect finds until notice to resume the Work is given.
    b. Cover finds with plastic film held in place by earth, rocks, or other weights placed outside the find. Should additional backfilling be necessary for safety or to prevent caving, place backfill material loosely over plastic film.
    c. Sheet or shore as necessary to protect excavations underway. Place temporary fence to prevent unauthorized access.
    d. Dewater finds made below water table as necessary to protect construction Work underway. Divert groundwater or surface runoff away from find by ditching or other acceptable means.
6. Removal of Finds:

a. Finds are property of Milwaukee County. Do not remove or disturb finds without Contractor's written authorization.
b. Should Milwaukee County elect to have a find removed, provide equipment, labor, and material to permit safe removal of find without damage. Provide transportation for delivery to individuals, institutions, or other places as Milwaukee County may find desirable, expedient, or required by law.

3.04 TEMPORARY CONTROLS

A. Actions for Protecting Butler's Garter Snake Habitat: Install trenched-in silt fencing just outside the wetland boundary to prevent snakes from entering the project site once snakes emerge from hibernation (March 16). The fence shall encompass the construction site on all sides up to 300 feet from any snake overwintering wetlands in order to avoid snake mortality. The fence should be installed with loop-arounds at the ends and at openings in order to redirect the snakes away from them. Fences should be maintained throughout the snake's entire active period (Mar. 16 – Nov. 5).

B. Air Pollution Control:

1. Minimize air pollution from construction operations.
2. Burning: Of waste materials, rubbish, or other debris will not be permitted on or adjacent to Site.
3. Conduct operations of dumping rock and of carrying rock away in trucks to cause a minimum of dust. Give unpaved streets, roads, detours, or haul roads used in construction area a dust-preventive treatment or periodically water to prevent dust. Strictly adhere to applicable environmental regulations for dust prevention.
4. Provide and maintain temporary dust-tight partitions, bulkheads, or other protective devices during construction to permit normal operation of existing facilities. Construct partitions of plywood, insulating board, plastic sheets, or similar material. Construct partitions in such a manner that dust and dirt from demolition and cutting will not enter other parts of existing building or facilities. Remove temporary partitions as soon as need no longer exists.
5. Minimize dust from construction operations.
6. Comply with local dust control ordinances.
7. Implement mitigation methods and equipment outlined in Dust Control Plan.

C. Noise Control:

1. Minimize noise from construction operations.
2. Comply with local noise control ordinances.

3. Implement mitigation methods and equipment outlined in Noise Control Plan.

D. Water Pollution Control:

1. Prior to commencing excavation and construction, obtain Contractor's agreement with detailed plans showing procedures intended to handle and dispose of storm water, groundwater, and dewatering pump discharges.
2. Comply with Section 01 57 13, Temporary Erosion and Sedimentation Control, for stormwater flow and surface runoff.
3. Water pollution control methods shall be in compliance with applicable permits.
4. Do not dispose of volatile wastes such as mineral spirits, oil, chemicals, or paint thinner in storm or sanitary drains. Disposal of wastes into streams or waterways is prohibited. Provide acceptable containers for collection and disposal of waste materials, debris, and rubbish.

E. Erosion, Sediment, and Flood Control: Provide, maintain, and operate temporary facilities as specified in Section 01 57 13, Temporary Erosion and Sedimentation Control, to control erosion and sediment releases, and to protect the Work and existing facilities from flooding during construction period.

F. Diesel Emission Control Technology:

1. Diesel Onroad Vehicles: All diesel onroad vehicles used on the project for more than 10 total days must have either (1) engines that meet U.S. Environmental Protection Agency (EPA) 2007 onroad emissions standards or (2) emission control technology verified by EPA or the California Air Resources Board (CARB) to reduce PM emissions by a minimum of 85 percent.
2. Diesel Generators: Beginning January 1, 2010, all diesel generators on site for more than 10 total days must be equipped with emission control technology verified by EPA or CARB to reduce PM emissions by a minimum of 85 percent.
3. Diesel Nonroad Construction Equipment:
   a. Until December 31, 2012, all diesel nonroad construction equipment with engines 75hp and greater on site more than 10 total days must have either (1) engines that meet EPA Tier 4 nonroad emissions standards, or (2) emission control technology verified by EPA or CARB for use with nonroad engines to reduce PM emissions by a minimum of 20 percent.

b. Beginning January 1, 2013, all diesel nonroad construction equipment on site for more than 10 total days must have either (1) engines meeting EPA Tier 4 nonroad emission standards or (2) emission control technology verified by EPA or CARB for use with nonroad engines to reduce PM emissions by a minimum of 85 percent for engines 75 hp and greater and by a minimum of 20 percent for engines between 25 and 75 hp.

c. Tier 0 engines are not allowed on site and must be upgraded to Tier 1 and then retrofit with an emission control device achieving the required reduction.

4. Upon confirming that the diesel vehicle, construction equipment, or generator has either a Tier 4 engine or pollution control technology installed and functioning, the developer will issue a compliance sticker indicating the level of emission control. All diesel vehicles, construction equipment, and generators on site shall display the compliance sticker in the designated location.
5. Pollution control technology shall be operated, maintained, and serviced as recommended by the manufacturer.
6. All diesel vehicles, construction equipment, and generators on site shall be fueled with ultra-low sulfur diesel fuel (ULSD) or a ULSD blend with sulfur content of 15 ppm or less.

G. Additional Diesel Requirements:

1. Construction shall not proceed until the Subcontractor submits a certified list of all diesel vehicles, construction equipment, and generators to be used on site. The list shall include the following:
   a. Subcontractor and sub-subcontractor name and address, plus contact person responsible for the vehicles or equipment.
   b. Equipment type, manufacturer, engine model year, engine certification (Tier rating), horsepower, plate, serial number, and expected fuel usage and/or hours of operation.
   c. For the pollution control technology installed: Technology type, serial number, make, model, manufacturer, EPA/CARB verification number/level, and installation date.
2. If the Subcontractor subsequently needs to bring on site equipment not on the list, the Subcontractor shall submit written notification within 24 hours that attests the equipment complies with all contract conditions.
3. All diesel equipment shall comply with all pertinent local, state, and federal regulations relative to exhaust emission controls and safety.
4. The Subcontractor shall establish generator sites and truck-staging zones for vehicles waiting to load or unload material on site. Such zones shall be located where diesel emissions have the least impact on abutters, the general public, and especially sensitive receptors such as

hospitals, schools, daycare facilities, elderly housing, and convalescent facilities.

5. During periods of inactivity, idling of diesel onroad vehicles and nonroad equipment shall be minimized and shall not exceed the time allowed under state and local laws. In the absence of state or local idling regulations, idling shall not exceed three minutes in any sixty-minute period.

H. Exemptions:

1. Onroad diesel vehicles, nonroad construction equipment, and generators on site for 10 working days or less over the life of the project need not install pollution control technology. This equipment must be included on the equipment list submitted by the Subcontractor and approved by the Contractor.
2. If the Subcontractor can prove to the Contractor's satisfaction that for a particular class of onroad diesel vehicle, nonroad construction equipment, or generator, (1) no alternative equipment with a Tier 4 engine is available, or (2) it is not technically feasible to meet the control level specified above, or (3) installing the control device would create a safety hazard or impaired visibility for the operator, then the Subcontractor may, with the Contractor's written approval, drop down to a lower level of control.
3. The Contractor may create an exemption when there is a compelling emergency need to use diesel vehicles or engines that do not meet the contract conditions for emission controls. An example would be the need for rescue vehicles or other equipment to prevent or remedy harm to human beings or nearby property. Meeting contract deadlines is not considered a compelling emergency.
4. Exemptions, if any, from state or local idling laws are specified by those laws, which shall be enforced on site. In locations without prevailing state or local idling regulations, idling for more than three minutes over a sixty-minute period is permitted only under the following circumstances:
    a. When an onroad diesel vehicle or nonroad construction equipment is forced to remain motionless because of traffic conditions or mechanical difficulties over which the operator has no control;
    b. To bring the onroad diesel vehicle, nonroad construction equipment, or generator to the manufacturer's recommended operating temperature;
    c. When there are regulations requiring temperature control for driver or passenger comfort and there are no auxiliary power sources available to provide temperature control;

d. When it is necessary to operate auxiliary equipment that is located in or on the diesel vehicle or construction equipment, to accomplish the intended use of the vehicle or equipment (for example, cranes and cement mixers);
e. When the onroad diesel vehicle, nonroad construction equipment, or generator is being repaired, if idling is necessary for such repair; and/or;
f. When the onroad diesel vehicle, nonroad construction equipment, or generator is queued for inspection, if idling is necessary for such inspection.

I. Reporting:

1. The Subcontractor shall submit to the developer's representative a monthly report that, for each onroad diesel vehicle, nonroad construction equipment, or generator, includes:
   a. Number of hours of engine operation.
   b. Any problems with the equipment or emission controls.
2. In addition, the monthly report shall contain certified copies of fuel deliveries for the time period that identify:
   a. Source of supply.
   b. Quantity of fuel.
   c. Quality of fuel, including sulfur content (percent by weight).

J. Compliance: All onroad diesel vehicles, nonroad construction equipment, and generators must be compliant with these provisions whenever they are present on the project site. The Subcontractor's compliance with this notice shall not be grounds for claims as outlined in the Contract General Terms and Conditions.

K. Non-Compliance:

1. If any onroad diesel vehicle, nonroad construction equipment, or generator is found to be in non-compliance with the contract terms, then Subcontractor shall make the necessary corrections to bring the equipment into compliance at no cost to the Contractor.
2. Once the Subcontractor has brought previously non-compliant machinery into compliance, the Contractor shall promptly issue the Subcontractor a written acknowledgment of compliance.

3.05 ACCESS ROADS

A. Construct access roads within easements, rights-of-way, or Project limits. Utilize existing roads where shown.

B. Maintain drainage ways. Install and maintain culverts to allow water to flow beneath access roads. Provide corrosion-resistant culvert pipe of adequate strength to resist construction loads.

C. Provide gravel, crushed rock, or other stabilization material to permit access by all motor vehicles at all times.

D. Maintain road grade and crown to eliminate potholes, rutting, and other irregularities that restrict access.

E. Coordinate with Contractor detours and other operations affecting traffic and access. Provide at least 72 hours' notice to Contractor of operations that will alter access to Site.

F. Upon completion of construction, restore ground surface disturbed by access road construction to original grade.

3.06 PARKING AREAS

A. Control vehicular parking to preclude interference with public traffic or parking, access by emergency vehicles or construction operations.

B. Provide parking facilities for personnel working on Project.

3.07 VEHICULAR TRAFFIC

A. Comply with Laws and Regulations regarding closing or restricting use of public streets or highways. No public or private road shall be closed, except by written permission of proper authority. Ensure the least possible obstruction to traffic and normal commercial pursuits.

B. Conduct the Work to interfere as little as possible with public travel, whether vehicular or pedestrian.

C. Whenever it is necessary to cross, close, or obstruct roads, driveways, and walks, whether public or private, provide and maintain suitable and safe bridges, detours, or other temporary expedients for accommodation of public and private travel.

D. Road Closures: Maintain satisfactory means of exit for persons residing or having occasion to transact business along route of the Work. If it is necessary to close off roadway or alley providing sole vehicular access to property for periods greater than 2 hours, provide written notice to each owner so affected 3 days prior to such closure. In such cases, closings of up to 4 hours may be allowed. Closures of up to 10 hours may be allowed if a week's written notice is given and undue hardship does not result.

E. Maintenance of traffic is not required if Subcontractor obtains written permission from authority having jurisdiction over public property involved, to obstruct traffic at designated point.

F. In making street crossings, do not block more than one-half the street at a time. Whenever possible, widen shoulder on opposite side to facilitate traffic flow. Provide temporary surfacing on shoulders as necessary.

G. Maintain top of backfilled trenches before they are paved, to allow normal vehicular traffic to pass over. Provide temporary access driveways where required. Cleanup operations shall follow immediately behind backfilling.

H. When flaggers and guards are required by regulation or when deemed necessary for safety, furnish them with approved orange wearing apparel and other regulation traffic control devices.

I. Provide snow removal to facilitate normal vehicular traffic on public or private roads affected by construction. Perform snow removal promptly and efficiently by means of suitable equipment whenever necessary for safety, and as may be directed by proper authority.

J. Notify fire department and police department before closing street or portion thereof. Notify said departments when streets are again passable for emergency vehicles. Do not block off emergency vehicle access to consecutive arterial crossings or dead-end streets, in excess of 300 linear feet, without written permission from fire department. Conduct operations with the least interference to fire equipment access, and at no time prevent such access. Furnish Contractor’s night emergency telephone numbers to police department.

K. Temporary Bridges:

1. Construct temporary bridges at points where maintenance of traffic across pipeline construction is necessary.
2. Make bridges over public streets, roads, and highways acceptable to authority having jurisdiction thereover.
3. Bridges erected over private roads and driveways shall be adequate for service to which they will be subjected.
4. Provide substantial guardrails and suitably protected approaches.
5. Provide footbridges not less than 4 feet wide with handrails and uprights of dressed lumber.
6. Maintain bridges in place as long as conditions of the Work require their use for safety of public, except that when necessary for proper prosecution of the Work in immediate vicinity of bridge. Bridge may be

relocated or temporarily removed for such period as Engineer may permit.

3.08 CLEANING DURING CONSTRUCTION

A. In accordance with General Conditions, as may be specified in other Specification sections, and as required herein.

B. Wet down exterior surfaces prior to sweeping to prevent blowing of dust and debris. At least weekly, sweep floors (basins, tunnels, platforms, walkways, roof surfaces), and pick up and dispose of debris.

C. Provide approved containers for collection and disposal of waste materials, debris, and rubbish. At least weekly, dispose of such waste materials, debris, and rubbish offsite.

D. At least weekly, brush sweep entry drive, roadways, and other streets and walkways affected by the Work and where adjacent to the Work.

END OF SECTION

SECTION 01 57 13
TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.01 WORK OF THIS SECTION

A. This section covers work necessary for stabilization of soil to prevent erosion during and after construction and land disturbing activities. The work shall include the furnishing of all labor, materials, tools, and equipment to perform the work and services necessary as herein specified and as indicated on the Drawings. This shall include installation, maintenance, and final removal of all temporary soil erosion and sediment control measures.

B. The minimum areas requiring soil erosion and sediment control measures are indicated on the Drawings. The right is reserved to modify the use, location, and quantities of soil erosion and sediment control measures based on activities of the Subcontractor and as the Contractor considers to be to the best interest of the USEPA.

C. See additional information noted on the Drawings.

1.02 GENERAL

A. See Conditions of the Contract and Division 1, General Requirements, which contain information and requirements that apply to the Work specified herein and are mandatory for this project.

B. All activities shall conform to the Wisconsin Department of Natural Resources (WDNR) Construction Standards, the specifications, and the Drawings. In the event of a conflict, the more stringent requirement shall apply.

C. The sections of the Erosion and Sediment Control Standards referenced include, but are not limited to:

STANDARD	Number	Effective Date
Channel Erosion Mat [PDF 142KB]	1053	Aug-05
Ditch Checks [PDF 25KB]		
• Figure 1 [PDF 25KB]	1062	Mar-06
• Figure 2 [PDF 32KB]		

STANDARD	Number	Effective Date
Construction Site Diversion [PDF 20KB]	1066	Mar-06
Dust Control [PDF 125KB]	1068	Mar-04
Grading Practices for Erosion Control - Temporary [PDF 131KB]	1067	Mar-04
Interim Sediment Control: Water Application of Polymers [PDF 268KB]	1051	Nov-02
Land Application of Anionic Polyacrylamide [PDF 615KB]	1050	Jul-01
Mulching for Construction Sites [PDF 142KB]	1058	Jun-03
Non-channel Erosion Mat [PDF 165KB]	1052	Aug-03
Sediment Bale Barrier [PDF 136KB]	1055	Aug-03
Sediment Basin [PDF 91KB]	1064	Mar-06
Sediment Trap [PDF 193KB]	1063	Sep-05
Seeding [PDF 160KB]	1059	Nov-03
Silt Fence [PDF 37KB] • illustration [PDF 90KB] • illustration (DGN) [ZIP 79KB]	1056	Mar-06
Silt Curtain [ZIP 554KB]	1070	Sep-05
Stone Tracking Pad and Tire Washing [PDF 108KB]	1057	Aug-03
Storm Drain Inlet Protection For Construction Sites [PDF 379KB] • illustration [PDF 245KB] • illustration (DGN) [ZIP 298KB]	1060	Oct-03
Turbidity Barriers [PDF 1.4MB]	1069	Sep-05
Vegetative Buffer for Construction Sites [PDF 141KB]	1054	May-03

D. Soil erosion stabilization and sedimentation control consist of the following elements:

1. Maintenance of existing permanent or temporary storm drainage piping and channel systems, as necessary.
2. Construction of new permanent and temporary storm drainage piping and channel systems, as necessary.
3. Construction of temporary erosion control facilities such as silt fences, check dams, etc.
4. Topsoil and Seeding:
    a. Placement and maintenance of Temporary Seeding on all areas disturbed by construction.
    b. Placement of permanent topsoil, fertilizer, and seed, etc., in all areas not occupied by structures or pavement, unless shown otherwise.
5. Soil Stabilization Seeding: Placement of fertilizer and seed, etc., in areas as specified hereinafter.

E. The Subcontractor shall be responsible for phasing Work in areas allocated for his exclusive use during this Project, including any proposed stockpile areas, to restrict sediment transport. This will include installation of any temporary erosion control devices, ditches, or other facilities.

F. The areas set aside for the Subcontractor's use during the Project may be temporarily developed to provide satisfactory working, staging, and administrative areas for his exclusive use. Preparation of these areas shall be in accordance with other requirements contained within these Specifications and shall be done in a manner to both control all sediment transport away from the area.

G. All permanent stockpiles shall be seeded with soil stabilization seed and protected by construction of silt fences and permanent 2-foot, minimum depth, ditches, completely surrounding stockpiles and located within 10 feet of the toes of the stockpile slopes.

H. Sediment transport and erosion from working stockpiles shall be controlled and restricted from moving beyond the immediate stockpile area by construction of temporary toe-of-slope ditches and accompanying silt fences, as necessary. The Subcontractor shall keep these temporary facilities in operational condition by regular cleaning, regrading, and maintenance. Stockpiles remaining in place longer than 14 calendar days shall be considered permanent stockpiles for purposes of erosion and sediment control.

I. The Subcontractor shall maintain all elements of the Soil Erosion Stabilization and Sedimentation Control systems and facilities to be constructed during this Project for the duration of his activities on this Project. Formal inspections made jointly by the Subcontractor and the Contractor shall be conducted every 2 weeks to evaluate the Subcontractor's conformance to the requirements of both these Specifications and WDNR Regulations.

J. All silt traps shall be cleaned of collected sediment after every rainfall or as determined from the biweekly inspections. Cleaning shall be done in a manner that will not direct the sediment into the storm drain piping system. Removed sediment shall be taken to an area selected by the Contractor where it can be cleaned of sticks and debris, then allowed to dry. Final sediment and debris disposal shall be onsite as designated by Contractor.

K. Replacement or repair of failed or overloaded silt fences, check dams, or other temporary erosion control devices shall be accomplished by the Subcontractor within 24 hours after receiving written notice from the Contractor.

L. Unpaved earth drainage ditches shall be regraded as needed to maintain original grade and remove sediment buildup. If a ditch becomes difficult to maintain, the Subcontractor shall cooperate with the Engineer and install additional erosion control devices such as check dams, temporary paving, or silt fences as directed by the Engineer.

M. If the Subcontractor has not complied with any of the above maintenance efforts to the satisfaction of the Contractor within 2 working days after receiving written notification from the Contractor, the USEPA shall have the prerogative of engaging others to perform any needed maintenance or cleanup, including removal of accumulated sediment at constructed erosion control facilities, and deduct from the Subcontractor's monthly partial payment the costs for such efforts plus a $500 administration fee.

1.03 SUBMITTALS

A. Submittals shall be made in accordance with Section 01 33 00, Submittal Procedures.

B. In addition, the Contractor shall provide the following specific information:

1. Certificates of inspection of seed by state or federal authorities and copies of delivery invoices or other proof of quantities of fertilizer.
2. Manufacturer's certificate of compliance attesting that the geotextile meets the requirements of these Specifications.

PART 2 PRODUCTS

2.01 PERMANENT SEED

A. Seed for those areas where topsoil is to be applied shall be in accordance with WDNR Standard 1059.

2.02 SOIL STABILIZATION AND TEMPORARY SEED

A. Summer seed mix shall be in accordance with WDNR Standard 1059.

B. Winter seed mix shall be in accordance with WDNR Standard 1059.

2.03 TOPSOIL

A. Topsoil shall be as specified under Section 31 23 23, Fill and Backfill.

2.04 FERTILIZER

A. Fertilizer shall be commercial, chemical type, uniform in composition, free-flowing, conforming to state and federal laws, and suitable for application with equipment designed for that purpose.

B. Fertilizer shall have a minimum percentage of plant food by weight for the following: Permanent fertilizer mix shall be 10 percent nitrogen, 10 percent phosphoric acid, and 10 percent potash.

2.05 LIME

A. Ground dolomitic limestone not less than 85 percent total carbonates and magnesium, ground so that 50 percent passes through a 100-mesh sieve and 90 percent passes a 20-mesh sieve. Coarser material will be acceptable provided the specified rates of application are increased proportionately on the basis of quantities passing the 100-mesh sieve.

2.06 STRAW MULCH

A. Threshed straw of oats, wheat, barley, or rye, free from seed of noxious weeds, or clean salt hay.

PART 3 EXECUTION

3.01 GENERAL

A. The Subcontractor shall install erosion and sediment control measures and maintain in accordance with the Drawings. The sequence of construction shown on the Drawings is made a part of these Contract Documents.

B. The Subcontractor shall provide and maintain Temporary Seeding at all times.

3.02 SUPER SILT FENCE

A. The Subcontractor shall construct silt fence in accordance with WDNR Standard 1059.

3.03 SEEDING

A. General:

1. The Subcontractor shall give at least 3 days notice to the Engineer prior to seeding to allow the Contractor to inspect the prepared areas. The Subcontractor shall rework any areas not approved for seeding to the Contractor's satisfaction.
2. The Subcontractor shall keep the Contractor advised of schedule of operations.
3. Seed shall be clean, delivered in original unopened packages and bearing an analysis of the contents, guaranteed 95 percent pure with minimum germination rate of 85 percent.

B. Schedules:

1. Seeding shall be performed in accordance with the following schedule:
   a. Summer Seeding: Between March 15 and June 15, or September 1 to November 15.
   b. Winter Seeding: All other times of year, except when weather conditions prohibit further construction operations as determined by the Contractor.

C. Soil Stabilization and Temporary Seeding:

1. Soil stabilization seeding shall consist of the application of the following materials in quantities as further described herein for stockpiles and disturbed areas left inactive for more than 14 days.
   a. Lime.
   b. Fertilizer.
   c. Seed.
   d. Mulch.
   e. Maintenance.
2. Hydroseeding will be permitted as an alternative method of applying seed and associated soil conditioning agents described above. Should the Contractor elect to apply soil stabilization seeding by hydroseeding methods, he shall submit his operational plan and methods to the Engineer.

3. Temporary Seeding is to be placed and maintained over all disturbed areas prior to Permanent Seeding. Maintain Temporary Seeding until such time as areas are approved for Permanent Seeding. As a minimum, maintenance shall include the following:
    a. Fix-up and reseeding of bare areas or redisturbed areas.
    b. Mowing for stands of grass or weeds exceeding 6 inches in height.

D. Topsoil and Permanent Seeding:

1. Topsoil and Permanent Seeding shall consist of the application of the following materials in quantities as further described herein:
    a. 4-inch depth of topsoil.
    b. Lime.
    c. Fertilizer.
    d. Permanent seed mix.
    e. Mulch.
2. Topsoil is to be placed over all disturbed areas that are not surfaced with concrete, asphalt, or pavers.
3. Preparation:
    a. After rough grading is completed and reviewed by the Contractor, Subcontractor shall spread topsoil as hereinbefore specified over all areas to receive Permanent Seeding to a minimum compacted depth of 6 inches with surface elevations as shown. Loosen the finished surface to a depth of 2 inches and leave in smooth condition, free from depressions or humps, ready for seeding.
    b. Finish Grading:
        1) Subcontractor shall rake the topsoiled area to a uniform grade, so that all areas drain as indicated on the grading plan.
        2) Subcontractor shall remove all trash and stones exceeding 1 inch in diameter from area to a depth of 2 inches.
4. Permanent Seed:
    a. After soil has been scarified, apply seed and other products at the rate and proportion specified below:
        1) Seed Mix: 150 pounds per acre.
        2) 10-10-10 Fertilizer: 1,000 pounds per acre.
        3) Lime: 3 tons per acre.
        4) Water: As necessary.
5. Maintenance:
    a. Maintenance Period: Subcontractor shall begin maintenance immediately after each portion of permanent grass is planted and continue for 8 weeks after all planting is completed.
    b. Maintenance Operations: Subcontractor shall water to keep surface soil moist. Repair washed out areas by filling with topsoil, liming, fertilizing, and seeding. Replace mulch on banks when

washed or blown away. Mow to 2 inches after grass reaches 3 inches in height, and mow frequently enough to keep grass from exceeding 3-1/2 inches. Weed by local spot application of selective herbicide only after first planting season when grass is established.

6. Guarantee:
   a. If, at the end of the 8-week maintenance period, a satisfactory stand of grass has not been produced, the Subcontractor shall renovate and reseed the grass or unsatisfactory portions thereof immediately, or, if after October 15 during the next planting season. If a satisfactory stand of grass develops by July 1 of the following year, it will be accepted. If it is not accepted, a complete replanting will be required during the planting season meeting all of the requirements specified under paragraph Permanent Seed.
   b. A satisfactory stand is defined as grass or section of grass that has a substantial establishment of new grass, strongly rooted, and uniformly green in appearance from a distance of 50 feet. No noticeable thin or bare areas as determined by the Contractor.

END OF SECTION

SECTION 01 72 00
DECONTAMINATION OF PERSONNEL AND EQUIPMENT

PART 1 GENERAL

1.01 GENERAL

A. Onsite decontamination stations as shown on the drawings, large enough to accommodate the largest piece of construction equipment to be used at the site, shall be provided by the Subcontractor in conformance with this section and the Site Health and Safety Plan. The Subcontractor will be responsible for providing the appropriate decontamination tools, equipment, solutions, liquids, containers, and supplies.

B. All water generated during decontamination activities shall be collected, contained, and transported to the TSCA Dewatering Pad for treatment prior to discharge.

C. All personnel shall be decontaminated before leaving the site, as specified in the Site Health and Safety Plan. “Leaving the site” is defined as leaving the exclusion area and entering the contamination reduction area. Decontamination shall be required prior to breaks, when picking up tools, equipment, or materials in the support zone, or any other activities where the potential exists for contaminant transfer.

D. Equipment shall be cleaned and decontaminated prior to use onsite, and prior to leaving the site.

E. All equipment shall be washed and cleaned under Level D requirements or as specified by the Site Safety Officer prior to initiation of work at the site.

F. All decontamination operations shall be conducted by Subcontractor personnel wearing Level D protective equipment and a face shield or additional protection as specified by the Site Safety Officer.

1.02 SUBMITTALS

A. Action Submittals:

1. Subcontractor shall prepare and submit a decontamination station design for approval.

PART 2 PRODUCTS

2.01 GENERAL

A. The Subcontractor shall furnish all equipment and supplies necessary for the decontamination process such as clean water supply tank, trisodium phosphate detergent, a mobile steam cleaner or hot water high pressure washer, buckets, brushes, etc, as required.

B. The Subcontractor shall furnish sealable United States Department of Transportation (U.S. DOT)-approved containers (55-gallon drums) having watertight lids stored in a containment area as required, or poly tank for the storage of decontamination water.

C. Tanks or drums shall be stored in a lined containment area or on a containment pad.

D. The Subcontractor shall also supply labeling materials.

PART 3 EXECUTION

3.01 GENERAL

A. The Subcontractor shall follow the general decontamination plans, as specified in the Site Health and Safety Plan. Prior to mobilization, the Subcontractor shall finalize all personnel decontamination needs, equipment, and procedures with the Contractor. A decontamination station, meeting specifications and equipped with a means of catching all water, shall be constructed by the Subcontractor at the locations shown on the drawings.

3.02 EQUIPMENT DECONTAMINATION

A. The Subcontractor shall decontaminate the equipment after use in the following manner:

1. Scrape and remove all earthen materials from the equipment.
2. Hose down equipment with a portable high-pressure, hot-water washer (steam cleaner).
3. Collect rinsate and scrapings. Place rinsate in approved tanks or drums, and transport to the TSCA Dewatering Pad for treatment prior to discharge.
4. Scrapings shall be stored on-site and covered until it can be disposed of at an approved offsite disposal facility.
5. Subcontractor is responsible for management and treatment of all decontamination water and discharge to the Milwaukee River in accordance with the WPDES permit.

6. Subcontractor is responsible for management of all scrapings and disposal at an approved offsite disposal facility.

3.03 PERSONNEL DECONTAMINATION

A. Personnel decontamination procedures to be used shall be performed prior to leaving the excavation location. The Subcontractor shall provide all protective clothing and the equipment necessary for its own personnel to comply with the decontamination procedures as specified in the Site Health and Safety Plan.

END OF SECTION

SECTION 01 77 00
CLOSEOUT PROCEDURES

PART 1 GENERAL

1.01 SUBMITTALS

A. Informational Submittals:

1. Submit prior to application for final payment.
   a. Record Documents: As required in General Conditions.
   b. Approved Shop Drawings and Samples: As required in the General Conditions.
   c. Special bonds, Special Guarantees, and Service Agreements.
   d. Consent of Surety to Final Payment: As required in General Conditions.
   e. Releases or Waivers of Liens and Claims: As required in General Conditions.
   f. Releases from Agreements.
   g. Final Application for Payment: Submit in accordance with procedures and requirements stated in Section 01 29 00, Payment Procedures.
   h. Extra Materials: As required by individual Specification sections.

1.02 RECORD DOCUMENTS

A. Quality Assurance:

1. Furnish qualified and experienced person, whose duty and responsibility shall be to maintain record documents.
2. Accuracy of Records:
   a. Coordinate changes within record documents, making legible and accurate entries on each sheet of Drawings and other documents where such entry is required to show change.
   b. Purpose of Project record documents is to document factual information regarding aspects of the Work, both concealed and visible, to enable future modification of the Work to proceed without lengthy and expensive Site measurement, investigation, and examination.
3. Make entries within 24 hours after receipt of information that a change in the Work has occurred.
4. Prior to submitting each request for progress payment, request Contractor's review and approval of current status of record documents. Failure to properly maintain, update, and submit record documents may

result in a deferral by Contractor to recommend whole or any part of Subcontractor's Application for Payment, either partial or final.

1.03 RELEASES FROM AGREEMENTS

A. Furnish USEPA written releases from property owners or public agencies where side agreements or special easements have been made, or where Subcontractor's operations have not been kept within the USEPA's construction right-of-way.

B. In the event Subcontractor is unable to secure written releases:

1. Inform USEPA of the reasons.
2. USEPA or its representatives will examine the Site, and USEPA will direct Subcontractor to complete the Work that may be necessary to satisfy terms of the side agreement or special easement.
3. Should Subcontractor refuse to perform this Work, USEPA reserves right to have it done by separate contract and deduct cost of same from Contract Price, or require Subcontractor to furnish a satisfactory bond in a sum to cover legal Claims for damages.
4. When USEPA is satisfied that the Work has been completed in agreement with Contract Documents and terms of side agreement or special easement, right is reserved to waive requirement for written release if: (i) Subcontractor's failure to obtain such statement is due to grantor's refusal to sign, and this refusal is not based upon any legitimate Claims that Subcontractor has failed to fulfill terms of side agreement or special easement, or (ii) Subcontractor is unable to contact or has had undue hardship in contacting grantor.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 MAINTENANCE OF RECORD DOCUMENTS

A. General:

1. Promptly following commencement of Contract Times, secure from Engineer at no cost to Subcontractor, one complete set of Contract Documents.
2. Label or stamp each record document with title, "RECORD DOCUMENTS," in neat large printed letters.
3. Record information concurrently with construction progress and within 24 hours after receipt of information that change has occurred. Do not cover or conceal Work until required information is recorded.

B. Preservation:

1. Maintain documents in a clean, dry, legible condition and in good order. Do not use record documents for construction purposes.
2. Make documents and Samples available at all times for observation by Contractor.

C. Making Entries on Drawings:

1. Using an erasable colored pencil (not ink or indelible pencil), clearly describe change by graphic line and note as required.
   a. Color Coding:
      1) Green when showing information deleted from Drawings.
      2) Red when showing information added to Drawings.
      3) Blue and circled in blue to show notes.
2. Date entries.
3. Call attention to entry by "cloud" drawn around area or areas affected.
4. Legibly mark to record actual changes made during construction, including, but not limited to:
   a. Depths of various elements of foundation in relation to finished first floor data if not shown or where depth differs from that shown.
   b. Horizontal and vertical locations of existing and new Underground Facilities and appurtenances, and other underground structures, equipment, or Work. Reference to at least two measurements to permanent surface improvements.
   c. Location of internal utilities and appurtenances concealed in the construction referenced to visible and accessible features of the structure.
   d. Locate existing facilities, piping, equipment, and items critical to the interface between existing physical conditions or construction and new construction.
   e. Changes made by Addenda and Field Orders, Work Change Directive, Change Order, and Engineer's written interpretation and clarification using consistent symbols for each and showing appropriate document tracking number.
5. Dimensions on Schematic Layouts: Show on record drawings, by dimension, the centerline of each run of items such as are described in previous subparagraph above.
   a. Clearly identify the item by accurate note such as "cast iron drain," "galv. water," and the like.
   b. Show, by symbol or note, vertical location of item ("under slab," "in ceiling plenum," "exposed," and the like).

c. Make identification so descriptive that it may be related reliably to Specifications.

3.02 FINAL CLEANING

A. At completion of the Work or of a part thereof and immediately prior to Subcontractor's request for certificate of Substantial Completion; or if no certificate is issued, immediately prior to Subcontractor's notice of completion, clean entire Site or parts thereof, as applicable.

1. Leave the Work and adjacent areas affected in a cleaned condition satisfactory to USEPA and Contractor.
2. Remove grease, dirt, dust, paint or plaster splatter, stains, labels, fingerprints, and other foreign materials from exposed surfaces.
3. Repair, patch, and touch up marred surfaces to specified finish and match adjacent surfaces.
4. Clean all windows.
5. Clean and wax wood, vinyl, or painted floors.
6. Broom clean exterior paved driveways and parking areas.
7. Hose clean sidewalks, loading areas, and others contiguous with principal structures.
8. Rake clean all other surfaces.
9. Remove snow and ice from access to buildings.
10. Replace air-handling filters and clean ducts, blowers, and coils of ventilation units operated during construction.
11. Leave water courses, gutters, and ditches open and clean.

B. Use only cleaning materials recommended by manufacturer of surfaces to be cleaned.

END OF SECTION

SECTION 01 91 14
EQUIPMENT TESTING AND FACILITY STARTUP

PART 1 GENERAL

1.01 DEFINITIONS

A. Facility: Entire Project, or an agreed-upon portion, including all of its unit processes.

B. Functional Test: Test or tests in presence of Contractor to demonstrate that installed equipment meets manufacturer's installation, calibration, and adjustment requirements and other requirements as specified.

C. Performance Test: Test or tests performed after any required functional test in presence of Contractor to demonstrate and confirm individual equipment meets performance requirements specified in individual sections.

D. Unit Process: As used in this section, a unit process is a portion of the facility that performs a specific process function, such as clarifier, sand filter, and granular activated carbon system.

E. Facility Performance Demonstration:

1. A demonstration, conducted by Subcontractor, with assistance of Contractor, to demonstrate and document the performance of the entire operating facility, both manually and automatically (if required), based on criteria developed in conjunction with USEPA and as accepted by Contractor.
2. Such demonstration is for the purposes of (i) verifying to Contractor entire facility performs as a whole, and (ii) documenting performance characteristics of completed facility for Contractor's records. Neither the demonstration nor the evaluation is intended in any way to make performance of a unit process or entire facility the responsibility of Subcontractor, unless such performance is otherwise specified.

1.02 SUBMITTALS

A. Informational Submittals:

1. Facility Startup and Performance Demonstration Plan.
2. Functional and performance test results.
3. Completed Unit Process Startup Form for each unit process.
4. Completed Facility Performance Demonstration/Certification Form.

1.03 FACILITY STARTUP AND PERFORMANCE DEMONSTRATION PLAN

A. Develop a written plan, in conjunction with operations personnel; to include the following:

1. Step-by-step instructions for startup of each unit process and the complete facility.
2. Unit Process Startup Form (sample attached), to minimally include the following:
   a. Description of the unit process, including equipment numbers/nomenclature of each item of equipment and all included devices.
   b. Detailed procedure for startup of the unit process, including valves to be opened/closed, order of equipment startup, etc.
   c. Startup requirements for each unit process, including water, power, chemicals, etc.
   d. Space for evaluation comments.
3. Facility Performance Demonstration/Certification Form (sample attached), to minimally include the following:
   a. Description of unit processes included in the facility startup.
   b. Sequence of unit process startup to achieve facility startup.
   c. Description of computerized operations, if any, included in the facility.
   d. Subcontractor certification facility is capable of performing its intended function(s), including fully automatic operation.
   e. Signature spaces for Subcontractor and Contractor.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. Facility Startup Meetings: Schedule, in accordance with requirements of Section 01 31 19, Project Meetings, to discuss test schedule, test methods, materials, chemicals and liquids required, facilities operations interface, and USEPA involvement.

B. Subcontractor’s Testing and Startup Representative:

1. Designate and furnish one or more personnel to coordinate and expedite testing and facility startup.
2. Representative(s) shall be present during startup meetings and shall be available at all times during testing and startup.

C. Provide temporary valves, gauges, piping, test equipment and other materials and equipment required for testing and startup.

D. Provide other subcontractors' and equipment manufacturers' staff adequate to prevent delays. Schedule ongoing work so as not to interfere with or delay testing and startup.

E. Others will:

1. Provide water, power, chemicals, and other items as required for startup, unless otherwise indicated.
2. Water hoses from fire hydrant shown on the Drawings to be provided by Subcontractor.
3. Operate process units and facility with support of Subcontractor.
4. Provide labor and materials as required for laboratory analyses.

3.02 EQUIPMENT TESTING

A. Preparation:

1. Complete installation before testing.
2. Furnish qualified manufacturers' representatives, when required by individual Specification sections.
3. Obtain and submit from equipment manufacturer's representative Manufacturer's Certificate of Proper Installation Form.
4. Equipment Test Report Form: Provide written test report for each item of equipment to be tested, to include the minimum information:
   a. Owner/Project Name.
   b. Equipment or item tested.
   c. Date and time of test.
   d. Type of test performed (Functional or Performance).
   e. Test method.
   f. Test conditions.
   g. Test results.
   h. Signature spaces for Subcontractor and Contractor as witness.
5. Cleaning and Checking: Prior to beginning functional testing:
   a. Calibrate testing equipment in accordance with manufacturer's instructions.
   b. Inspect and clean equipment, devices, connected piping, and structures to ensure they are free of foreign material.
   c. Lubricate equipment in accordance with manufacturer's instructions.
   d. Turn rotating equipment by hand when possible to confirm that equipment is not bound.

e. Open and close valves by hand and operate other devices to check for binding, interference, or improper functioning.
f. Check power supply to electric-powered equipment for correct voltage.
g. Adjust clearances and torque.
h. Test piping for leaks.

6. Ready-to-test determination will be by Contractor based at least on the following:
   a. Acceptable Operation and Maintenance Data.
   b. Notification by Subcontractor of equipment readiness for testing.
   c. Receipt of Manufacturer's Certificate of Proper Installation, if so specified.
   d. Adequate completion of work adjacent to, or interfacing with, equipment to be tested.
   e. Availability and acceptability of manufacturer's representative, when specified, to assist in testing of respective equipment.
   f. Satisfactory fulfillment of other specified manufacturer's responsibilities.
   g. Equipment and electrical tagging complete.
   h. Delivery of all spare parts and special tools.

B. Functional Testing:

1. Conduct as specified in individual Specification sections using fire hydrant water.
2. Notify USEPA and Contractor in writing at least 10 days prior to scheduled date of testing.
3. Prepare Equipment Test Report summarizing test method and results.
4. When, in Contractor's opinion, equipment meets functional requirements specified, such equipment will be accepted for purposes of advancing to performance testing phase, if so required by individual Specification sections. Such acceptance will be evidenced by Contractor/USEPA's signature as witness on Equipment Test Report.

C. Performance Testing:

1. Conduct as specified in individual Specification sections.
2. Notify Contractor and USEPA in writing at least 10 days prior to scheduled date of test.
3. Performance testing shall not commence until equipment has been accepted by Contractor as having satisfied functional test requirements specified.
4. Type of fluid, gas, or solid for testing shall be as specified.
5. Unless otherwise indicated, furnish labor, materials, and supplies for conducting the test and taking samples and performance measurements.

6. Prepare Equipment Test Report summarizing test method and results.
7. When, in Contractor's opinion, equipment meets performance requirements specified, such equipment will be accepted as to conforming to Contract requirements. Such acceptance will be evidenced by Contractor's signature on Equipment Test Report.

3.03 STARTUP OF UNIT PROCESSES

A. Prior to unit process startup, equipment within unit process shall be accepted by Contractor as having met functional and performance testing requirements specified.

B. Make adjustments, repairs, and corrections necessary to complete unit process startup.

C. Startup shall be done with river water if available or if directed by Contractor, Subcontractor shall use fire hydrant water.

D. Startup shall be considered complete when, in opinion of Contractor, unit process has operated in manner intended for 7 continuous days without significant interruption. This period is in addition to functional or performance test periods specified elsewhere.

E. Significant Interruption: May include any of the following events:

1. Failure of Subcontractor to provide and maintain qualified onsite startup personnel as scheduled.
2. Failure to meet specified functional operation for more than 2 consecutive hours.
3. Failure of any critical equipment or unit process that is not satisfactorily corrected within 5 hours after failure.
4. Failure of any noncritical equipment or unit process that is not satisfactorily corrected within 8 hours after failure.
5. As determined by Contractor.

F. A significant interruption will require startup then in progress to be stopped. After corrections are made, startup test period to start from beginning again.

3.04 FACILITY PERFORMANCE DEMONSTRATION

A. When, in the opinion of Contractor, startup of all unit processes has been achieved, sequence each unit process to the point that facility is operational.

B. Demonstrate proper operation of required interfaces within and between individual unit processes.

C. After facility is operating, complete performance testing of equipment and systems not previously tested.

D. Document, as defined in Facility Startup and Performance Demonstration Plan, the performance of the facility including its computer system, until all unit processes are operable and under control of computer system.

E. Certify, on the Facility Performance Demonstration/Certification Form, that facility is capable of performing its intended function(s), including fully automatic and computerized operation.

3.05 FACILITY STATUS AFTER TESTING

A. After successful testing, and with the agreement of the Contractor, drain all outside equipment and piping to prevent freezing.

3.06 SUPPLEMENTS

A. Supplements listed below, following "End of Section," are a part of this Specification:

1. Unit Process Startup Form.
2. Facility Performance Demonstration/Certification Form.

END OF SECTION

UNIT PROCESS STARTUP FORM

PROJECT: Lincoln Park/Milwaukee River Channel Sediment Site

Unit Process Description: (Include description and equipment number of all equipment and devices):

Startup Procedure (Describe procedure for sequential startup and evaluation, including valves to be opened/closed, order of equipment startup, etc.):

Startup Requirements (Water, power, chemicals, etc.):

Evaluation Comments:

FACILITY PERFORMANCE DEMONSTRATION/CERTIFICATION FORM

PROJECT: Lincoln Park/Milwaukee River Channel Sediment Site

Unit Processes Description (List unit processes involved in facility startup):

_____

_____

_____

_____

Unit Processes Startup Sequence (Describe sequence for startup, including computerized operations, if any):

_____

_____

_____

_____

_____

Subcontractor Certification that Facility is capable of performing its intended function(s), including fully automatic operation:

Subcontractor: _____ Date: _____, 20____

Contractor: _____ Date: _____, 20____
(Authorized Signature)

SECTION 31 01 00
SITE MANAGEMENT AND CONSTRUCTION SEQUENCING

PART 1 GENERAL

1.01 SUMMARY

A. This section describes the work involved in the site management and sequencing of construction at the site.

1.02 DEFINITIONS

A. Project Limits: Areas, as shown or specified, within which Work is to be performed.

B. Interfering of Objectionable Material: Trash, rubbish, and junk; vegetation and other organic matter, whether alive, dead, or decaying; topsoil.

1.03 ACTION SUBMITTALS

A. Construction Sequencing Plan. Develop a construction sequencing plan that reflects the following:

1. Site Preparation.
    a. Office Trailer Area.
    b. TSCA Dewatering Pad.
    c. Site Clearing.
    d. Access Points and Decon Pads.
2. Lincoln Creek Bypass.
3. Temporary Cut Off Structures.
4. Sediment Excavation.
    a. Working Surface within Creek Bed.
    b. Equipment.
    c. Sequence.
5. Staging, Decon, and Disposal.
6. Restoration.
7. Demobilization.

B. Site Management Plan. Develop a site management plan to include but not be limited to:

1. Temporary controls for preventing and minimizing air pollution.
2. Waste Management and Disposal (TSCA and Non-TSCA solids).
3. Compliance with WDNR Chapter 30 and NR216 site specific permits.

4. Compliance with WDNR WPDES permit, Corps of Engineers permit (equivalent, but not the same as WDNR chapter 30), as well as compliance with county and city stormwater ordinances
5. Compliance with the procedures outlined in the emergency action requirements outlined in the project's Site management Plan.
6. Detailed Bypass and Dewatering Plan.
7. Water Treatment Plan.

1.04 REGULATIONS

A. Comply with all applicable federal, state, and local site-specific permit requirements.

B. Subcontractor shall have copies of the applicable federal, state, and local site-specific permits onsite.

C. If conditions outside the scope of these specifications are encountered, all federal, state and local requirements shall apply. Notify the USEPA and the Contractor immediately if conditions outside the scope of these specifications are encountered.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 STORAGE YARDS AND BUILDINGS

A. Temporary Storage Yards: Construct temporary storage yards for storage of products that are not subject to damage by weather conditions.

B. Temporary Storage Buildings:

1. Provide environmental control systems that meet recommendations of manufacturers of equipment and materials stored.
2. Arrange or partition to provide security of contents and ready access for inspection and inventory.
3. Store combustible materials (paints, solvents, fuels) in a well-ventilated and remote building meeting safety standards.

3.02 FLAMMABLE AND COMBUSTIBLE LIQUIDS

A. Storage of all flammable and combustible liquids shall meet all applicable Laws and Regulations, including 29 CFR 1926.152.

B. The use of burning at the Site for the disposal of refuse and debris will not be permitted.

3.03 WELDING, CUTTING AND BRAZING

A. Any welding, cutting and brazing work and storage of equipment shall meet all applicable Laws and Regulations, including 29 CFR 1910 Subpart Q.

3.04 HANDLING AND DISPOSAL OF WASTE (SOLIDS)

A. Excavated Sediment:

1. General demolition debris and unsalvageable material shall be disposed of at an approved offsite disposal facility.
2. Hazardous wastes shall be disposed of in accordance with applicable regulations and as specified in the Subcontractor's Site Management Plan.
3. Dispose of material upon approval from the Contractor.

3.05 CONSTRUCTION BYPASS AND DEWATERING

A. General:

1. Continuously control water during course of construction, including weekends and holidays and during periods of work stoppages, and provide adequate backup systems to maintain control of water.
2. Remove and control water during periods when necessary to properly accomplish Work.

B. Bypass and Dewatering Systems:

1. Provide, operate, and maintain bypass and dewatering systems in accordance with Section 31 23 19.01, Lincoln Creek Bypass and Dewatering.
2. Bypass and dewatering system shall be of sufficient size and capacity to permit excavation and subsequent construction in dry conditions. Continuously maintain area free of water, regardless of source, and until backfilled to final grade.
3. Design and Operate Dewatering Systems:
   a. To avoid inducing settlement or damage to existing facilities, completed Work, or adjacent property.
   b. To relieve artesian pressures and resultant uplift of excavation bottom.
4. Provide sufficient redundancy in each system to keep the area free of water in event of component failure.
5. Provide 100 percent emergency power backup with automatic startup and switchover in event of electrical power failure.

C. Monitoring Flows: Monitor volume of water pumped per calendar day, as Work progresses. Also monitor volume of water introduced each day for performance of Work. Monitor flows using measuring devices acceptable to USEPA.

D. Disposal of Water: Pump water collected by dewatering operations to Milwaukee River.

3.06 PERIMETER FENCE

A. Install orange safety fence as perimeter fence as shown on Drawings.

B. Repair fencing as necessary to maintain security.

END OF SECTION

SECTION 31 10 00
SITE CLEARING

PART 1 GENERAL

1.01 DEFINITIONS

A. Interfering or Objectionable Material: Trash, rubbish, and junk; vegetation and other organic matter, whether alive, dead, or decaying; topsoil.

B. Clearing: Removal of interfering or objectionable material lying on or protruding above ground surface.

C. Grubbing: Removal of vegetation and other organic matter including stumps, buried logs, and roots greater than 2-inch caliper to a depth of 6 inches below subgrade.

D. Scalping: Removal of sod without removing more than upper 3 inches of topsoil.

E. Stripping: Removal of topsoil remaining after applicable scalping is completed.

F. Project Limits: Areas, as shown or specified, within which Work is to be performed.

1.02 SUBMITTALS

A. Action Submittals: Drawings clearly showing clearing, grubbing, and stripping limits.

1.03 QUALITY ASSURANCE

A. Obtain Contractor’s approval of staked clearing, grubbing, and stripping limits prior to commencing clearing, grubbing, and stripping.

1.04 SCHEDULING AND SEQUENCING

A. Prepare Site only after adequate erosion and sediment controls are in place. Limit areas exposed uncontrolled to erosion during installation of temporary erosion and sediment controls to maximum of 5 acres.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. Clear, grub, and strip areas actually needed for waste disposal, borrow, or Site improvements within limits shown or specified.

B. Do not injure or deface vegetation that is not designated for removal.

3.02 LIMITS

A. As follows, but not to extend beyond Project limits.

1. Excavation 5 feet beyond top of cut slopes.
2. Waste Disposal:
   a. Clearing: 5 feet beyond perimeter.
   b. Scalping and Stripping: Not required.
   c. Grubbing: Around perimeter as necessary for neat finished appearance.

B. Remove rubbish, trash, and junk from entire area within Project limits.

3.03 CLEARING

A. Clear areas within limits shown or specified.

B. Fell trees so that they fall away from facilities and vegetation not designated for removal.

C. Cut stumps not designated for grubbing flush with ground surface.

D. Cut off shrubs, brush, weeds, and grasses to within 2 inches of ground surface.

3.04 GRUBBING

A. Grub areas within limits shown or specified.

3.05 SCALPING

A. Do not remove sod until after clearing and grubbing is completed and resulting debris is removed.

B. Scalp areas within limits shown or specified.

3.06 STRIPPING

A. Do not remove topsoil until after scalping is completed.

B. Strip areas within limits to minimum depths shown or specified. Do not remove subsoil with topsoil.

C. Stockpile strippings to be used for topsoil, separately from other excavated material.

3.07 TREE REMOVAL OUTSIDE CLEARING LIMITS

A. Remove Within Project Limits:

1. Dead, dying, leaning, or otherwise unsound trees that may strike and damage Project facilities in falling.
2. Trees designated by Contractor.

B. Cut stumps off flush with ground, remove debris, and if disturbed, restore surrounding area to its original condition.

3.08 SALVAGE

A. Saleable log timber may be sold to Subcontractor’s benefit. Promptly remove from Project Site.

3.09 DISPOSAL

A. Clearing and Grubbing Debris:

1. Dispose of debris offsite.
2. Burning of debris onsite will not be allowed.
3. Dispose of unburned and noncombustible debris offsite.
4. Woody debris may be chipped. Chips may be sold to Subcontractor’s benefit or used for landscaping onsite as mulch or uniformly mixed with topsoil, provided that resulting mix will be fertile and not support combustion. Maximum dimensions of chipped material used onsite shall be1/4 inch by 2 inches. Dispose of chips that are unsaleable or unsuitable for landscaping or other uses with unchipped debris.
5. Limit offsite disposal of clearing and grubbing debris to locations that are approved by federal, state, and local authorities, and that will not be visible from Project.

B. Scalpings: As specified for clearing and grubbing debris.

C. Strippings:

1. Dispose of strippings that are unsuitable for topsoil or that exceed quantity required for topsoil offsite.
2. Stockpile topsoil in sufficient quantity to meet Project needs. Dispose of excess strippings as specified for clearing and grubbing.

END OF SECTION

SECTION 31 23 00
STREAM BANK CONSTRUCTION

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Society for Testing and Materials (ASTM):
   a. D698, Test Method for Laboratory Compaction Characteristics of Soil using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)).
   b. D2922, Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

1.02 DEFINITIONS

A. Bankfull or Bankfull Stage: Defined as the elevation on the bank where flooding begins (incipient point of flooding).

B. Thalweg: Defined as the "flowline" or deepest point of the channel cross section.

C. Top of Bank (Top of Cut/Fill Slope): The point at which the proposed channel cross section intercepts the existing ground. Any land disturbance beyond this point is covered under 31 01 00, Site Management and Construction Sequencing, Article 3.10, Site Preparation.

D. The terms "Geotextile" or "Geotextile- Encapsulated" when used to describe materials shown on the details for Stream Bank Surface Stabilization and Stream Bank Reconstruction (both bank height <10'<) shall refer to Woven Coir Fabric.

E. Refer to applicable definitions in Section 31 32 00, Woven Mattress Coir Fabric Blanket (Coir Fabric).

F. Refer to applicable definitions in Section 31 37 01, Buffer and Riparian Plantings.

G. Stream Bank Stabilization: The application of coir fabric and soil bio-engineering techniques to the surface face of undisturbed banks per the details shown on the plans.

H. Stream Bank Reconstruction: The application of coir fabric and soil bio-engineering to the surface face and/or subsurface of "over excavated" banks per the details shown on the plans.

I. Imported Material: Materials obtained from sources offsite, suitable for specified use and tested and certified clean by Contractor.

J. General Fill: Imported materials required to raise existing grade from the rough grade, to the Final Grade.

1.03 ACTION SUBMITTALS

A. Written plans for the sequencing, excavation, and disposal of materials removed from the existing stream banks shall refer to applicable submittals in Section 31 01 00, Site Management and Construction Sequencing.

B. Written Borrow Excavation Plan, Detailing:

1. Methods and sequencing of borrow excavation.
2. Proposed offsite borrow sites.
3. Copy of applicable permits or property owner agreements.
4. Proposed locations and extents of onsite stockpiled borrow material.
5. Quantity, types and sizes of equipment proposed to perform the Work.

C. Written Bank Stabilization Plan, Detailing:

1. Methods and sequencing of fabric installation.
2. Sequencing of bio-engineering.
3. Copy of manufacturer's/supplier's product tag.
4. Proposed staging area.
5. Quantity, types and sizes of equipment proposed to perform the Work.

D. Written Bank Reconstruction Plan, Detailing:

1. Methods and sequencing of borrow installation.
2. Methods and sequencing of fabric installation.
3. Sequencing of bio-engineering.
4. Copy of manufacturer's/supplier's product tag.
5. Proposed staging area.
6. Quantity, types and sizes of equipment proposed to perform the Work.

1.04 QUALITY ASSURANCE

A. Survey Control: The Subcontractor shall have onsite, at all times work is performed, an instrument capable of measuring elevations (survey level), survey rod, and personnel competent of confirming and recording spot elevations and grades. Control points shall be installed along the entire length of the project to assist with the confirmation of elevations and grades.

1.05 SCHEDULING AND SEQUENCING

A. The Subcontractor shall perform all excavation activities covered under Section 31 23 16, Excavation, prior to performing bank stabilization/reconstruction work.

B. The Contractor will field review the existing erosion control measures at each individual location prior to the start of Bank Stabilization/Reconstruction work.

C. The Subcontractor shall make repairs to erosion control measures which have failed or add additional measures based on the Contractor's recommendation.

D. The Subcontractor shall make their own determination as to which bank stabilization/reconstruction method is applicable at each location. The written plan shall be submitted in accordance with Article 1.2 and approved by the Contractor prior to proceeding with the Work.

E. The Subcontractor shall provide an as-built survey of the Work to the Contractor.

PART 2 PRODUCTS

2.01 SOURCE QUALITY CONTROL

A. All imported general fill material shall be tested and certified clean by the Subcontractor.

B. Testing to certify that the imported material is clean will be performed by the Subcontractor or the supplier, at a frequency not to exceed 1 sample per 1,000 cubic yards of imported material. The constituents to be analyzed will be at the discretion of the Contractor, and will depend on the location of the borrow source(s) and previous land uses at the borrow source.

2.02 GENERAL FILL

A. As defined in Section 31 23 23, Fill and Backfill.

PART 3 EXECUTION

3.01 STRIPPING

A. Do not remove topsoil until after scalping is completed.

3.02 GENERAL

A. It is recommended that the installation equipment have a hydraulic thumb.

B. The Subcontractor shall provide an as-built survey of the constructed channel, verifying points and elevations shown on the Drawings, prior to acceptance of the work for payment.

1. The survey shall include elevations and benchmark tied references to the following channel cross section points:
   a. Thalweg.
   b. Top and Bottom (toe) of Bank.

C. Excavate to lines, grades and dimensions shown and as necessary to accomplish the Work. Excavate to within tolerances of plus or minus 0.1 foot, except where the dimensions or grades are shown or specified as maximum or minimum.

3.03 INSTALLATION OF BANK SURFACE STABILIZATION

A. Surface stabilization will only be performed in areas of bank disturbance which did not include excavation of bank material. Areas would include ingress and egress points for equipment performing "in-stream" work.

B. Existing vegetation outside of the access areas is to remain.

C. Existing vegetation inside of the access areas shall be cut flush with the ground (plus or minus 0.2 foot) using hand or mechanical means and methods which do not disturb the surface of the ground.

3.04 INSTALLATION OF BANK RECONSTRUCTION (BANK HEIGHT <= 10')

A. Reconstruction will be performed in areas of bank disturbance which include excavation of bank material. Areas would also include ingress and egress points for equipment performing "in-stream" work.

B. Existing vegetation outside of the excavation areas is to remain.

C. The Subcontractor shall key coir fabric per the detail prior to applying borrow material.

D. General fill material shall be applied in maximum 12-inch lifts and compacted to 95 percent Standard Proctor above the water line. General fill material applied below the water line shall be compacted using the bucket of the excavator. (Minimum Excavator HP 325.)

E. Seeding mixtures and mulch shall be applied to the bank surface prior to installation of the coir fabric. Fabric installation shall be per the details and in accordance with Section 31 32 01, Woven Mattress Coir Fabric Blanket (Coir Fabric).

F. The top of the bank fabric anchor shall be installed per the details.

G. Soil Bio-Engineering shall be applied in accordance with the details shown on the plans.

3.05 INSTALLATION OF BANK RECONSTRUCTION (BANK HEIGHT >10')

A. Reconstruction will be performed in areas of bank disturbance which include excavation of bank material. Areas would include ingress and egress points for equipment performing "in-stream" work as well as excavation for remediation.

B. Existing vegetation outside of the excavation areas is to remain.

C. The Subcontractor is required to excavate a minimum of 5 feet into the bank beyond the original and/or adjacent bank surface

D. The Subcontractor shall install rip rap per the detail prior to installing the coir fabric.

E. The Subcontractor shall key coir fabric per the detail prior to applying borrow material.

F. General fill material shall be applied in maximum 12-inch lifts and compacted to 95 percent Standard Proctor above the water line. Borrow material applied below the water line shall be compacted using the bucket of the excavator (Minimum Excavator HP 325.).

G. After compacting the soil the coir fabric is pulled tight over the lift surface and anchored per the detail shown on the plans.

H. Brushlayer is then applied to the top of the fabric from the previous coir lift.

I. The fabric is then folded over the dead stout stakes and the brushlayer. Steps F-I are repeated

J. The top of the bank fabric anchor shall be installed per the details.

K. Soil Bio-Engineering shall be applied in accordance with the details shown on the plans.

3.06 STOCKPILING OF EXCAVATED MATERIAL

A. Stockpile excavated material that is suitable for use as fill or backfill material as needed.

B. Confine stockpile areas to within the easements and approved Work areas.

C. Subcontractor shall maintain erosion control measures at all stockpile areas.

D. Do not stockpile excavated material adjacent to trenches and other excavations.

E. Do not stockpile materials over existing utilities.

3.07 DISPOSAL OF SPOIL

A. Dispose of excavated materials which are unsuitable or exceed quantity needed for restoration (larger rock), as directed by the Contractor.

B. Dispose of debris resulting from the removal of organic matter, trash, refuse and junk as specified in Section 31 01 00, Site Management and Construction Sequencing, for clearing and grubbing debris.

3.08 SITE TESTING

A. In-Place Density Tests: In accordance with ASTM D2922. During Placement of General Fill, test as follows:

1. General Fill: One test per each 2,500 square feet, with a minimum of 1 test per lift.

END OF SECTION

SECTION 31 23 13
SUBGRADE PREPARATION

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
   a. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft^3 (600 kN-m/m^3)).
   b. D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).

1.02 DEFINITIONS

A. Optimum Moisture Content: As defined in Section 31 23 23, Fill and Backfill.

B. Prepared Ground Surface: Ground surface after completion of clearing and grubbing, scalping of sod, stripping of topsoil, excavation to grade, and scarification and compaction of subgrade.

C. Relative Compaction: As defined in Section 31 23 23, Fill and Backfill.

D. Relative Density: As defined in Section 31 23 23, Fill and Backfill.

E. Subgrade: Layer of existing soil after completion of clearing, grubbing, scalping of topsoil prior to placement of fill, roadway structure or base for floor slab.

F. Proof-Rolling: Testing of subgrade by compactive effort to identify areas that will not support the future loading without excessive settlement.

1.03 INFORMATIONAL SUBMITTALS

A. The subcontractor shall submit the proposed proof-rolling equipment specifications to the Contractor.

1.04 SEQUENCING AND SCHEDULING

A. Complete applicable Work specified in Sections 31 10 00, Site Clearing and 31 23 16, Excavation, prior to subgrade preparation.

1.05 QUALITY ASSURANCE

A. Notify Contractor when subgrade is ready for compaction or proof-rolling or whenever compaction or proof-rolling is resumed after a period of extended inactivity.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Prepare subgrade when unfrozen and free of ice and snow.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. Keep subgrade free of water, debris, and foreign matter during compaction or proof-rolling.

B. Bring subgrade to proper grade and cross-section and uniformly compact surface.

C. Do not use sections of prepared ground surface as haul roads. Protect prepared subgrade from traffic.

D. Maintain prepared ground surface in finished condition until next course is placed.

3.02 PROOF ROLLING

A. After overexcavating and replacing unsuitable material and removing debris, proof-roll the entire subgrade to locate any soft/loose soils or potentially unsuitable conditions. Proof-rolling shall be performed with a loaded tandem dump truck having a minimum weight of 25,000 pounds and exerting a minimum uniform average pressure of 40 psi.

B. Overexcavate only as directed by the Contractor any rutted areas, wet, unsuitable, or soft or loose subgrade material (as specified in Article 3.06 of this Section), as directed by Contractor. Replace overexcavated soft or loose subgrade material as specified in Article 3.06 of this Section, and compact as specified in Section 31 23 23, Fill and Backfill.

C. At the direction of the Contractor, perform additional proof-rolling after subgrade soil has been compacted to confirm firm and unyielding conditions.

3.03 COMPACTION

A. After proof-rolling, compact all subgrade soils to minimum 95 percent relative compaction as determined in accordance with ASTM D698. This compaction must be achieved throughout the top 1 foot of the prepared subgrade. Where overexcavation and replacement of unsuitable, soft or loose materials is required, compact as specified in Section 31 23 23, Fill and Backfill.

B. If any two of the four most recent tests fall below 95 percent relative compaction, or any one of the tests falls below 92 percent, additional compaction effort will be required.

C. As necessary, modify the moisture content of subgrade soils to achieve the required relative compaction.

3.04 MOISTURE CONDITIONING

A. Dry Subgrade: Add water, then mix to make moisture content uniform throughout.

B. Wet Subgrade: Aerate material by blading, discing, harrowing, or other methods, to hasten drying process.

3.05 TESTING

A. The Contractor may require additional testing of soft or loose subgrade material prior to subgrade preparation.

B. In-Place Density Tests: In accordance with ASTM D2922. Test top 1 foot of subgrade at a frequency of one test every 5,000 square feet.

3.06 CORRECTION

A. Soft or Loose Subgrade:

1. Adjust moisture content and recompact, or
2. Over excavate as specified in Section 31 23 16, Excavation, and replace with suitable material from the excavation, as specified in Section 31 23 23, Fill and Backfill.

B. Unsuitable Material: Over excavate as specified in Section 31 23 16, Excavation, and replace with suitable material from the excavation, as specified in Section 31 23 23, Fill and Backfill.

END OF SECTION

SECTION 31 23 16
EXCAVATION

PART 1 GENERAL

1.01 DESCRIPTION

A. This section applies to all types of excavation including contaminated sediment, TSCA-contaminated sediment, and common excavation to achieve a PCB concentration in the sediment of less than 1 mg/kg.

1.02 DEFINITIONS

A. Contaminated Sediment Excavation: Removal of any contaminated sediment (PCBs >1 and <50 mg/kg) from Lincoln Creek and the Western Oxbow in the Milwaukee River. Approximate extent of contaminated sediment excavation is shown on the Drawings, but actual extent will be determined by confirmation sampling in the field.

B. TSCA-Contaminated Sediment Excavation: Removal of any contaminated sediment (PCBs >50 mg/kg) from Lincoln Creek and the Western Oxbow in the Milwaukee River. Approximate extent of TSCA-contaminated sediment excavation is shown on the Drawings, but actual extent will be determined by confirmation sampling in the field.

C. Common Excavation: Removal of any non-contaminated, non-rock soils.

1.03 INFORMATIONAL SUBMITTALS

A. Excavation Plan, Detailing:

1. Methods and sequencing of excavation.
2. Shoring design detailing how sides of excavations will be supported, detrimental settlement prevented, and lateral movement of existing facilities, adjacent property, and completed Work protected.
3. Proposed locations of stockpiled excavated material.
4. Anticipated difficulties and proposed resolutions.
5. Proposed contaminated and TSCA sediment disposal facilities.
6. Proposed common excavation disposal location.
7. Excavation Plan shall be sealed by a WI P.E.

B. Survey Plan, Detailing:

1. Within 7 days after Notice of Award, Subcontractor shall submit a Survey Plan that is consistent with the Specifications provided. The submittal will consist of:
   a. Type of survey to be used.
   b. Proposed Surveyor's relevant qualifications and experience.
   c. Approximate number of survey points within a given area.
   d. Precision of the equipment.
   e. Accuracy of the survey.
   f. The reporting format to meet the Specifications.

C. Daily Excavation Reports:

1. Subcontractor shall submit a daily report to the Contractor describing each calendar day's activities (12 am to 11:59 pm) beginning with mobilization to the site and ending with demobilization from the site. The report shall be submitted no later than 5:00 p.m. following the reported day.
2. The Daily Work Report shall include the following:
   a. Project name, day, and date.
   b. Weather conditions for the site, including high and low temperature, precipitation levels, maximum and average wind velocity and direction, sky conditions and minimum/maximum water depth fluctuations.
   c. Location of excavation performed for the day with figure indicating excavation area.
   d. The day's activities shall be reported to include active excavation times, time when excavation was not conducted due to mechanical failure, time when excavation was not conducted due to maintenance of equipment, time and reason for excavation downtime due to delays by others.
   e. Approximate volume (cubic yards) excavated.
   f. Debris type, approximate volume, location encountered, and location placed.
   g. Health and Safety reporting to include accidents, spills, and near-misses, and actions taken to contain and correct each incident with the name of the individual reporting the event.
   h. Description of all monitoring performed by the Subcontractor, including surveys.
   i. Safety topics, images of day's activities, meeting or inspections with applicable decisions, and/or miscellaneous notes appropriate to the day's activities.

D. Weekly Progress Report:

1. Subcontractor shall submit a weekly progress report to the Contractor describing each week's activities beginning with mobilization to the site and ending with demobilization from the site. The report shall be submitted no later than Monday at 5:00 p.m. following the reported week.
2. The Weekly Progress Report shall include the following:
   a. Project name and reported week.
   b. Weekly Survey data and report.
   c. Total volume excavated during the week based on the survey results.
   d. Equipment repairs and maintenance performed.
   e. Next week's expected activities.
3. The following shall be included in each weekly survey report:
   a. Documentation of the surveyor, equipment, and methods used in the survey.
   b. Survey map of Lincoln Creek and Western Oxbow at 1 inch equals 50 feet, 1-foot contour interval in paper copy and MicroStation format.
   c. The survey of the reporting period shall be compared with the previous reporting period and the pre-excavation survey to determine volume excavated to date.
   d. Subcontractor shall furnish one set of the final soundings, plan and sections, and quantity calculations.
   e. Subcontractor shall furnish electronic files of the mapping and profiling results. This shall include raw and post processed survey data. Data format shall be delivered in ASCII and InRoads DTM compatible format.
   f. The survey data shall be Wisconsin State Plane Coordinate (SPC) NAD 1927, South, U.S. Survey Feet.

E. Project Closeout Report:

1. At the end of each stream zone (1, 2A, 2B, and 3A), a closeout report shall be completed and delivered to the Contractor no later than 30 days following completion of dredging for the subject work window. The report shall include the follow sections:
   a. Introduction:
      1) Remediation overview.
      2) Project background.
   b. Excavation Operations:
      1) Overview of excavation operations.
      2) Summary of work window operations.
      3) Schedule.

4) Production.
5) Debris.
6) Dewatering activities.
7) Overview.
8) System improvements.
9) Communications.

c. Debris removal.

d. QA/QC Operations:
1) Survey.
2) Equipment and personnel.
3) QA Survey methods.
4) QC Survey methods.

1.04 QUALITY ASSURANCE

A. Provide adequate survey control to avoid unauthorized over excavation.

1.05 WEATHER LIMITATIONS

A. Material excavated when frozen or when air temperature is less than 32 degrees F shall not be used as fill or backfill until material completely thaws.

B. Material excavated during inclement weather shall not be used as fill or backfill until after material drains and dries sufficiently for proper compaction.

1.06 SEQUENCING AND SCHEDULING

A. Clearing, Grubbing, and Stripping: Complete applicable Work specified in Section 31 10 00, Site Clearing, prior to excavating.

B. Dewatering: Conform to applicable requirements of Section 31 23 19.01, Lincoln Park Bypass and Dewatering, prior to initiating excavation.

C. Excavation Support: Install and maintain as necessary to support sides of excavations and prevent detrimental settlement and lateral movement of existing facilities, adjacent property, and completed Work.

1.07 PRE-EXCAVATION, PROGRESS, AND POST-EXCAVATION SURVEYS

A. Subcontractor shall engage a registered Surveyor licensed in Wisconsin and experienced in stream and stream bank surveying to perform a pre-excavation survey before excavation operations commence, weekly surveys to track progress, and post-excavation bathymetric surveys to document conditions at completion for each creek section. Subcontractor shall submit a Survey Plan

(as described in Article Submittals) with the proposed Surveyor's relevant qualifications and experience described in sufficient detail to provide a clear demonstration of their competency to perform the work as required by the Contract.

B. Subcontractor shall perform a pre-excavation survey within 21 days after Notice of Award.

C. Subcontractor shall make a specific effort to include the creek bed in the areas where the earthen berms will be placed in the pre- and post-construction surveys.

D. Subcontractor shall perform progress surveys on a weekly basis during the dredging work window and provide results to the Contractor.

E. Subcontractor shall perform a survey within 7 days after the excavation is complete for each creek section. Subcontractor shall report the survey in the weekly progress report and propose to use the survey as a post-excavation survey for the reported pile. If conditions are satisfactory to the Contractor, the survey will be deemed as the post-excavation survey for the reported creek section.

F. Subcontractor shall attempt to use the same Surveyor to complete all surveys. In the event a different Surveyor is required, the Subcontractor shall submit a modified Survey Plan with the proposed Surveyor. Subcontractor shall receive approval from Contractor prior to using the proposed Surveyor to perform surveys.

G. Survey accuracy shall meet the following requirements:

1. Site Control Points:
    a. CH2M HILL will furnish up to two site control point locations as determined by the Subcontractor.
    b. The site control points will be based on the horizontal datum of NAD-27, Wisconsin State Plane Coordinate System South, U.S. Survey Feet (Grid), and the Vertical Datum of NGVD 1929.
2. Accuracy and Tolerances: The Surveyor shall have equipment that is capable of measuring and recording the vertical and horizontal location of the top of sediment in Lincoln Creek and the Western Oxbow. The survey equipment shall provide a permanent record of the positions referenced to the Project coordinate system. The location of the top of sediment shall be measured and recorded with equipment capable of producing one-foot surface contours at a 95 percent confidence level.
    a. Horizontal Accuracy: Plus or minus 0.1 ft.
    b. Vertical Accuracy: Plus or minus 0.01 ft (0.1 for unpaved ground surface elevations).

H. The vertical datum used for the dredging Work in the river shall be National Geodetic Vertical Datum (NGVD) 1929. The plane coordinate datum used for excavation Work shall be Wisconsin State Plane Coordinate (SPC) NAD 1927, South, U.S. survey feet.

I. Survey methods and means for verifying dredged elevations shall be by electronic means, calibrated to Project datum prior to the beginning of the Work.

J. Horizontal positioning for depth measurements shall use electronic positioning modes or systems, or hybrid combinations of instrumental and electronic data measurement and recording systems to measure, adjust, correlate, print, plot, and record horizontal and vertical observations.

K. The USEPA, Contractor, or designated representative will be permitted to have an observer present during all survey events, if desired.

L. The Surveyor shall be responsible for computing the volume of material dredged in cubic yards, for acceptance or payment purposes based on the before and after dredge soundings. In the event that the post-excavation completion survey discloses that the excavation is not satisfactorily completed, the Subcontractor shall resume dredging until the Work is deemed complete.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. Excavate to lines, grades, and dimensions shown and as necessary to accomplish Work. Excavate to within tolerance of plus or minus 0.1 foot, except where dimensions or grades are shown or specified as maximum or minimum. Allow for forms, working space, granular base, topsoil, and similar items, wherever applicable.

B. Excavation and transportation activities within Lincoln Creek and the Western Oxbow shall be performed on mats to prevent equipment tracks and wheels from contacting sediment.

C. Do not over excavate without written authorization of Contractor.

D. Remove or protect obstructions as shown and as specified in Section 01 50 00, Temporary Facilities and Controls, Article Protection of Work and Property.

3.02 CLASSIFIED EXCAVATION

A. Excavation is classified; see Article Definitions for classifications.

3.03 CONTAMINATED SOIL EXCAVATION

A. The Contractor will determine the extent of contaminated soil excavation in a preconstruction sediment investigation.

B. Do not begin contaminated or TSCA-contaminated sediment excavation without approval of the Contractor. The Contractor will be present during excavation activities.

C. Conduct contaminated and TSCA-contaminated sediment excavation in horizontal stages no deeper than 1 foot each. Do not excavate another stage from any area until approved by the Contractor. Continue contaminated sediment and TSCA-contaminated excavation in this manner until excavation is complete, as directed by the Contractor.

D. Contractor will collect confirmation samples within the excavation area when the excavation has reached the extents identified by the preconstruction soils investigation. Analysis of the samples will be performed by a mobile laboratory. If test results indicate soils remain with PCB concentrations greater than 1 mg/kg, additional soil will be removed, as directed by the Contractor.

E. If stockpiling excavated contaminated soil is necessary prior to offsite disposal, stage excavated contaminated soil as specified in Part 3.05.

F. Subcontractor shall perform air monitoring in accordance with their health and safety plan.

3.04 EMBANKMENT AND CUT SLOPES

A. Shape, trim, and finish cut slopes to conform with lines, grades, and cross-sections shown, with proper allowance for topsoil or slope protection, where shown.

B. Remove stones and rock that exceed 3-inch diameter and that are loose and may roll down slope. Remove exposed roots from cut slopes.

C. Round tops of cut slopes in soil to not less than a 6-foot radius, provided such rounding does not extend offsite or outside easements and rights-of-way, or adversely impacts existing facilities, adjacent property, or completed Work.

3.05 STOCKPILING EXCAVATED MATERIAL

A. Stockpile excavated material that is suitable for use as fill or backfill until material is needed.

B. Stockpile excavated TSCA-contaminated sediment on dewatering pad out of creek bank to prevent contact with flood water. If stockpiling excavated contaminated sediment, the Subcontractor must place excavated contaminated sediment on a liner located outside the 100-year floodplain to prevent contact with flood waters, cover with a UV stable geomembrane and anchor to prevent erosion of the stockpile or release of contaminated soils.

C. Post signs indicating proposed use of material stockpiled. Post signs that are readable from all directions of approach to each stockpile. Signs should be clearly worded and readable by equipment operators from their normal seated position.

D. Confine stockpiles to within easements, rights-of-way, and approved work areas. Do not obstruct roads or streets.

E. Do not stockpile excavated material in Lincoln Creek or Western Oxbow, or adjacent to trenches and other excavations, unless excavation side slopes and excavation support systems are designed, constructed, and maintained for stockpile loads.

F. Do not stockpile excavated materials near or over existing facilities, adjacent property, or completed Work, if weight of stockpiled material could induce excessive settlement.

3.06 DISPOSAL OF SPOIL

A. Common excavated materials, which are unsuitable or exceed quantity needed for fill or backfill, shall be left onsite by working into final grade under the supervision of the Contractor.

B. Dispose of excavated TSCA-contaminated sediment at TSCA disposal facility approved by USEPA and Contractor.

C. Dispose of contaminated sediment at a disposal facility approved by USEPA and Contractor.

D. Dispose of debris resulting from removal of organic matter, trash, refuse, and junk as specified in Section 31 10 00, Site Clearing, for clearing and grubbing debris.

END OF SECTION

SECTION 31 23 19.01
LINCOLN CREEK BYPASS AND DEWATERING

PART 1 GENERAL

1.01 DEFINITIONS

A. Temporary Earthen Cut-Off Structure: Earthen structure to be constructed of material compatible with the restoration materials and does not have grain sizes less than a representative D50 in the Lincoln Creek channel. Maximum height of earthen structure shall be 6-feet.

B. Temporary Sheet Pile Cut-Off Structure: Steel sheet pile system designed and installed in the locations shown on the drawings. These structures shall be designed and drawings sealed by a P.E. licensed in Wisconsin.

C. Surface Water from Undisturbed Areas (Chapter 30): Water associated with initial dewatering of the site. Includes the Lincoln Creek upstream bypass around disturbed areas, precipitation on undisturbed areas, and storm sewer outfall discharges on undisturbed areas.

D. Surface Water from Disturbed Areas (WPDES Wastewater): Water associated with major precipitation events that overtop the cut-off structures, precipitation collected on active excavation areas, and storm sewer outfall discharges on active excavation areas.

E. Groundwater from Disturbed Areas (WPDES Wastewater): Water associated with excavations below the normal water table, excavations during removal of contaminated sediment, and restoration after the removal of contaminated sediment.

F. Exhibit 1 provides further detail on the types of water and handling procedures.

1.02 ACTION SUBMITTALS

A. Detailed Bypass and Dewatering Plan.

B. Detailed Water Treatment Plan.

1.03 BYPASS AND DEWATERING PLAN

A. As a minimum, include:

1. Description of proposed temporary cutoff structures including, but not limited to, equipment, materials, installation, and removal methods.
   a. Elevation height of proposed temporary cutoff structures shall not exceed the elevations shown in Exhibit 2.
2. Description of proposed Lincoln Creek bypass system including, but not limited to, equipment; methods; standby equipment and power supply, means of measuring flow to discharge locations to be utilized. The bypass system must convey a minimum of 100 cubic feet of water per second.
3. Description of proposed management of outfall discharges. Subcontractor may use diversions or pump bypass systems. The outfall management descriptions shall include but is not limited to, equipment; methods; standby equipment and power supply, means of measuring flow, and discharge locations to be utilized.
4. Descriptions of proposed dewatering systems including, but not limited to, equipment; methods; standby equipment and power supply, means of measuring flow, and discharge locations to be utilized.
5. Drawings showing locations, dimensions, and relationships of elements of each system.
6. Design calculations demonstrating adequacy of proposed bypass and dewatering systems and components.
7. If system is modified during installation or operation revise or amend and resubmit Bypass and Dewatering Plan.
8. Compliance with WDNR Chapter 30 site specific permit.
9. Leak test piping in accordance with Section 40.80.01-Process Piping Leakage Testing.

B. All structures and systems presented in the Bypass and Dewatering Plan will be designed and sealed by a P.E. licensed in Wisconsin.

C. USGS Gage 040869416 information for Lincoln Creek at Sherman Boulevard in Milwaukee, WI can be found on the internet at the following location:

1. http://waterdata.usgs.gov/wi/nwis/uv/?site_no=040869416&PARAmeter_cd=00065,00060

D. USGS Gage 04087000 information for the Milwaukee River in Milwaukee, WI can be found on the internet at the following location:

1. http://waterdata.usgs.gov/wi/nwis/uv/?site_no=04087000&PARAmeter_cd=00065,00060

1.04 WATER TREATMENT PLAN

A. Two water treatment systems will be required:

1. Chapter 30 System for TSS treatment.
   a. 2,000 gpm capacity minimum.
2. WPDES System for TSS and PCB treatment.
   a. 500 gpm capacity minimum.

B. To include but not be limited to:

1. Description of proposed water treatment systems including, but not limited to, equipment; methods; standby equipment and power supply, means of measuring flow to discharge locations to be utilized.
2. Compliance with WDNR Chapter 30 and WPDES site specific permits
3. Size of the electrical power supply and distribution plans.
4. System drawings including:
   a. Flow diagrams.
   b. Water treatment plan layout.
5. The Chapter 30 water treatment system must be capable of meeting the following at a minimum:
   a. Minimum flow of 2,000 gallons per minute (gpm).
   b. Reducing the influent TSS to the required discharge limit of 40 mg/L.
6. The WPDES water treatment system must be capable of meeting the following at a minimum:
   a. Minimum flow of 500 gallons per minute (gpm).
   b. Reducing the influent TSS to the required discharge limit of 40 mg/L and the discharge limit of less than 0.1 µg/L for PCBs.
7. Leak test piping in accordance with Section 40 80 01, Process Piping Leakage Testing.
8. Test water treatment systems in accordance with Section 01 91 14, Equipment Testing and Facility Startup.
9. Sampling Plan to monitor for compliance.
10. Operation and Maintenance plan.
11. Preventive Maintenance Plan: Upon Notice of Award, the Subcontractor shall submit for review and approval a PMP per the minimum requirements presented in this specification.
12. Project Organization and Responsibility Plan: Upon Notice of Award, the Subcontractor shall submit for review and approval a Project Organization and Responsibility Plan. The plan shall discuss the proposed staff for operating and maintaining the water treatment systems.
13. Records and Reports: The Subcontractor shall maintain management, operation, and maintenance records and prepare management, operation, and maintenance reports. All records and copies of reports shall be turned over to Contractor within 5 days after subcontract completion.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. Continuously control water during course of construction, including weekends and holidays and during periods of work stoppages, and provide adequate backup systems to maintain control of water.

B. Remove and control water during periods when necessary to properly accomplish Work.

3.02 SURFACE WATER CONTROL

A. See Section 01 50 00, Temporary Facilities and Controls, Article Temporary Controls.

B. Remove surface runoff controls when no longer needed.

3.03 LINCOLN CREEK BYPASS

A. Design, provide, operate, and maintain bypass system of sufficient size and capacity to prevent water from entering work area to permit excavation and subsequent construction in dry. Continuously maintain excavations free of water, regardless of source, and until backfilled to final grade.

B. Route bypass on property available for Subcontractor's use as shown on the drawings.

C. Provide sufficient redundancy in each system to keep excavation free of water in event of component failure.

D. If pumps are used, provide 100 percent emergency power backup with automatic startup and switchover in event of electrical power failure or redundant diesel powered pumps.

3.04 CUT-OFF STRUCTURES

A. Design, provide, operate, and maintain cut-off structures of sufficient size and capacity to prevent water from entering work area to permit excavation and subsequent construction in dry. Continuously maintain excavations free of water, regardless of source, and until backfilled to final grade.

B. Cut-off structures shall be designed to meet the elevation requirements listed in Exhibit 2.

C. Earthen cut-off structures shall be constructed of material compatible with the restoration materials and shall not have grain sizes less than a representative D50 in the Lincoln Creek channel. Maximum height of earthen structure shall be 6-feet.

D. Earthen cut-off structures shall be designed to wash away and not cause the flooding out upstream vegetation above the historic Estabrook Dam pool (Elevation 617).

E. Subcontractor shall survey the channel up to and including the earthen cut-off structures location pre- and post-project to verify that the earthen cut-off structure has been removed and that any material wash-out has been removed.

3.05 DEWATERING SYSTEMS

A. Provide, operate, and maintain dewatering systems of sufficient size and capacity to permit excavation and subsequent construction in dry and to lower and maintain water level so excavation can occur in the dry. Continuously maintain excavations free of water, regardless of source, and until backfilled to final grade.

B. Design and Operate Dewatering Systems:

1. To prevent loss of ground as water is removed.
2. To avoid inducing settlement or damage to existing facilities, completed Work, or adjacent property.

C. Provide sufficient redundancy in each system to keep excavation free of water in event of component failure.

D. Provide supplemental ditches and sumps only as necessary to collect water from local seeps. Do not use ditches and sumps as primary means of dewatering.

3.06 MONITORING FLOWS

A. Monitor volume of water pumped per calendar day from excavations, as Work progresses. Also monitor volume of water introduced each day into excavations for performance of Work. Monitor flows using measuring devices acceptable to Contractor.

3.07 OPERATION OF WATER TREATMENT SYSTEMS

A. The Subcontractor shall be responsible for the operation and maintenance of the water treatment systems. The Subcontractor shall operate the water treatment systems so treated water meets the discharge requirements.

B. The Subcontractor shall furnish an operator with a valid Wisconsin operator's license who shall act as the person responsible for plant operation and who shall be available for consultation with the Contractor or with pertinent regulatory agencies as needed. The operator shall also fill out forms documenting work accomplished. The Subcontractor shall develop recording and reporting forms specific to the maintenance of the individual systems and submit the appropriate forms to Contractor for approval.

C. Sample Collection Points:

1. Sample collection points for performance measurements as determined by the Contractor.
2. The Subcontractor shall maintain the collection points in a clean and fully operational condition. Repair as needed if leaks develop.

D. Maintenance of the Water Treatment System: The Subcontractor shall perform all preventive and corrective maintenance, within limits specified herein, needed to keep the water treatment system equipment in operational condition.

E. Preventive Maintenance:

1. The Subcontractor shall prepare a Preventive Maintenance Plan (PMP). The PMP shall describe the type of maintenance to be performed and the date for which performance is scheduled.
2. The Subcontractor shall submit a draft PMP to the Contractor no later than 21 days after the subcontract award. Upon Contractor approval, the PMP shall become part of this document and the Subcontractor shall perform preventive maintenance in accordance therewith.
3. The submitted plan shall include components to be inspected and maintained, inspection and maintenance techniques, and frequencies, and reporting methodology.
4. The Subcontractor may, at the Subcontractor's discretion, perform preventive maintenance on equipment not included in the PMP in order to avoid potential corrective maintenance costs.
5. When the results of PM indicate that defective parts or components need to be repaired or replaced, the Subcontractor shall be responsible for such repairs, if within the scope of corrective maintenance.

3.08 DISPOSAL OF WATER

A. Comply with discharge permits for water disposal from authorities having jurisdiction.

B. Treat water collected by dewatering operations, as required by regulatory agencies, prior to discharge.

C. Discharge water as required by discharge permit and in manner that will not cause erosion or flooding, or otherwise damage existing facilities, completed Work, or adjacent property.

1. Diffuser: Diffuser shall be a 60-ft or 80-ft circumference geotexile tube anchored in the Milwaukee River and protected from washing downriver.

D. Remove solids from treatment facilities and perform other maintenance of treatment facilities as necessary to maintain their efficiency.

3.09 PROTECTION OF PROPERTY

A. Make assessment of potential for dewatering induced settlement. Provide and operate devices or systems, including but not limited to reinjection wells, infiltration trenches and cutoff walls, necessary to prevent damage to existing facilities, completed Work, and adjacent property.

B. Securely support existing facilities, completed Work, and adjacent property vulnerable to settlement due to dewatering operations. Support shall include, but not be limited to, bracing, underpinning, or compaction grouting.

3.10 SUPPLEMENTS

A. The supplements listed below, following “End of Section”, are part of this Specification.

1. Exhibit 1 – Lincoln Park/Milwaukee River Wastewater Management Flow Chart.
2. Exhibit 2 - Summary of Temporary Cut-off Structure Requirements.

END OF SECTION

SECTION 31 23 19.01 – EXHIBIT 1

Lincoln Park/Milwaukee River Wastewater Management Flow Chart

Surface Water

1. SW Undisturbed Areas

Examples:
-Initial Dewatering
-Lincoln Creek Upstream Diversion Around Disturbed Areas
-Precipitation on Undisturbed Areas
-Storm Sewer Outfall on Undisturbed Areas
-Major Precipitation Event Overtops Diversion Devices and is Not Collected in Work Area

Is it Pumped?

No

Yes

No Treatment Required; Discharge Directly to River With Energy Dissipation

Is it Pumped Before Entering Limits of Work?

Yes

No

2. SW Disturbed Areas

Examples:
-Major Precipitation Event Overtops Diversion Devices and is Collected in Work Area
-Precipitation Collected on Disturbed Areas
-Storm Sewer Outfall on Disturbed Areas

Does the Disturbed Area in Question Have Sediment >1ppm PCBs (Based on RI Data or Conf. Samples)?

No

Outfalls 001 (North Bridge) & 002 (South Bridge) Treat to Remove TSS; Discharge to River With Energy Dissipation (Ch. 30 Requirement Incorporated Into WPDES Wastewater Permit)

Yes

Groundwater

3. GW Disturbed Areas

Examples:
-In Excavation Below Normal Water Table
-During Removal of Contaminated Sediment
-Restoration After Removal of Contaminated Sediment

Is There More Than 12 Inches of Water Above the Disturbed Surface?

Yes

Pump Water That Is >12 Inches Above the Disturbed Surface

Pump Water That Is <12 Inches Above the Disturbed Surface

No

Outfall 003 Treat to Remove TSS and PCBs; Discharge to River With Energy Dissipation (WPDES Wastewater Permit TSS/PCB Treatment Requirement)

Decon Water

4. Decon Water

Examples:
-Collected from Cleaning Trucks and Equipment on Decon Pads
-Dewatering on TSCA Staging Pad

EXHIBIT 2

SUMMARY OF TEMPORARY CUT-OFF STRUCTURE REQUIREMENTS

Stage	Type of Cut-off	Recommended Maximum Cut-off Elevation
1 – Lincoln Creek cut-offs 1A and 1C (Upstream of Green Bay Avenue Bridge and at Confluence with Milwaukee River western oxbow)	Earthen	1A: 617.0 feet 1C: 617.0 feet
1 – Milwaukee River western oxbow cut-offs 1B and 1D	Sheet Pile	1B: 620.0 feet 1D: 620.0 feet
2 – Milwaukee River western oxbow cut offs 2A and 2B	Sheet Pile	2A: 620.0 feet 2B: 620.0 feet
2 – Lincoln Creek re-routing	None (Re-routing of Lincoln Creek)	N/A

* Earthen cut-off to wash away with less than 100-year return period storm event.

SECTION 31 23 23
FILL AND BACKFILL

PART 1 GENERAL

1.01 SCOPE

A. This section applies to placement and compaction of most earthen materials, except for topsoil and trench backfill.

1.02 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
   a. C117, Standard Test Method for Materials Finer Than 75-Micrometers (No. 200) Sieve in Mineral Aggregates by Washing.
   b. C136, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
   c. D75, Standard Practice for Sampling Aggregates.
   d. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)).
   e. D1556, Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
   f. D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).
   g. D2922, Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
   h. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
   i. D4254, Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.

1.03 DEFINITIONS

A. Relative Compaction:

1. Ratio, in percent, of as-compacted field dry density to laboratory maximum dry density as determined in accordance with ASTM D698.
2. Apply corrections for oversize material to either as-compacted field dry density or maximum dry density, as determined by Contractor.

B. Optimum Moisture Content:

1. Determined in accordance with ASTM Standard specified to determine maximum dry density for relative compaction.
2. Determine field moisture content on basis of fraction passing 3/4-inch sieve.

C. Relative Density: Calculated in accordance with ASTM D4254 based on maximum index density determined in accordance with ASTM D4253 and minimum index density determined in accordance with ASTM D4254.

D. Prepared Ground Surface: Ground surface after completion of required demolition, clearing and grubbing, scalping of sod, stripping of topsoil, excavation to grade, and subgrade preparation.

E. Completed Course: A course or layer that is ready for next layer or next phase of Work.

F. Lift: Loose (uncompacted) layer of material.

G. Geosynthetics: Geotextiles, geogrids, or geomembranes.

H. Well-Graded:

1. A mixture of particle sizes with no specific concentration or lack thereof of one or more sizes.
2. Does not define numerical value that must be placed on coefficient of uniformity, coefficient of curvature, or other specific grain size distribution parameters.
3. Used to define material type that, when compacted, produces a strong and relatively incompressible soil mass free from detrimental voids.

I. Influence Area: Area within planes sloped downward and outward at 60-degree angle from horizontal measured from:

1. 1 foot outside outermost edge at base of foundations or slabs.
2. 1 foot outside outermost edge at surface of roadways or shoulder.
3. 0.5 foot outside exterior at spring line of pipes or culverts.

J. Borrow Material: Material from required excavations on or near site.

K. Imported Material: Materials obtained from sources offsite, suitable for specified use and tested and certified clean by Subcontractor.

L. Structural Fill: Fill materials as required under structures, pavements, and other facilities.

M. General Fill: Fill materials required to raise existing grade in areas other than under structures. Includes perimeter berm construction material and overexcavation correction material.

1.04 SUBMITTALS

A. Samples:

1. Each imported material taken at source, prior to construction.
2. Structural fill.

B. Quality Control Submittals:

1. Catalog and manufacturer's data sheets for compaction equipment.
2. Certified test results from independent testing agency.
   a. Certified gradation test results in accordance with ASTM D422, for imported materials.
   b. Certified modified Proctor compaction test results in accordance with ASTM D698, for structural fill, and general fill (up to 12 test samples).
3. Contract with an independent testing laboratory to provide testing services required. Contractor shall be responsible for the cost of all testing.
4. Provide manufacture's data sheet for proposed geotextile.

1.05 QUALITY ASSURANCE

A. Notify Contractor when:

1. Ready for backfilling, and whenever backfilling operations are resumed after a period of inactivity.
2. Soft or loose subgrade materials are encountered wherever embankment or site fill is to be placed.
3. Fill material appears to be deviating from Specifications.

1.06 SEQUENCING AND SCHEDULING

A. Complete applicable Work specified in Section 31 10 00, Site Clearing; Section 31 23 16, Excavation; and Section 31 23 13, Subgrade Preparation, prior to placing fill or backfill.

B. Do not place any fill material until after subgrade has been prepared as specified in Section 31 23 13, Subgrade Preparation.

PART 2 PRODUCTS

2.01 SOURCE QUALITY CONTROL

A. All imported borrow, backfill, structural, and general fill material shall be tested and certified clean by the Subcontractor.

B. Testing to certify that the imported material is clean will be performed by the Subcontractor or the supplier, at a frequency not to exceed 1 sample per 3,000 cubic yards of imported material. The constituents to be analyzed will be at the discretion of the Contractor, and will depend on the location of the borrow source(s) and previous land uses at the borrow source.

C. Gradation Tests:

1. As necessary to locate acceptable sources of imported material.
2. During production of imported material, perform gradation tests in accordance with ASTM C117 and ASTM C136, and provide samples to the Contractor, as follows:
   a. General Fill: One test from every 5,000 cubic yards of material.
   b. Structural Fill: one per source**.**
3. Include a description of grain angularity with the reported test results.
4. Clearly mark each sample, and show source of material and intended use.

2.02 GENERAL FILL

A. Soil material from stockpiles located at Moss American site. Three separate stockpiles are available for potential material reuse and consist of the Leon stockpile (9,500 cubic yards), Calumet access road (1,900 cubic yards), and Calumet soil stockpile (16,800 cubic yards). Subcontractor shall use this material first before importing other general fill.

B. Any natural soil material, excluding organic soils, debris, or other deleterious materials.

C. Maximum particle size of 4 inches.

2.03 STRUCTURAL FILL

A. 1-inch minus crushed gravel or crushed rock.

B. Free from dirt, clay balls, and organic material.

C. Well-graded from coarse to fine and containing sufficient fines to bind material when compacted, but with maximum 8 percent by weight passing No. 200 sieve.

2.04 SAND

A. Free from clay, organic matter, or other deleterious material.

B. Gradation as determined in accordance with ASTM C117 and ASTM C136:

Sieve Size	Percent Passing by Weight
1/4-inch	100
No. 4	95 - 100
No. 200	0 – 8

2.05 WATER FOR MOISTURE CONDITIONING

A. Free of hazardous or toxic contaminants, or contaminants deleterious to proper compaction.

PART 3 EXECUTION

3.01 GENERAL

A. Keep placement surfaces free of water, debris, and foreign material during placement and compaction of fill and backfill materials.

B. Place and spread fill and backfill materials in horizontal lifts of uniform thickness no greater than 1 foot, in a manner that avoids segregation, and compact each lift to specified densities prior to placing succeeding lifts. Slope lifts only where necessary to conform to final grades or as necessary to keep placement surfaces drained of water.

C. During filling and backfilling, keep level of fill and backfill around each structure even.

D. Do not place fill or backfill, if fill or backfill material is frozen, or if surface upon which fill or backfill is to be placed is frozen.

E. Tolerances:

1. Final Lines and Grades: Within a tolerance of 0.1 foot unless dimensions or grades are shown or a minimum is specified otherwise.
2. Grade to establish and maintain slopes and drainage as shown. Reverse slopes are not permitted.

F. Settlement: Correct and repair any subsequent damage to structures, pavements, curbs, slabs, piping, and other facilities, caused by settlement of fill or backfill material.

3.02 BACKFILL UNDER AND AROUND STRUCTURES

A. Under Facilities: Within influence area beneath structures, slabs, pavements, curbs, piping, conduits, duct banks, and other facilities, backfill with structural fill, unless otherwise shown. Place structural fill in lifts of 8-inch maximum thickness and compact each lift to minimum of 100 percent relative compaction as determined in accordance with ASTM D698**,** Method.

3.03 BACKFILL OF OVEREXCAVATION

A. All overexcavations left after removal of unsuitable, soft, or loose soils from the subgrade, as specified in Section 31 23 13, Subgrade Preparation, shall be backfilled with general fill.

B. Place general fill in lifts no greater than 1 foot thick and compact each lift to a minimum of 95 percent relative compaction as determined in accordance with ASTM D698.

3.04 FILL

A. Outside Influence Areas beneath Structures, Tanks, Pavements, Curbs, Slabs, Piping, and Other Facilities: Unless otherwise shown, place general fill as follows:

1. Allow for 6-inch thickness of topsoil where required.
2. Maximum 8-inch thick lifts.
3. Place and compact fill across full width of embankment.
4. Compact to minimum 95 percent relative compaction as determined in accordance with ASTM D698, Method.
5. Dress completed embankment with allowance for topsoil, crest surfacing, and slope protection, where applicable.

3.05 PLACING FILL OVER GEOSYNTHETICS

A. General:

1. Place fill over geosynthetics with sufficient care so as not to damage them.
2. Place fill only by back dumping and spreading.
3. Dump fill only on previously placed fill.
4. While operating equipment, avoid sharp turns, sudden starts or stops that could damage geosynthetics.

5. Place fill during cooler early morning hours to minimize wrinkles in the geosynthetic material.

B. Hauling: Utilize low ground pressure equipment.

C. Spreading:

1. Spreading equipment shall be track mounted, with a low ground pressure, less than 4.5 psi contact pressure.
2. Operate spreading equipment on minimum of 18 inches of fill over geosynthetics.
3. Spread fill in same direction as unseamed overlaps to avoid separation of seams and joints.
4. Never push fill downslope. Spread fill over sideslopes by pushing up from slope bottom.
5. Flatten wrinkles of geosynthetics in direction of spreading. Correct wrinkles in geotextiles.
6. Maintain proper overlap of unseamed geosynthetics.
7. Avoid overstressing geosynthetics and seams.

D. Geosynthetic Damage:

1. Mark punctures, tears, or other damage to geosynthetics, so repairs may be made.
2. Clear overlying fill as necessary to repair damage.
3. Repairs to geosynthetics shall be made by respective installers as specified in respective specification section for each geosynthetic.

3.06 SITE TESTING

A. A qualified independent testing agency shall provide site testing. The Contractor will be responsible for removing any material that does not meet the Specification requirements at no additional cost to the Owner.

B. Gradation:

1. One sample from each 1,500 tons of finished product or more often as determined by Contractor, if variation in gradation is occurring, or if material appears to depart from Specifications.
2. Include description of grain angularity in test results.
3. If test results indicate material does not meet Specification requirements, terminate material placement until corrective measures are taken.
4. Remove material placed in Work that does not meet Specification requirements.

C. In-Place Density Tests: In accordance with ASTM D2922**.** During placement of materials, test as follows:

1. Structural Fill: Minimum of four tests per lift below structures and minimum of two tests per lift around structures.
2. General Fill: One test per each 5,000 square feet, with a minimum of 1 test per lift.
3. Additional tests shall be performed if requested by the Contractor. The frequency and location of testing shall be determined solely by the Contractor. The Contractor may require a test on any lift of fill at any time, location, or elevation.

END OF SECTION

SECTION 31 32 01
WOVEN MATTRESS COIR BLANKET (COIR FABRIC) FOR STREAM CHANNEL BANKS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards that may be referenced in this Section:

1. ASTM International (ASTM):
   a. D1777, Standard Test Method for Thickness of Textile Materials.
   b. D3776, Standard Test Methods for Mass Per Unit Area (Weight) of Fabric.
   c. D4595, Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.
   d. D5035, Standard Test Method for Breaking Force and Elongation of Textile Fabrics (Strip Method).
   e. D5261, Standard Test Method for Measuring Mass per Unit Area of Geotextiles.

1.02 DEFINITIONS

A. Fabric: Coir blanket, 100 percent natural, organic blanket woven from spun mattress coir yarns.

B. Overlap: Distance measured perpendicular from overlapping edge of one sheet to underlying edge of adjacent sheet.

C. Dead Stout Stake: Wooden stake used to permanently secure fabric as shown on Drawings and defined in Section 31 37 01, Buffer and Riparian Plantings.

1.03 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
   a. Manufacturer material specifications and product literature.
   b. Description of proposed method of geotextile deployment, and provisions for holding fabric in-place and permanently secured.

2. Samples:
   a. Fabric: One-piece, minimum 18-inches long, taken across full width of roll of each type and weight of fabric furnished for Project. Label each with brand name and furnish documentation of lot and roll number from which each Sample was obtained.

B. Informational Submittals: Certifications from each fabric manufacturer that furnished products have specified property values. Certified property values shall be either minimum or maximum average roll values, as appropriate, for fabrics furnished.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver each roll with sufficient information attached to identify it for inventory and quality control.

B. Handle products in manner that maintains undamaged condition.

C. Do not store products directly on ground. Ship and store fabric with suitable wrapping for protection against moisture and ultraviolet exposure. Store fabric in way that protects it from elements. If stored outdoors, elevate and protect fabric with waterproof cover.

1.05 SCHEDULING AND SEQUENCING

A. Prior to fabric installation, prepare ground surface as specified in Section 31 37 01, Buffer and Riparian Plantings.

B. Notify Contractor whenever fabrics are to be placed. Do not place fabric without Contractor's approval of underlying materials.

PART 2 PRODUCTS

2.01 FABRIC

A. Composed of 100 percent natural, spun mattress coir yarn interlaced to form woven mat with uniform weave pattern.

B. Calendared or finished so yarns will retain their relative position with respect to each other.

C. Unseamed Sheet Width: Minimum 8-feet.

D. Equivalent substitute products to those shown on the Drawings will be acceptable only with approval from Contractor.

2.02 SECURING STAKES

A. Dead Stout Stakes:

1. Spacing as shown on the Drawings.
2. Dimensions as shown on the Drawings.
3. Length as shown on the Drawings.

PART 3 EXECUTION

3.01 LAYING COIR FABRIC

A. Lay and maintain fabric smooth and free of tension, folds, wrinkles, or creases.

B. Lay fabric pieces from downstream to upstream (overlap downstream end of fabric over the top of upstream end of previously installed downstream fabric piece), from bottom of bank slope to top of slope.

3.02 SHEET ORIENTATION ON SLOPES

A. Orient fabric with long dimension of each sheet perpendicular to the direction of flow in the channel.

3.03 JOINTS

A. Unseamed Joints: Overlap minimum of 9-inches, unless otherwise shown on the Drawings.

3.04 SECURING FABRIC

A. Secure fabric during installation as shown on the Drawings, using trenches and stakes at the top and bottom of slopes.

B. Roll out and install fabric from bottom of bank slope to top of slope.

C. Install additional stakes at the break in bank slope at the back of the bankfull bench.

3.05 REPAIRING FABRIC

A. Repair or replace torn, punctured, flawed, deteriorated, or otherwise damaged fabric with new unused fabric.

B. Repair Procedure:

1. Place patch of undamaged fabric over damaged area and at least 18-inches in all directions beyond damaged area, minimum of 4 square feet of fabric.
2. Remove interfering material as necessary to expose damaged fabric for repair.
3. Permanently attach repair using dead stout stakes.

END OF SECTION

SECTION 31 32 19.16
GEOTEXTILE

PART 1 GENERAL

1.01 SCOPE

A. The Work includes manufacture, fabrication (if needed), supply, and installation of geotextiles associated with the applications as shown on the Drawings.

1.02 REFERENCES

A. The following is a list of standards that may be referenced in this section:

1. ASTM International (ASTM):
   a. D3786, Standard Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics - Diaphragm Bursting Strength Tester Method.
   b. D4355, Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus.
   c. D4491, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
   d. D4533, Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
   e. D4632, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
   f. D4751, Standard Test Method for Determining Apparent Opening Size of a Geotextile.
   g. D4833, Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
   h. D4884, Standard Test Method for Strength of Sewn or Thermally Bonded Seams of Geotextiles.
   i. D5261, Standard Test Method for Measuring Mass per Unit Area of Geotextiles.

1.03 DEFINITIONS

A. Fabric: Geotextile, a permeable geosynthetic comprised solely of textiles.

B. Maximum Average Roll Value (MaxARV): Maximum of series of average roll values representative of geotextile furnished.

C. Minimum Average Roll Value (MinARV): Minimum of series of average roll values representative of geotextile furnished.

D. Nondestructive Sample: Sample representative of finished Work, prepared for testing without destruction of Work.

E. Overlap: Distance measured perpendicular from overlapping edge of one sheet to underlying edge of adjacent sheet.

F. Seam Efficiency: Ratio of tensile strength across seam to strength of intact geotextile, when tested according to ASTM D4884.

1.04 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
   a. Manufacturer material specifications and product literature.
   b. Installation drawings showing geotextile sheet layout, location of seams, direction of overlap, and sewn seams.
   c. Description of proposed method of geotextile deployment, sewing equipment, sewing methods, and provisions for holding geotextile temporarily in place until permanently secured.
2. Samples:
   a. Geotextile: One-piece, minimum 18 inches long, taken across full width of roll of each type and weight of geotextile furnished for Project. Label each with brand name and furnish documentation of lot and roll number from which each Sample was obtained.
   b. Field Sewn Seam: 5-foot length of seam, 12 inches wide with seam along center, for each type and weight of geotextile.
   c. Securing Pin and Washer: One each.

B. Informational Submittals:

1. Certifications from each geotextile manufacturer that furnished products have specified property values. Certified property values shall be either minimum or maximum average roll values, as appropriate, for geotextiles furnished.
2. Manufacturer's QC test results for every 250,000 square feet of material supplied.
3. Field seam efficiency test results.

1.05 DELIVERY, STORAGE, AND HANDLING

A. No material shall be delivered to the site without having the roll certification data submitted and approved by the Contractor.

B. Deliver each roll with sufficient information attached to identify it for inventory and quality control.

C. Handle products in manner that maintains undamaged condition. Adhere to manufacturer's guidelines for handling.

D. Do not store products directly on ground. Ship and store geotextile with suitable wrapping for protection against moisture and ultraviolet exposure. Store geotextile in way that protects it from elements. If stored outdoors, elevate and protect geotextile with waterproof cover.

1.06 SCHEDULING AND SEQUENCING

A. Where geotextile is to be laid directly upon ground surface, prepare subgrade as specified in Section 31 23 13, Subgrade Preparation, first.

B. Notify Contractor whenever geotextiles are to be placed. Do not place geotextile without Contractor's approval of underlying materials.

PART 2 PRODUCTS

2.01 GENERAL

A. Geotextile shall be nonwoven and have a nominal weight per area of 0.27 kg/m^2 (8 oz/yd^2) per ASTM D5261.

B. Geotextile shall be used for cushioning of geomembranes and at other locations as shown on the Drawings.

2.02 NONWOVEN GEOTEXTILE

A. Pervious sheet of polyester, polypropylene, or polyethylene fabricated into stable network of fibers that retain their relative position with respect to each other. Nonwoven geotextile shall be composed of continuous or discontinuous (staple) fibers held together through needle-punching, spun-bonding, thermal-bonding, or resin-bonding.

B. Geotextile Edges: Salvaged or otherwise finished to prevent outer material from pulling away from geotextile.

C. Unseamed Sheet Width: Minimum 12 feet.

2.03 REQUIRED PROPERTIES

A. Property Values:

1. Geotextile properties shall meet or exceed the values specified in Table 1, Required Geotextile Properties, contained in this section of the Specifications.
2. The manufacturer shall provide test results for all properties listed in Table 1.
3. The manufacturer shall certify that the materials supplied meet the requirements of this Part.

B. Integrity: Geotextiles shall retain their structure during handling, placement, and long-term service.

2.04 CONFORMANCE TESTING

A. Prior to deployment of the rolls of geotextile, the Subcontractor will obtain samples at a frequency of one per production lot or one per 250,000 square feet of each material type, whichever results in the greater number of tests. The Subcontractor will test the samples to determine conformance with both the design specifications and the list of certified properties.

B. As a minimum, the following tests will be performed on geotextiles (each type, except as noted):

1. Mass per Unit Area: ASTM D5261.
2. Grab Strength: ASTM D4632.
3. Tear Strength: ASTM D4533.
4. Burst Strength: ASTM D3786.
5. Puncture Strength: ASTM D4833.
6. Permittivity: ASTM D4491.
7. AOS: ASTM D4751.

2.05 TRANSPORTATION, HANDLING, AND STORAGE

A. Geotextiles shall be supplied in rolls wrapped in protective dust-proof covers and marked or tagged with all of the following information:

1. Manufacturer’s name.
2. Product identification.
3. Lot number.
4. Roll number.
5. Roll dimensions.

B. Transportation of the geotextiles to the site and all handling on site shall be the responsibility of the Subcontractor.

C. During shipment and storage, the geotextile shall be protected from mud, dirt, UV exposure, dust, puncture, cutting, or other damaging or deleterious conditions. Protective wrappings which are damaged shall be repaired or replaced, as necessary.

D. The Subcontractor shall be responsible for on-site storage of the geotextiles. The Subcontractor shall protect storage area(s) from theft, vandalism, passage of vehicles, etc.

2.06 SEWING THREAD

A. Polypropylene, polyester, or Kevlar thread.

B. Durability: Equal to or greater than durability of geotextile sewn.

PART 3 EXECUTION

3.01 GENERAL

A. Unacceptable Materials and Work: Materials and Work which fail to meet the requirements of these Specifications shall be removed and disposed of at the Subcontractor's expense. This includes geotextile rolls that are not labeled or where the label has deteriorated to the point of being illegible.

3.02 HANDLING AND PLACEMENT

A. At a minimum, geotextiles shall be placed according to the specifications and recommendations of the manufacturer.

B. The Subcontractor shall handle all geotextiles in such a manner as to ensure that they are not damaged. Do not drag the geotextile across textured geomembrane. If necessary, use a smooth slip sheet under the textile. Position the geotextile after deployment and remove the slip sheet, if used.

C. Orient geotextile with the long dimension of each sheet perpendicular to the direction of slope.

D. Place geotextiles in a manner that prevents folds and wrinkles. Folds or wrinkles shall be pulled smooth prior to seaming.

E. In the presence of wind, all exposed geotextiles shall be weighted with sandbags or equivalent. Geotextile shall not be installed during wind speeds, sustained or gusts, exceeding 25 miles per hour. Sandbags shall be installed

during placement and shall remain until replaced with cover material. Do not use securing pins or staples.

F. Geotextiles shall be cut using an approved geotextile cutter only. Special care shall be taken to protect underlying geosynthetic materials from damage during cutting.

G. During geotextile placement, care shall be taken not to entrap stones, excessive dust, or moisture that could damage the geomembrane, clog drains or filters, or hamper subsequent seaming.

H. After installation and immediately prior to placing overlying materials, the geotextile shall be examined over its entire surface to ensure that no potentially harmful foreign objects, such as needles, are present. Any foreign objects encountered shall be removed, or the geotextile shall be replaced.

I. If light colored geotextile is used, precautions shall be taken against "snowblindness" of personnel.

J. After deployment, all geotextile intended to be covered shall be covered to prevent exposure to ultraviolet (UV) radiation (sunlight) within a period of 48 hours. If required due to construction constraints, a maximum exposure period of 7 days may be allowed at the Contractor's discretion. Any geotextile that is not covered within 7 days shall be removed and replaced at the Subcontractor's expense, except geomembrane that is not intended to be covered, as shown on the Drawings.

3.03 SEAMING

A. Geotextiles shall be overlapped 3 inches prior to seaming.

B. All geotextiles shall be continuously sewn (i.e., spot sewing is not allowed). The strength of field seams shall not be less than 50 percent of that of the un-aged fabric material in any principal direction, when tested in accordance with ASTM D 4884 at a rate of strain of 12 inches per minute. The Subcontractor shall submit details of his proposed sewing (e.g., type of seam, number of stitches per inch, number of stitching rows, etc.) and typical samples of the seam for approval by the Contractor prior to installation. Thermal bonding of polypropylene fabrics will only be allowed if the Subcontractor can demonstrate consistency and uniformity of the seam, as well as compliance with the seam strength criterion of no less than 50 percent of that of the un-aged fabric material in any principal direction (when the seam is tested in accordance with ASTM D 4884). If thermal joining is used, the minimum overlap between sheets shall be increased to 12 inches. Leister welding (spot or continuous) will not be accepted as a replacement for sewing.

C. Areas to be seamed shall be clean and free of foreign material.

D. Sewing shall be done using polymeric thread with chemical resistance properties equal to or exceeding those of the geotextile, or as approved by the Contractor.

E. All sewing shall be done using a sewing machine which creates a chain stitch. When entering and exiting a seam, the stitches shall be overlapped to prevent unraveling.

3.04 REPAIR

A. Any holes or tears in the geotextile shall be repaired as follows:

1. Remove any soil or other material which may have penetrated the torn geotextile.
2. A patch made from the same geotextile shall be double seamed into place with the seams 1/4 inch to 3/4 inch apart and no closer than 1 inch from any edge. The patch shall extend at least 12 inches beyond the edges of the damaged area. Seaming shall be in accordance with Article SEAMING of this section.

3.05 MATERIALS IN CONTACT WITH GEOTEXTILES

A. Before placing material over geotextile, notify Contractor. Do not cover installed geotextile until after Contractor provides authorization to proceed.

B. The Subcontractor shall place all soil materials located on top of a geotextile in such a manner as to ensure that the following conditions are satisfied:

1. No damage to the geotextile.
2. Minimal slippage of the geotextile on underlying layers.
3. No excess tensile stresses in the geotextile.

3.06 SUPPLEMENTS

A. The supplements listed below, following “END OF SECTION,” are part of this Specification.

1. Table 1: Required Geotextile Properties.

END OF SECTION

Table 1. Required Geotextile Properties

Property	Unit	Value [(a)]	Test Method
Mass/Unit Area	Oz/yd^2	8	ASTM D5261
Apparent Opening Size	U.S. Sieve	80 to 90	ASTM D4751
Grab Tensile Strength	Lb	205	ASTM D4632
Grab Elongation[(b)]	%	50	ASTM D4632
Trapezoidal Tear Strength	Lb	85	ASTM D4533
Puncture Strength	Lb	120	ASTM D4833
Burst Strength	Psi	350	ASTM D3786
UV Resistance (500 hours)	% strength retained	70	ASTM D4355
Permittivity	Sec^{-1}	1.35	ASTM D4491

Notes:

a) All values are minimum average values, except as noted.

b) Nominal values.

SECTION 31 37 01
BUFFER AND RIPARIAN PLANTINGS

PART 1 GENERAL

1.01 DEFINITIONS

A. Amelioration: The addition of soil, soil conditioners, fertilizer, or other soil additives that may be necessary to meet the requirements for seeding and mulching. Intent is to ensure establishment of healthy growing medium for pioneer plant materials.

B. Basal Cut Ends: Bottom ends of live branches that are intended to produce root development.

C. Brushlayer (Composed of Live Cutting Whips): A live cutting from trees/shrubs no younger than two growing seasons and no older than five growing seasons.

D. Dead Blow Hammer: Mallet that has sand or lead shot in the head.

E. Dead Stout Stakes: Stakes shall be of a length shown on the Drawings and Details. These are referred to as “dead stout stakes” and are cut to the appropriate length from untreated 2-inch by 4-inch (nominal) boards. In fabricating these units, each board of the select length shall be cut again diagonally across the 2-inch face to make two stakes from each length. The diagonal cut will begin and end 1/8 inch to 1/4 inch from the edge of the piece so the finished stake will have a 1/8-inch to 1/4-inch tip. Only new, sound, unused material shall be used. The stakes are to be used to secure woven coir fiber mat in-place. Two-foot long, 1/2-inch hooked rebar may be substituted when it is necessary to secure materials in rocky areas, as approved by Contractor.

F. Dormant Season: Time of year when plant materials are not actively growing.

G. Growing Tips: Top ends of live cut branches that are intended to produce leaf development.

H. Harvesting Site: Source area of native, live cut plant material branches.

I. Live Cuttings: Branches or stems from 1/2- to 1-inch in diameter and of a minimum length of 3 feet that have been cut and pruned from living plant material belonging to defined vegetative species. All side branches are trimmed. They are intended to take root and grow.

J. Live Stake: Live cutting from trees/shrubs no younger than two growing seasons and no older than five growing seasons.

K. Property Owner: Entity owning identified property or possessing rights to sign written agreement allowing harvesting of live cuttings for Project.

L. Soil Bioengineering: Use of live plant materials to provide erosion control, slope and stream bank stabilization, landscape restoration, and wildlife habitat.

M. Seeding: Refers to the grass on native seed mixture (depending on planting zone) that is to be installed under the woven coir fiber mat, in between soil bioengineering systems, and on all construction disturbance areas.

N. Straw Mulch (Mulching): Refers to long straw or hay that is to be used as mulching material under the woven coir fiber mat, in between soil bioengineering systems, and on all construction disturbance areas. Long straw mulch shall consist of dry straw or hay, free of noxious weeds. The mulch shall be reasonably bright in color and shall not be musty, moldy, caked, decayed, or dusty. This mulch shall be installed along with appropriate soil amelioration and seeding under the coir, on all open seeded soil slope face areas, and seeded construction disturbance areas.

O. Water: Water, which may be required for storage of plant materials during the live construction, shall contain no toxic elements that could be harmful to plant growth.

P. Woven Coir Fiber Mat: Refer to Section 31 32 01, Woven Mattress Coir Blanket for Stream Channel Banks.

1.02 SUBMITTALS

A. Action Submittals:

1. State of Wisconsin Department of Agriculture, Trade and Consumer Protection commercial aquatic applicator license.
2. Product data for pesticides.
3. List of live cutting harvest sites, 1 week prior to beginning the Work.
4. Subcontractor Planting Plan:
    a. Must provide a list of proposed plants to be used, including those listed and not listed in the Drawings.
    b. Must be reviewed by Contractor.

5. Copy of signed written agreement and applicable correspondence between harvest site property owner and Subcontractor, 1 week prior to beginning the Work. At a minimum the signed agreement shall:
   a. Grant permission to harvest.
   b. Specify the requirements of access/egress.
   c. Specify the use and condition that the harvesting site is to be left in.
   d. Acknowledge that the Subcontractor shall be solely responsible for activities on the harvesting site and shall hold the Contractor and USEPA harmless.
6. Copy of permits from regulatory agencies.
7. The Subcontractor may use a third party supplier to provide harvest materials. Suppliers must provide all of the written information required of the Subcontractor.
8. Copy of identification tags used to identify cuttings after harvest and during transport.

1.03 QUALITY ASSURANCE

A. Live Stakes:

1. Prior to leaving the harvest site (including commercial source), all live branch cuttings shall be inspected for acceptability by the Contractor, as described hereinafter.
   a. They shall be healthy, freshly cut, living material.
   b. No invasive vines or plant materials will be permitted to be mixed in with the cuttings.
   c. The cuttings shall be free from insect infestation and disease.

B. Trees, Shrubs, Balled and Burlapped Containerized Plants:

1. Trees, shrubs, balled and burlapped, containerized plants shall be inspected onsite prior to installation for acceptability by the Contractor, as described hereinafter.
   a. Trees, shrubs, balled and burlapped, containerized plants shall either be containerized (10 cubic inch plugs or 1 gallon containers) or dormant bare root seedlings, properly packaged to prevent drying or mildew of roots.
   b. All trees, shrubs, balled and burlapped, containerized plants shall be labeled.
   c. They shall be healthy and free from insect infestation and disease.

C. Grass and Seed Mixtures: The Subcontractor shall provide the bag identification tags to the Contractor for each bag of seed used on the site, prior to installation. All seed shall be certified weed free. Seeding rates are based on pure live seed (PLS). PLS analysis results shall be provided on each seed tag.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Delivery:

1. Transport live cuttings in enclosed trailer or covered with a tarpaulin during transportation from harvesting site to Project Site.
2. Place live cut branch bundles on transport vehicles in an orderly fashion, with growing tips toward cab of vehicle to prevent damage and to facilitate handling.
3. All cut plant material shall arrive on the jobsite within 8 hours of cutting or as approved by the Contractor if a commercial supplier is used. The Subcontractor shall schedule the cutting and delivery of the live cuttings to the site so that the materials can be installed a maximum of 2 days after they arrive.
4. Trees and shrubs shall be kept moist. Containerized plants shall be transported in a manner to prevent disturbance of potting soil.
5. Grasses and seed mixtures shall be transported in an enclosed cool and dry trailer.

B. Storage:

1. Live Cuttings: Store and protect live cuttings not installed on day of arrival at Project Site.
    a. Store in water or heeled-in in moist soil for a maximum of 2 days without refrigeration.
    b. Outside storage locations shall be continually shaded and protected from wind.
    c. Protect from drying at all times.
    d. When temperature reaches 50 degrees F and above on day material is harvested, live cut branches shall not be stored, but shall be installed on day of harvesting.
    e. Live cut branches that have been fabricated into live stakes must be used on the day of fabrication and may not be stored.
    f. If live stakes are not installed on the same day they are harvested, they shall be soaked in a root hormone solution overnight for next-day installation. This includes live cuttings from commercial suppliers, if the cuttings are not installed on the Project the same day they are harvested by the supplier.

2. Trees, Shrubs, Balled and Burlapped, Containerized Plants: Store and protect trees, shrubs, containerized plants not installed on day of arrival at Project Site.
    a. Outside storage locations shall be continually shaded and protected from wind.
    b. Protect from drying at all times.
    c. Refrigerate bare root plants when temperature reaches 50 degrees F and above.
3. Grass and Seed Mixtures: Store and protect grass and seed mixtures not installed on day of arrival at Project Site.
    a. Outside storage shall be shaded and dry.
    b. Bags shall be stored off of the ground at all times.

C. Handling:

1. All plant material shall be handled with care to limit stress and damage.
2. Damaged plants will be rejected.

1.05 ENVIRONMENTAL REQUIREMENTS

A. The individual conducting herbicide applications must have a state of Wisconsin Department of Agriculture, Trade and Consumer Protection commercial aquatic applicator license.

B. Live stakes, trees, shrubs, balled and burlapped, containerized plants and seed mixtures shall be planted during the their individual dormant seasons as directed in the planting schedule or as advised by a commercial plant supplier. Trees, shrubs, balled and burlapped, containerized plants shall be installed per the recommendations shown on the individual labels and as directed in the planting schedule or as advised by a commercial plant supplier.

C. Grass and seed mixtures shall be applied per supplier tag and as directed in the planting schedule or as advised by a commercial plant supplier.

D. After seeding, planting and/or installing, water all of the seeded areas and plantings. Original plant installations shall continue to be watered as needed for the duration of the Project and throughout the warranty period.

E. Fertilize according to soil test results (use of 25 pound low nitrogen 5-10-15 per 1,000 square feet is recommended) unless otherwise directed in the planting schedule or as advised by a commercial plant supplier.

1.06 PERFORMANCE REQUIREMENTS

A. General:

1. The Subcontractor shall warranty all plant material under this Contract for a period of 2 full growing seasons from the date of Final Acceptance. Original plants which die after final acceptance and during the warranty period shall be removed and replaced under the original Specifications, no later than the following planting season, at the Subcontractor's expense; provided, however, the Subcontractor shall be responsible for providing no more than the original plant and one replacement under the warranty. All replacement plants shall be maintained as specified for new plants for 1 year after the time of their installation and acceptance as replacements.
2. The end of the original warranty period does not release the Subcontractor from his responsibility to maintain the replacement plants for such additional year.

B. Soil Bioengineering:

1. Only living systems of the soil bioengineering (without open dead areas), of cut branches alive and healthy and properly installed, or of seed and mulch properly installed, at the time of final inspection will be accepted. For this Project the soil bioengineering systems include:
   a. Livestakes.
   b. Brushlayer.
   c. Grass seeding (with coir fabric).
2. The Subcontractor shall be responsible for the replacement of any nonliving systems before and immediately after the end of the first growing season.
3. Soil bioengineering system acceptance shall be as follows for branch rooting or ground cover (in percent) based on inspections after the first growing season (late Summer/early Fall) and at the beginning of the second growing season (late Spring/early Summer):
   a. Live Stakes: 10 percent cuttings rooting.
   b. Brushlayer: 90 percent cuttings rooting.
   c. Grass Seeding: 80 percent ground (no bare spots larger than 1 foot by 1 foot).
4. Replaced soil bioengineering systems shall be under warranty for an additional year.

C. Buffer Plantings:

1. Only living systems of the buffer plantings alive and healthy and properly installed, or of seed and mulch properly installed, at the time of

final inspection will be accepted. For this Project, the buffer plantings systems include:

a. Trees.
b. Shrubs.
c. Grass seeding (without coir fabric).

2. The Subcontractor shall be responsible for the replacement of any nonliving systems before and immediately after the end of the first growing season.
3. Buffer planting acceptance shall be as follows for sprouting, leaf growth, or ground cover (in percent) based on inspections after the first growing season (late Summer/early Fall) and at the beginning of the second growing season (late Spring/early Summer):
   a. Trees: 100 percent survival (75 percent of the plant showing sprouting and/or leaf production).
   b. Shrubs: 100 percent survival (75 percent of the plant showing sprouting and/or leaf production).
   c. Grass Seeding: 90 percent coverage (no bare spots larger than 1 foot by 1 foot).
4. Replaced buffer plantings shall be under warranty for an additional year.

1.07 MAINTENANCE

A. Soil Bioengineering:

1. Maintenance shall begin immediately after each method has been installed, continue throughout construction and the warranty period, and continue after installation as to any replacement methods. The following are maintenance requirements:
   a. Maintenance of installations shall begin immediately after installation and consists of spraying for insects and diseases, weeding, watering, and inspecting to see that the live plant materials are healthy, and performing adequately in protecting the slope. The Subcontractor shall be responsible for any permits related to pesticides. Report concerns to the Contractor.
   b. Soil bioengineering installations shall be protected at all times against trespassing and damage of any kind for the duration of construction and until acceptance of the work by the Contractor. Soil bioengineering work shall be done in the dormant season, including all living repairs.

c. The Subcontractor shall be responsible for keeping all installations and work incidental thereto in good condition by performing all other necessary operations during the construction period to care for promotion of healthy root and leaf growth and plant life so that all work is in satisfactory and acceptable condition to the Contractor.
d. All drainage systems shall be kept in good working order by the Subcontractor so that they do not negatively impact installed soil bioengineering systems.
e. All installation and plant material required by this Contract shall be in a satisfactory and acceptable condition when the Subcontractor applies for payment.
f. Maintenance for and in conjunction with the soil bioengineering shall be incidental to the work. Consisting of work furnished, installed and accepted (including all materials, i.e., labor, machinery, and maintenance care necessary to complete the work in a high quality workmanship-like manner).

B. Buffer Plantings:

1. Maintenance shall begin immediately after each method has been installed, continue throughout construction and the warranty period, and continue for after installation as to any replacement methods. The following are maintenance requirements:
   a. Maintenance of installations shall begin immediately after installation and consists of spraying for insects and diseases, weeding, watering, and inspecting to see that the live plant materials are healthy. The Subcontractor shall be responsible for any permits related to pesticides. Report concerns to the Contractor.
   b. Buffer planting installations shall be protected at all times against trespassing and damage of any kind for the duration of construction and until acceptance of the work by the Contractor.
   c. The Subcontractor shall be responsible for keeping all installations and work incidental thereto in good condition by performing all other necessary operations during the construction period to care for promotion of healthy root and leaf growth and plant life so that all work is in satisfactory and acceptable condition to the Contractor.
   d. All drainage systems and erosion control measures shall be kept in good working order by the Subcontractor so that they do not negatively impact installed buffer planting systems.

e. All installation and plant material required by this Contract shall be in a satisfactory and acceptable condition when the Subcontractor applies for payment.
f. Maintenance for and in conjunction with the buffer planting shall be incidental to the work. Consisting of work furnished, installed and accepted (including all materials, i.e., labor, machinery, and maintenance care necessary to complete the work in a high quality workmanship-like manner).

PART 2 PRODUCTS

2.01 BIOENGINEERING

A. Live Stakes:

1. Use live cuttings as specified in definitions trimmed of side branches and fashioned into live stakes.
2. The Subcontractor may use local harvest sites or a commercial supplier to supply live cuttings for the soil bioengineering items on the Project.
3. The Subcontractor is encouraged to locate local harvest sites for plant material sources. Coordinate with Milwaukee County for possible local harvest sites for plant material sources. Suitable species found on the project site, are preferred if available.
4. All harvested live cut native plant materials shall be taken from source locations within 50 miles of the Project Site. Source locations outside of this limit may be used, upon approval by the Contractor.
5. The Subcontractor may use other plant species than those shown on the plant schedules in the Plans, upon approval by the Contractor.
6. A list of commercial living material suppliers is available in this Specification.
7. Fabrication:
   a. Cut to length shown on Drawings.
   b. Minimum diameter shown on Drawings.
   c. Cut at a 45-degree angle at the basal end and cut flat on the other end.
8. Basal end is intended as the end to take root and shall be the end installed in ground.

B. Brushlayer:

1. Use live cuttings as specified in Definitions trimmed of side branches and fashioned into brushlayer cuttings.
2. The Subcontractor may use local harvest sites or a commercial supplier to supply live cuttings for the soil bioengineering items on the Project.

3. The Subcontractor is encouraged to locate local harvest sites for plant material sources. Suitable species found on the Project Site, are preferred if available.
4. All harvested live cut native plant materials shall be taken from source locations within 50 miles of the Project Site. Source locations outside of this limit may be used, upon approval by the Contractor.
5. The Subcontractor may use other plant species than those shown on the plant schedules in the Drawings, upon approval by the Contractor.
6. A list of commercial living material suppliers is available in this Specification.
7. Fabrication:
   a. Cut to length shown on Drawings.
   b. Minimum diameter of 1/2 inch (0.5 inch) and a maximum diameter of 1 inch.
   c. Cut flat on both ends.
8. Basal end is intended as the end to take root and shall be the end installed away from the stream bank face, in between the soil lifts.

C. Grass and Seed Mixtures (with Coir Fabric):

1. The seeding mixture shall conform to the Seeding Schedules as shown on the Drawings and Details. Special seed mixtures may be required as directed by the Contractor and shall be installed under this Section.
2. Seed species shall be those shown in the Plant Schedules on the Drawings. Alternate seed species may be used by the Subcontractor, at the request of the Property Owner and/or the Subcontractor upon approval by the Contractor.

D. Straw Mulch (Mulching): Refers to long straw or hay that is to be used as mulching material under the woven coir fiber mat, in between soil bioengineering systems, and on all construction disturbance areas. Long straw mulch shall consist of dry straw or hay, free of noxious weeds. The mulch shall be reasonably bright in color and shall not be musty, moldy, caked, decayed, or dusty. This mulch shall be installed along with appropriate soil amelioration and seeding under the coir, on all open seeded soil slope face areas, and seeded construction disturbance areas.

E. Water: Water, which may be required for storage of plant materials during the live construction, shall contain no toxic elements that could be harmful to plant growth. A nearby shaded pond or other area approved by the Contractor may be utilized for storage purposes.

F. Woven Coir Fiber Mat: Refer to Section 31 32 01, Woven Mattress Coir Blanket for Stream Channel Banks.

2.02 BUFFER PLANTINGS

A. Trees and Shrubs:

1. Plants shall be at least bare root, containerized seedlings, or balled and burlapped.
2. Tree and shrub species shall be those shown in the Plant Schedules on the Drawings. Alternate plant species may be used by the Subcontractor, at the request of the Property Owner and/or the Subcontractor upon approval by the Contractor.

B. Grass and Seed Mixtures (Without Coir Fabric):

1. The seeding mixture shall conform to the Seeding Schedules as shown on the Drawings and Details. Special seed mixtures may be required as directed by the Contractor and shall be installed under this Section.
2. Seed species shall be those shown in the Plant Schedules on the Drawings. Alternate seed species may be used by the Subcontractor, at the request of the Property Owner and/or the Subcontractor upon approval by the Contractor. The following is a list of seed suppliers. This list is given for information only and does not intend to endorse the use of any company appearing on the list. Local suppliers of seed are preferred.

C. Straw Mulch (Mulching): Refers to long straw or hay that is to be used as mulching material under the woven coir fiber mat, in between soil bioengineering systems, and on all construction disturbance areas. Long straw mulch shall consist of dry straw or hay, free of noxious weeds. The mulch shall be reasonably bright in color and shall not be musty, moldy, caked, decayed, or dusty. This mulch shall be installed along with appropriate soil amelioration and seeding under the coir, on all open seeded soil slope face areas, and seeded construction disturbance areas.

D. Water: Water, which may be required for storage of plant materials during the live construction, shall contain no toxic elements that could be harmful to plant growth. A nearby shaded pond or other area approved by the Contractor may be utilized for storage purposes.

E. Woven Coir Fiber Mat: Refer to Section 31 32 01, Woven Mattress Coir Blanket for Stream Channel Banks.

PART 3 EXECUTION

3.01 BIOENGINEERING

A. General:

1. Harvesting (by Subcontractor or Commercial Supplier):
   a. General: Plant materials may be harvested from sites located by the Subcontractor and approved by the Contractor. Only healthy, well-branched, and disease-free stock from species approved by the Contractor shall be acceptable. The Subcontractor is responsible for providing harvested material. The Contractor must approve harvest sites found by the Subcontractor 1 week prior to onsite work. The harvesting sites shall be left in a condition that meets the written satisfaction of the Property Owner. Larger log material shall be cut into 16-inch firewood lengths and neatly stacked where directed by the harvest site property owner. Alternatively, the property owner may want to have the unused material placed in brush piles for habitat enhancement or removed from the harvest site and disposed of in a lawful manner at the Subcontractor's cost.
   b. Cutting: Equipment such as chain saws, bush axes, loppers, and pruners may be used for harvesting, provided that they are used in such a manner that they leave clean cuts. Live growing plant material at the harvesting site shall be handled with care to avoid bark stripping and splitting of stems. Cuts shall be made 6 inches to 12 inches from the ground or as required by the harvest site Property Owner. Cuts shall be made flat or at a slight or blunt angle to ensure that the source sites will regenerate rapidly.
   c. Binding: Twine or hoisting belts shall be used to bind the live cuttings securely into bundles at the harvesting site for handling and for protection during transport. Live cuttings shall be grouped in such a manner that they stay together when handled. Side branches and brushy limbs shall be kept intact at this time and all growing tips shall be placed in the same direction.
   d. Identification: Prior to leaving the harvesting site (including a commercial source), all live branch cuttings shall be properly labeled by the Subcontractor or commercial supplier. Labels shall be securely attached to the bundles of live cuttings and shall indicate the species of the cuttings, the collection date, the location of harvesting, and the temperature at the time of harvest.

2. Fabrication: All live system preparation shall be done on the Project site and may not be done at the harvesting or other remote staging sites. Preparation includes cutting of live stakes and brushlayer and trimming of branches or other activities required in construction.

B. Live Stakes:

1. In all areas where coir fabric is to be used, the area shall first be ameliorated, seeded, lightly raked-in to 0.25-inch depth, and covered with 1.5 inches to 2 inches of long straw mulch; seed shall be broadcast by hand; then the coir fabric shall be placed. The seed mixture shall be as defined in the Seeding Schedules included on the Drawings.
2. Coir fabric shall be installed on the face and over the top of the bank. The coir material shall be secured with dead stout stakes in accordance with the Drawings and details. Overlap of the fabric shall be a minimum of 9 inches. Coir shall be securely fastened at the toe of each treated area and over the crown of the bank, as shown on the Drawings. At the top, the coir will line a trench 12 inches wide by 12 inches deep, staked in-place and backfilled. Material must be within 1 percent below and 3 percent above the optimum moisture content when placed.
3. The covered banks shall be smooth and neatly finished. The fabric shall not be in tension, but shall be neatly placed against the surface. At no time shall there be loose ends or unsecured coir fabric on the Project.
4. Live stakes shall be tamped into the ground using a dead blow hammer. They shall protrude from the finished ground elevation a length as shown on the Drawings and Details. On the sloped areas, they shall be placed at right angles to the slope face. In cases where the ground is hard, a pilot hole may be made to assist in inserting the live stake. The Subcontractor may use a 0.5-inch metal rod or other means acceptable to the Contractor for this purpose. The intent of this requirement is to maintain firm soil/stake contact after the live stake is installed. The rod must be removed carefully and may not be rotated to enlarge the hole.
5. Live stakes shall be installed on prepared areas at a rate designated on the Drawings in the Planting Schedule.
6. Shrub live stake applications must use at least three species, with a 30 percent, 30 percent, 40 percent mix of species. Tree live stake applications must use at least two species, with a 50 percent, 50 percent mix of species. All species, as well as, final locations and configurations shall be approved by the Contractor.
7. After installing, water all of the plantings. Plant installations shall continuously be watered as needed.

C. Brushlayer (Composed of Live Cutting Whips):

1. Brushlayer cuttings shall be placed in between the coir fabric wrapped soil lifts. They shall protrude from the finished ground elevation a minimum length of 24 inches.
2. Brushlayer shall be installed on prepared areas as designated on the Drawings.
3. Brushlayer cuttings shall be installed at a rate of at least 6 per linear foot in between each soil lift.
4. Shrub brushlayer applications must use at least three species, with a 30 percent, 30 percent, 40 percent mix of species, unless as specified on the Drawings. Tree brushlayer applications must use at least two species, with a 50 percent, 50 percent mix of species. All species, unless as specified on the Drawings, as well as, final locations and configurations shall be approved by the Contractor.
5. After installing, water all of the plantings. Plant installations shall continuously be watered as needed.

D. Grass and Seed Mixtures (with Coir Fabric):

1. Seed shall be installed at the rate shown on the Drawing Planting Schedule or as advised by a commercial plant supplier. Some species may be available as plugs and may be used as an alternate to seeding on this Project with the approval of the Contractor. The spacing of plugs shall be per the supplier’s recommendation.
2. In all areas where coir fabric is to be used, the area shall first be ameliorated, seeded, lightly raked-in to 0.25-inch depth, and covered with 1.5 inches to 2 inches of long straw mulch; seed shall be broadcast by hand; then the coir fabric shall be placed. The seed mixture shall be as defined in the Seeding Schedules included on the Drawings.
3. Coir fabric shall be installed on the face and over the top of the bank. The coir material shall be secured with dead stout stakes in accordance with the Drawings. Overlap of the fabric shall be a minimum of 9 inches. Coir Fabric shall be securely fastened at the toe of each treated area and over the crown of the bank, as shown on the Drawings. At the top, the coir will line a trench 12 inches wide by 12 inches deep, staked in-place and backfilled. Material must be within 1 percent below and 3 percent above the optimum moisture content when placed.
4. The covered banks shall be smooth and neatly finished. The fabric shall not be in tension, but shall be neatly placed against the surface. At no time shall there be loose ends or unsecured coir fabric on the Project.

5. After installation of coir fabric, seed with species mix and seeding rate specified in the Drawings for each soil bioengineer zone. The Subcontractor must coordinate with the Contractor prior to seeding overtop coir fabric.
6. After seeding, water all of the plantings. Plant installations shall continuously be watered as needed.

3.02 BUFFER PLANTINGS

A. Trees and Shrubs:

1. Plant Spacing:
   a. The trees and shrubs shall be installed at the spacing shown on the Drawing Planting Schedule or as advised by a commercial plant supplier (whichever is closer).
   b. The minimum number of trees to be planted per acre shall be per the Planting Schedule shown on the Drawings.
   c. The density of shrubs to be planted per acre shall be per the Planting Schedule shown on the Drawings.
   d. Installation instructions shall be in accordance with plant labels or as advised by a commercial plant supplier.
2. Plant Protection:
   a. Tree shelters shall be used to protect all seedlings.
   b. Six inches of well-aged hardwood mulch, weed control fabrics, or pre-emergent herbicide shall be used around the base of each installed tree or shrub to control competition from the herbaceous layer. The perimeter shall be no less than eighteen inches in diameter.
3. After planting, water all of the plantings. Plant installations shall be watered as needed.

B. Grass and Seed Mixtures (Without Coir Fabric):

1. Seed shall be installed at the rate shown on the Drawing Planting Schedule or as advised by a commercial plant supplier. Some species may be available as plugs and may be used as an alternate to seeding on this Project with the approval of the Contractor. The spacing of plugs shall be per the supplier's recommendation.
2. The area shall first be ameliorated, seeded, lightly raked-in to 0.25-inch depth, and covered with 1.5-inches to 2-inches of long straw mulch. Seed shall be broadcast by hand. The seed mixture shall be as defined in the Seeding Schedules included on the Drawings.
3. After seeding, water all of the plantings. Plant installations shall continuously be watered as needed. Water may be obtained from the creek.

END OF SECTION

SECTION 32 91 13
SOIL PREPARATION

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Society for Testing and Materials (ASTM):
   a. C33, Standard Specification for Concrete Aggregates.
   b. C602, Standard Specification for Agricultural Liming Materials.
2. U.S. Bureau of Reclamation (USBR):
   a. 514.4.4, Reclamation Instructions, Series 510—Land Classification Techniques and Standards, Part 514—Laboratory Procedures, Chapter 4—Particle-Size Analyses.
   b. 514.8.7, Reclamation Instructions, Series 510—Land Classification Techniques and Standards, Part 514—Laboratory Procedures, Chapter 8—Soil Chemical Tests.

1.02 SUBMITTALS

A. Shop Drawings: Product labels/data sheets.

B. Samples: Representative of stockpiled or imported topsoil.

C. Quality Control Submittals:

1. Certified Topsoil Analysis Reports:
   a. Indicate quantities of materials necessary to bring topsoil into compliance with textural/gradation requirements.
   b. Indicate quantity of lime, and quantity and analysis of fertilizer.

1.03 SEQUENCING AND SCHEDULING

A. Rough grade areas to be planted or seeded prior to performing Work specified under this section.

B. Install turf reinforcement mat prior to seeding.

PART 2 PRODUCTS

2.01 TOPSOIL

A. Topsoil removed during site preparation activities and stockpiled at location shown on Drawings.

B. General: Natural, friable, sandy loam, obtained from well-drained areas, free from objects larger than 1-1/2 inches maximum dimension, and free of subsoil, roots, grass, other foreign matter, hazardous or toxic substances, and deleterious material that may be harmful to plant growth or may hinder grading, planting, or maintenance.

C. Composition: As determined in accordance with USBR 514.4.4:

1. Gravel-Sized Fraction: Maximum 5 percent by weight retained on a No. 10 sieve.
2. Sand-Sized Fraction: Maximum 65 percent passing No. 10 sieve and retained on No. 270 sieve.
3. Silt-Sized Fraction: Maximum 50 percent passing No. 270 sieve and larger than 0.002 millimeter.
4. Clay-Sized Fraction: Maximum 25 percent smaller than 0.002 millimeter.

D. Organic Matter: Minimum 1.5 percent by dry weight as determined in accordance with USBR 514.8.7.

E. pH: Range 6.0 to 7.2.

F. Textural Amendments: Amend as necessary to conform to required composition by incorporating sand, peat, manure, or sawdust.

G. Source: Stockpile material onsite, in accordance with Section 32 91 13, Site Preparation. Import topsoil if onsite material fails to meet specified requirements or is insufficient in quantity.

2.02 LIME

A. Composition: Ground limestone with not less than 85 percent total carbonates, ASTM C602.

B. Gradation:

1. Minimum 50 percent passing No. 100 sieve.
2. Minimum 90 percent passing No. 20 sieve.

3. Coarser material acceptable provided rates of application are increased proportionately on basis of quantities passing No. 100 sieve.

2.03 SAWDUST OR GROUND BARK

A. Nontoxic, of uniform texture, and subject to slow decomposition when mixed with soil. Nitrogen-treated, or if untreated mix with minimum 0.15 pounds of ammonium nitrate or 0.25 pounds of ammonium sulfate per cubic foot of loose material.

2.04 PEAT

A. Composition: Natural residue formed by decomposition of reeds, sedges, or mosses in a freshwater environment, free from lumps, roots, and stones.

1. Organic Matter: Not less than 90 percent on a dry weight basis as determined by USBR 514.8.7.
2. Moisture Content: Maximum 65 percent by weight at time of delivery.

2.05 FERTILIZER

A. Manure: Well-rotted, stable or cattle manure, free from weed seed and refuse. Maximum 50 percent sawdust or shavings by volume.

1. Age: Minimum 4 months; maximum 2 years.

2.06 SAND

A. Fine Aggregate: Clean, coarse, well-graded, ASTM C33.

2.07 SOURCE QUALITY CONTROL

A. Topsoil Analysis/Testing: Performed by county or state soil testing service or approved certified independent testing laboratory.

PART 3 EXECUTION

3.01 SUBGRADE PREPARATION

A. Apply lime to subgrade before tilling if pH is determined low.

B. Scarify subgrade to minimum depth of 6 inches where topsoil is to be placed.

C. Remove stones over 2-1/2 inches in any dimension, sticks, roots, rubbish, and other extraneous material.

D. Limit preparation to areas which will receive topsoil within 2 days after preparation.

3.02 TOPSOIL PLACEMENT

A. Do not place topsoil when subsoil or topsoil is frozen, excessively wet, or otherwise detrimental to the Work.

B. Mix soil amendments, lime, and fertilizer with topsoil before placement or spread on topsoil surface and mix thoroughly into entire depth of topsoil before planting or seeding. Delay mixing of fertilizer if planting or seeding will not occur within 3 days.

C. Uniformly distribute to within 1/2-inch of final grades. Fine grade topsoil eliminating rough or low areas and maintaining levels, profiles, and contours of subgrade.

D. Remove stones exceeding 1-1/2 inches, roots, sticks, debris, and foreign matter during and after topsoil placement.

E. Remove surplus subsoil and topsoil from site. Grade stockpile area as necessary and place in condition acceptable for planting or seeding.

END OF SECTION

SECTION 32 92 00
LAWNS AND GRASSES

PART 1 GENERAL

1.01 DEFINITIONS

A. Maintenance Period: Begin maintenance immediately after each area is planted and continue for a period of 8 weeks after all planting under this section is completed.

B. Satisfactory Stand: Grass of 10,000 square feet or larger that has:

1. No bare spots larger than 3 square feet.
2. Not more than 10 percent of total area with bare spots larger than 1 square foot.
3. Not more than 15 percent of total area with bare spots larger than 6 square inches.

C. Standard Specifications: Wisconsin Department of Transportation Standard Specifications, 2011.

1.02 SUBMITTALS

A. Shop Drawings: Product labels/data sheets.

B. Quality Control Submittals:

1. Seed: Certification of seed analysis, germination rate, and inoculation:
   a. Certify that each lot of seed has been tested by a testing laboratory certified in seed testing, within 6 months of date of delivery. Include with certification:
      1) Name and address of laboratory.
      2) Date of test.
      3) Lot number for each seed specified.
      4) Test Results: (i) name, (ii) percentages of purity and of germination, and (iii) weed content for each kind of seed furnished.
   b. Mixtures: Proportions of each kind of seed.
2. Seed Inoculant Certification: Bacteria was prepared specifically for legume species to be inoculated.

C. Contract Closeout Submittals: Description of required maintenance activities and activity frequency.

1.03 DELIVERY, STORAGE, AND PROTECTION

A. Seed:

1. Furnish in standard containers with seed name, lot number, net weight, percentages of purity, germination, and hard seed and maximum weed seed content, clearly marked for each container of seed.
2. Keep dry during storage.

B. Hydroseeding Mulch: Mark package of wood fiber mulch to show air dry weight.

1.04 WEATHER RESTRICTIONS

A. Perform Work under favorable weather and soil moisture conditions as determined by accepted local practice.

1.05 SEQUENCING AND SCHEDULING

A. Complete Work under this section within 10 days following completion of soil preparation.

B. Notify Contractor at least 3 days in advance of:

1. Each material delivery.
2. Start of planting activity.

C. Planting Season: Those times of year that are normal for such Work as determined by accepted local practice.

1.06 MAINTENANCE SERVICE

A. Subcontractor: Perform maintenance operations during maintenance period to include:

1. Watering: Keep surface moist.
2. Washouts: Repair by filling with approved fill material, fertilizing, seeding, and mulching.
3. Mowing: Mow to 2 inches after grass height reaches 3 inches, and mow to maintain grass height from exceeding 3 1/2 inches.
4. Fences: Repair and maintain until satisfactory stand of grass is established.
5. Reseed unsatisfactory areas or portions thereof immediately at the end of the maintenance period if a satisfactory stand has not been produced.
6. Reseed/replant during next planting season if scheduled end of maintenance period falls after September 15.

7. Reseed/replant entire area if satisfactory stand does not develop by July 1 of the following year.

PART 2 PRODUCTS

2.01 FERTILIZER

A. Commercial, uniform in composition, free-flowing, suitable for application with equipment designed for that purpose. Minimum percentage of plant food by weight.

B. Application Rates: Determined by soil analysis results.

C. Mix:

1. Nitrogen: 10.
2. Phosphoric Acid: 10.
3. Potash: 10.

2.02 SEED

A. Fresh, clean new-crop seed that complies with the tolerance for purity and germination established by Official Seed Analysts of North America.

B. Seed mixture shall be mowed turf grass listed in Schedule 6 as shown in the Drawings.

C. Seeds of Legumes: Inoculated with pure culture of nitrogen-fixing bacteria prepared specifically for legume species in accordance with inoculant manufacturer's instructions.

2.03 WATER

A. Any water used to moisten surface soils or in hydroseeding operation shall be from a potable source or a source approved by the Contractor.

2.04 HYDROSEEDING MULCH

A. Wood Cellulose Fiber Mulch:

1. Specially processed wood fiber containing no growth or germination inhibiting factors.
2. Dyed a suitable color to facilitate inspection of material placement.
3. Manufactured such that after addition and agitation in slurry tanks with water, the material fibers will become uniformly suspended to form a homogenous slurry.

4. When hydraulically sprayed on ground, material will allow absorption and percolation of moisture.

PART 3 EXECUTION

3.01 PREPARATION

A. Grade areas to smooth, even surface with loose, uniformly fine texture.

1. Roll and rake, remove ridges, fill depressions to meet finish grades.
2. Limit such Work to areas to be planted within immediate future.
3. Remove debris, and stones larger than 1-1/2 inches diameter, and other objects that may interfere with planting and maintenance operations.

B. Moisten prepared areas before planting if soil is dry. Water thoroughly and allow surface to dry off before seeding. Do not create muddy soil.

C. Restore prepared areas to specified condition if eroded or otherwise disturbed after preparation and before planting.

3.02 FERTILIZER

A. As described in Section T-901 of the Standard Specifications.

3.03 SEEDING

A. As described in Section T-901 of the Standard Specifications.

B. Hydroseeding:

1. Application Rate: Based on manufacturer's recommendations.
2. Apply on moist soil, only after free surface water has drained away.
3. Prevent drift and displacement of mixture into other areas.
4. Upon application, allow absorption and percolation of moisture into ground.
5. Mixtures: Seed and fertilizer may be mixed together, apply within 30 minutes of mixing to prevent fertilizer from burning seed.

3.04 FIELD QUALITY CONTROL

A. Eight (8) weeks after seeding is complete and on written notice from Subcontractor, Contractor will, within 15 days of receipt, determine if a satisfactory stand has been established.

B. If a satisfactory stand has not been established, Contractor will make another determination after written notice from Subcontractor following the next growing season.

END OF SECTION

SECTION 33 47 13.01
POND AND RESERVOIR LINERS—HDPE

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
   a. A193/A193M, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service, and other Special Purpose Applications.
   b. A194/A194M, Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service, or both.
   c. A276, Standard Specification for Stainless and Steel Bars and Shapes.
   d. B211, Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire.
   e. C881/C881M, Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
   f. D570, Standard Test Method for Water Absorption of Plastics.
   g. D638, Standard Test Method for Tensile Properties of Plastics.
   h. D696, Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between Minus 30 Degrees C and 30 Degrees C with Vitreous Silica Dilatormeter.
   i. D746, Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.
   j. D751, Standard Test Methods for Coated Fabrics.
   k. D792, Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
   l. D882, Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
   m. D1004, Standard Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting.
   n. D1505, Standard Test Method for Density of Plastics by the Density-Gradient Technique.
   o. D1693, Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics.
   p. D2240, Standard Test Method for Rubber Property-Durometer Harness.
   q. D4833, Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.

r. D5199, Standard Test Method for Measuring Nominal Thickness of Geosynthetics.
s. D5321, Standard Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method.
t. D5641, Standard Practice for Geomembrane Seam Evaluation by Vacuum Chamber.
u. D5994, Standard Test Method for Measuring Core Thickness of Textured Geomembrane.
v. D6392, Standard Test Method for Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods.

1.02 DEFINITIONS

A. Boot: Watertight collar fabricated from geomembrane sheet for sealing geomembrane to pipes and other objects that penetrate geomembrane.

B. Film Tearing Bond: Failure in ductile mode of one bonded sheet, by testing, prior to complete separation of bonded area.

C. Geomembrane: Essentially impermeable geosynthetic composed of one or more layers of polyolefin materials fusion bonded into single-ply integral sheet.

D. Panel: Piece of geomembrane composed of two or more sheets seamed together.

E. Sheet: Seamless piece of geomembrane.

F. Watertight: Geomembrane installation free of flaws and defects that will allow passage of water and gases, liquids, and solids to be contained under anticipated service conditions.

1.03 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
   a. Manufacturer’s specifications, literature for each geomembrane furnished, and products used to complete installation.
   b. Compensation allowance calculation and numerical values for temperature induced geomembrane expansion and contraction.
   c. Polymer Resin: Product identification and Supplier.
   d. Geomembrane sheet layout with proposed size, number, position, and sequence of sheet placement, and location of field seams.

e. Proposed equipment for material placement.
f. Procedures for material installation.

B. Informational Submittals:

1. Qualifications:
   a. Manufacturer.
   b. Installer.
   c. Independent testing agency.
2. Quality Assurance Program: Written description of geomembrane manufacturer's and installer's formal programs for manufacturing, fabricating, handling, installing, seaming, testing, and repairing geomembrane.
3. Manufacturer's Certificate of Compliance, in accordance with Section 01 43 33, Manufacturers' Field Services.
4. Production dates for geomembrane.
5. Testing:
   a. Factory QC test results for supplied geomembrane.
   b. Rough-surfaced geomembrane coefficient of interface friction test results.
   c. Certified Field seam test results.
   d. Laboratory Testing Equipment: Certified calibrations, manufacturer's product data, and test procedures.
6. Geomembrane Installer's Certification of Subsurface Acceptability: Form attached at end of this section.
7. Manufacturer's Certificate of Proper Installation, in accordance with Section 01 43 33, Manufacturers' Field Services.
8. Special guarantee.

1.04 QUALIFICATIONS

A. Independent Testing Agency: Minimum 5 years' experience in field of geomembrane testing. Laboratory shall maintain calibrated instruments, equipment, and documented standard procedures for performing specified testing.

B. Manufacturer: Successfully manufactured a minimum of 10 million square feet of each type of geomembrane material specified.

C. Installer: Successfully installed a minimum of 1 million square feet and 10 projects of each type of geomembrane product specified in applications similar to the Project. Installer shall be the manufacturer, approved manufacturer installer, or Subcontractor approved by the Contractor to install the geomembrane.

D. Minimum qualifications stated above will be deemed met if the firm or cumulative experience of key personnel (supervisors and trained installation/testing technicians) proposed for this Project has minimum experience specified. If key personnel provision is used to qualify the firm, submit letter stating key personnel meet the minimum experience requirements and those individuals are available for and will be committed to this Project.

1.05 COORDINATION MEETINGS

A. A geomembrane preconstruction meeting shall be held at the site prior to installation of the geomembrane.

B. Attendees (at a Minimum):

1. Subcontractor's designated quality control representative.
2. Contractor.
3. Representatives of geomembrane installer.
4. Others requested by Contractor.

C. Topics:

1. Specifications and Drawings.
2. Submittal requirements and procedures.
3. Schedule for beginning and completing geomembrane installation.
4. Training for installation personnel.
5. Installation crew size.
6. Establishing geomembrane marking system, to include sheet identification, defects, and satisfactory repairs, to be used throughout Work.
7. Lines of authority and communication.
8. Health and safety.
9. Temperature and weather limitations.

D. Seam Installation and Testing Demonstration: Performed by geomembrane installer, for each type of seam required.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Geomembrane:

1. Individually package each sheet and protect from damage during shipment.
2. Mark each package with identification of material type, size, and weight.

B. Epoxy Adhesive:

1. Storage Temperature:
   a. Control temperature above 60 degrees F and dispose of cartridges if shelf life has expired.
   b. If stored at temperatures below 60 degrees F, test adhesive prior to use to determine if adhesive meets specified requirements.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Do not install geomembrane or perform seaming under the following conditions, unless it can be demonstrated to satisfaction of Contractor that performance requirements can be met under these conditions:

1. Air temperature is less than 35 degrees F or more than 85 degrees F.
2. Relative humidity is more than 90 percent.
3. Raining, snowing, frost is in ground, in the presence of standing water, or wind is excessive.

B. Do not place granular materials on geomembrane when ambient temperature is less than 35 degrees F, unless it can be demonstrated to satisfaction of Contractor that materials can be placed without damage.

1.08 SEQUENCING AND SCHEDULING

A. Factory test results for supplied geomembrane materials shall be acceptable to Contractor prior to shipment of geomembrane.

B. Before placing geomembrane on soil surfaces, prepare subgrade as specified in Section 31 23 13, Subgrade Preparation.

1.09 SPECIAL GUARANTEE

A. Provide manufacturer’s extended guarantee or warranty, with USEPA named as beneficiary, in writing, as special guarantee. Special guarantee shall provide for correction, or at option of USEPA, removal and replacement of Work specified in this Specification section found defective during periods below, commencing on date of Substantial Completion. Duties and obligations for correction or removal and replacement of defective Work as specified in General Conditions.

1. Guaranty geomembrane against manufacturing defects, deterioration due to ozone, ultraviolet, and other exposure to elements for period of 20 years on pro rata basis.
2. Guaranty geomembrane against defects in material and factory seams for period of 2 years commencing with the Date of Final Acceptance.

3. Guaranty geomembrane against defects resulting from installation for period of 2 years commencing with the Date of Final Acceptance.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Geomembrane:

1. GSE Lining Technology, Inc., Houston, TX.
2. Poly-Flex, Inc., Grand Prairie, TX.
3. AGRU America, Georgetown, SC.

2.02 GEOMEMBRANE

A. Composition: High density polyethylene (HDPE) containing no plasticizers, fillers, extenders, reclaimed polymers, or chemical additives, except following:

1. Approximately 2 percent by weight of carbon black to resin for ultraviolet resistance.
2. Antioxidants and heat stabilizers, not to exceed 1.5 percent total by weight, may be added as required for manufacturing.

B. Furnish in rolled single-ply continuous sheets with no factory seams.

C. Sheet Thickness: 60 mils.

D. Sheet Width: Minimum 15 feet.

E. Roll Length: Longest that will be manageable and reduce field seams.

F. Manufactured with rough textured sides (both sides). Manufactured so that surface irregularities that produce specified friction are adequately fused into sheet or are extruded with sheet, on both sides of sheet. Texture is to be in addition to base thickness specified for sheet.

G. Meet manufacturer’s most recent published specifications and required minimum HDPE geomembrane values in this table.

Minimum Physical Properties for HDPE Geomembrane		
Property	**Required Value**	**Test Method**
Specific Gravity	0.940 to 0.936, g/cc; not more than 15% greater than base resin density	ASTM D792, Method A-1 or ASTM D1505
Rough-Surfaced, HDPE Minimum Properties, Each Direction		
Thickness, min., for thinner areas of textured sheet	57 mil	ASTM D5199, Modified Note 2, or ASTM D5994
Tensile Stress at Yield	2 lb/mil thickness	ASTM D638
Elongation at Yield	12% plus or minus 3%	
Puncture Resistance	1 lb/mil thickness	ASTM D4833
Tear Resistance	0.70 lb/mil thickness	ASTM D1004, Die C
Brittleness Temperature	Minus 70º F, no cracks	ASTM D746 (Proc. B)
Coefficient of Linear Thermal Expansion	1.2 x 10^{-4} in/in/degree C	ASTM D696
Environmental Stress Crack	300 hours	ASTM D5397
Bonded Seam Strength in Shear	2 lb/in-width/mil thickness, min. & FTB	ASTM D 6392
Bonded Seam Strength in Peel	1.2 lb/in-width/mil thickness, min. & FTB	ASTM D6392
Water Absorption, Weight Change/Adap.	0.085% max.	ASTM D570

Notes:

1. Commercially available micrometers may be used that have a 60-degree taper to a point with a radius of 1/32 inch. Contractor shall make enough measurements of thinner areas of textured sheet to develop statistical basis for thickness.

H. Extrudate for Fusion Welding of HDPE Geomembranes: Formulated from the same resin as geomembrane and shall meet applicable physical property requirements.

2.03 SEALANT CAULKING

A. Two-component sealant formulated of 100 percent polyurethane elastomer, such as Elastuff 120 Mastic as supplied by United Paint and Coatings, Greenacre, WA.

B. Butyl rubber sealant such as Butylgrip Sealant, supplied by the Biddle Company, St. Louis, MO.

PART 3 EXECUTION

3.01 PREPARATION

A. Geomembrane Inspection: During unwrapping visually inspect and mark each imperfection for repair.

B. Do not place geomembrane until condition of subgrade or geosynthetics installed is acceptable to Contractor.

C. Subgrade: Maintain in smooth, uniform, and compacted condition as specified in Section 31 23 13, Subgrade Preparation, during installation of geotextile and geomembrane.

3.02 WELDING UNITS

A. Single or double hot-wedge fusion seam welding.

B. Extrusion welding systems.

C. Hot-air welding is not acceptable.

3.03 GEOMEMBRANE INSTALLATION

A. Do not install geomembrane or seam unless Subcontractor can demonstrate successful performance and test results showing seams meet strength specifications.

B. Protection:

1. Do not use geomembrane surfaces as work area for preparing patches, storing tools and supplies, or other uses. Use protective cover as work surface, if necessary.
2. Instruct workers about requirements for protection of geomembrane, such as, handling geomembrane material in high winds, handling of equipment, and walking on geomembrane surfaces. Shoes of personnel walking on geomembrane shall be smooth bonded sole or be covered with smooth type of overboot. Prohibit smoking, eating, or drinking in

vicinity of geomembrane, placing heated equipment directly on geomembrane, or other activities that may damage geomembrane.

3. Do not operate equipment without spark arrestors in vicinity of geomembrane material nor place generators or containers of flammable liquid on geomembranes.
4. Protect from vehicle traffic and other hazards.
5. Keep free of debris during placement.
6. Prevent uplift, displacement, and damage by wind.
7. Only small rubber-tired equipment, with maximum tire inflation pressure of 5 pounds per square inch, shall be allowed directly on geomembrane, unless otherwise approved by Contractor. Demonstrate that equipment can be operated without damaging geomembrane.

C. Placement:

1. Miscellaneous products required for completion of geomembrane installation shall be in accordance with this specification and geomembrane manufacturer's recommendations.
2. Reduce field seaming to the minimum amount possible. Horizontal seams on slopes will not be acceptable. Seams parallel to toe shall be at least 5 feet from toe. Align rough-sided sheets in manner that maximizes their frictional capabilities along slope.
3. Prevent wrinkles, folds, or other distress that can result in damage or prevent satisfactory alignment or seaming. Provide for factors such as expansion, contraction, overlap at seams, anchorage requirements, seaming progress, and drainage.
4. Temporarily weight sheets with sandbags to anchor or hold them in position during installation. Use continuous holddowns along edges to prevent wind flow under sheet.
    a. Bag Fabric: Sufficiently close knit to preclude fines from working through bags.
    b. Bags: Contain not less than 40 pounds nor more than 60 pounds of sand having 100 percent passing No. 8 screen and shall be securely closed after filling to prevent sand loss.
    c. Do not use tires or paper bags, whether or not lined with plastic. Burlap bags, if used, shall be lined with plastic.
    d. Immediately remove damaged or improperly sealed bags from work area, and clean up spills.
5. Anchor perimeter of geomembrane as shown or as otherwise approved by Contractor. Anchor and seal geomembrane to structures, pipes, and other types of penetrations as shown or as approved by Contractor.
6. Place overlying geotextile immediately following completion of geomembrane installation and field testing as acceptable to Contractor.

D. Field Seams:

1. Wipe sheet contact surfaces clean to remove dirt, dust, moisture, and other foreign materials and prepare contact surfaces in accordance with seaming method accepted by Contractor.
2. Lap sheet edges to form seams. Adjust edges to be seamed and temporarily anchor to prevent wrinkling and shrinkage.
3. Seams shall not go through a boot. Locate seams minimum of 2 feet from boot.
4. Avoid seam intersections involving more than three thicknesses of geomembrane material. Offset seam intersections at least 2 feet. Extend seams through anchor trench to sheet edges.
5. Seal seam “T” intersections by removing excess material and extrusion welding lap joint.
6. Seam sheets together, using fusion-extrusion or hot-wedge welding system, equipment, and techniques.
7. Capping of Field Seams: Use 8-inch wide (minimum) cover strip of same thickness as geomembrane (and from same roll, if available). Position strip over center of field seam and weld to geomembrane using fillet weld each side, including copper wire as described above for spark testing.

3.04 PLACING PRODUCTS OVER GEOMEMBRANE

A. Prior to placing material over geomembrane, notify Contractor. Do not cover installed geomembrane until after Contractor provides authorization to proceed.

B. Do not place granular materials on geomembrane where typical height of wrinkles is greater than 2 inches and spacing between wrinkles is less than 10 feet.

C. Do not place soil materials in manner that will cause wrinkles to fold over or become confined to form a vertical ridge.

D. Place soil materials when geomembrane is cool and contracted and wrinkles are minimized.

E. If tears, punctures, or other geomembrane damage occurs during placement of overlying products, remove overlying products as necessary to expose damaged geomembrane, and repair damage as specified in Article Repairing Geomembrane.

F. Geomembrane installer shall remain available during placement of overlying products to repair geomembrane if damaged.

3.05 REPAIRING GEOMEMBRANE

A. Any geomembrane surface showing injury because of scuffing, penetration by foreign objects, or distress from rough subgrade shall be replaced or covered and sealed with an additional layer of geomembrane material of proper size.

B. Repair damage or rejected seams with pieces of flat and unwrinkled geomembrane material free from defects and seams. Patches shall be tightly bonded on completion of repair Work.

C. Patch shall be neat in appearance and of size 4 inches larger in all directions than area to be repaired. Round corners of patch to minimum 1-inch radius.

D. Prepare contact surfaces and seam patch in accordance with paragraph Field Seams.

1. Pull and hold flat receiving surface in area to be patched.
2. Seal each patch by extrusion welding continuous bead along edge, with no free edge remaining.
    a. Vacuum box test each patch on completion.

3.06 FIELD QUALITY CONTROL

A. Prior to starting geomembrane installation and daily thereafter for installation on subgrade, geomembrane installer shall certify in duplicate that surface upon which geomembrane shall be installed is acceptable, on form located at end of section.

B. Identify each test by date of sample, date of test, sample location, name of individual who performed test, standard test method used, list of departures from standard test methods, at minimum.

C. In-Place Observation and Testing:

1. Visually inspect geomembrane sheets, seams, anchors, seals, and repairs for defects as installation progresses and again on completion.
2. Depending on seam welding equipment used, test each seam and repair using vacuum testing device, spark testing device, or air channel pressure test for double wedge welded seams.
3. Perform testing in presence of Contractor.

D. Field Testing Equipment:

1. Tensiometer:
   a. Motor driven portable tensile tester with jaws capable of traveling at measured rate of 2 inches per minute (for HDPE) and 20 inches per minute (for LLDPE).
   b. Equip with gauge which measures force in unit pounds exerted between jaws.
   c. Minimum capacity of 500 pounds.
2. Vacuum Box: Conform to ASTM D5641.
3. High Voltage Spark Detector: Tinker and Rasor Holiday Detector, Model AP-W, set at 20,000 volts.

E. Field Seam Sampling:

1. Verify that seaming equipment and operators are performing adequately. Produce test seam samples at beginning of each shift for each seaming crew. In addition, if seaming has been suspended for more than 1/2 hour, or if breakdown of seaming equipment occurs, produce test seam samples prior to resuming seaming.
2. Sample Size: 12 inches wide plus seam width, and 30 inches long.
3. Nondestructive Sampling (Test Seams):
   a. For boots and seams that cannot be otherwise tested, insert copper wire for spark test at edge of overlapping sheet in extrudate of weld prior to filet welding. Position to within 1/8 inch of sheet edge.
   b. Frequency: Minimum one Sample per 500 feet of field seam or portion thereof, and minimum one Sample per seaming crew per 5-hour work period.
   c. Produce Samples using same materials, equipment, personnel, and procedures as field seams made at time of work in progress and under same conditions.
4. Destructive Sampling:
   a. Frequency: Minimum one sample per 500 linear feet of field seem. Contractor reserves the right to reduce this testing requirement if other seam tests appear adequate for assuring seam quality.
   b. Remove Samples from field seams at locations selected by Contractor.
   c. Repair field seams in accordance with repair procedures specified in these Specifications.
5. Sample Identification:
   a. Number, date, and identify each sample as to personnel making seam and location of sample or location of field seam Work in progress at time Sample is made.

b. Mark location of Sample, or location of field seam in progress at time sample is made, on panel/sheet layout drawing.

6. Subcontractor shall conform to the following testing requirements for nondestructive and destructive seam tests used to define quality of field seams:
   a. Perform shear and peel testing on portion of sample as specified hereinafter using approved field tensiometer.
   b. Send portion of sample by overnight service to approved Independent Testing Agency for verification of field test results.
   c. Archive a portion of sample for potential verification testing later.
   d. Independent Testing Agency shall provide preliminary test results by facsimile or other means no later than 24 hours after Samples have been received from Subcontractor, unless otherwise approved by Contractor. Certified test results shall be provided no more than 7 days after Samples have been received from Subcontractor.
7. Conform to ASTM D6392 and this specification.
   a. Seam testing for geomembrane includes strength tests, vacuum box testing, high voltage spark tests, air channel pressure tests, and probing.
   b. Leak testing includes water level leakage testing, electrical resistivity testing, and tracer dye leakage testing.

F. Field Seam Strength Sample Testing:

1. General:
   a. Test each sample for seam peel and tensile strength.
   b. Save test samples, including specimens tested, until notified by Contractor relative to their disposal.
   c. Each sample that fails under test shall be shipped immediately by express delivery to Contractor for determination of corrective measures required.
2. Field Seam Acceptance Criteria: Per table under Article 2.02, Geomembrane.
   a. Bonded Shear Strength of HDPE:
      1) In Shear: Minimum 2 pounds per inch width per mil thickness as determined in accordance with ASTM D6392.
      2) In Peel: Minimum 1.2 pounds per inch width per mil thickness as determined in accordance with ASTM D6392.
3. Test Failure: If sample fails, entire field seam from which it was taken shall be considered a failure and shall be rejected as a result of nonconformance with specification requirements. Comply with following corrective measures:
   a. Nondestructive Sample Failure: Rerun field weld test using same sample. If that test passes, Contractor may assume error was made

in first test and accept field seam. If second test fails, cap each field seam represented by failed sample and submit new test Sample made during capping procedure.

b. Destructive Sample Failure: Rerun field weld test using new sample from same seam. If that test passes, Contractor may assume error was made in first test and accept field seam. If second test fails, either cap field seam between two previous passed seam test locations that include failed seam or take another sample on each side of failed seam location (10 feet minimum), and test both. If both pass, cap field seam between two locations. If either fails, repeat process of taking samples for test. Each field seam shall be bounded by two passed test locations prior to acceptance.

G. Vacuum Box Testing of Geomembrane Welds:

1. Vacuum box test each of these types of welds: Fillet, extrusion lap, and single hot-wedge fusion lap.
2. Testing Procedures: Conforming to ASTM D5641.

H. High-Voltage Spark Testing of Fillet Welds:

1. Provide each seam to be tested with copper wires properly embedded in seam as shown and with provisions for electrical grounding to test equipment.
2. Pass spark tester along length of seam containing copper wire.
3. Presence of a visible spark along tested seam shall be evidence of a faulty seam.
4. Mark faulty areas for repair and retesting.

I. Air Channel Pressure Testing of Double Hot-Wedge Seam:

1. Insert a needle with gauge in air space between welds. Pump air into space to 30 psi and hold for 5 minutes.
2. At end of 5 minutes, depressurize seam by placing needle hole in air space between welds at opposite end of seam and observe gauge.
3. Seam is acceptable if seam maintains at least 27 psi during 5-minute hold and pressure drops within 30 second of depressurization.
4. Seam is acceptable if seam maintains a minimum of 27 psi. If pressure drops below 27 psi during test period, or does not drop during 30-second depressurization period, repair needle holes and retest seam by same procedure or vacuum box test along entire length of seam.
5. Vacuum box test entire length of seam if second air pressure test fails.
   a. If no bubbles appear in vacuum box, lower weld will be considered defective and upper seam is acceptable.

b. If bubbles appear in vacuum box, repair each defective area by extrusion welding and test again by vacuum box.

6. As alternative to vacuum box testing, apply soap solution to exposed seam edge while maintaining required air channel test pressure.
   a. If bubbles appear, mark, trim unbonded edge, and extrusion weld defective areas.
   b. If no bubbles appear and test pressure cannot be maintained, leak is judged to be in bottom or second seam.
7. If leak is judged to be in bottom seam, cap strip length of seam tested will be accepted.
8. Mark and repair needle holes.

J. Documentation:

1. Record Documents, include the following:
   a. Panel and sheet numbers.
   b. Seaming equipment and operator identification.
   c. Temperature and speed setting of equipment.
   d. Date seamed.
   e. Identity and location of each repair, cap strip, penetration, boot and sample taken from installed geomembrane for testing.

3.07 MANUFACTURER'S SERVICES

A. Provide authorized representative of geomembrane manufacturer onsite for technical supervision and assistance during the following:

1. Preparation and inspection of surfaces on which geomembrane is to be placed.
2. Inspection of geomembrane prior to installation.
3. Installation of geomembrane.
4. Placement of cover over installed geomembrane.
5. Certification of Proper Installation.

3.08 CLEANUP

A. Clean up work area as the Work proceeds. Take particular care to ensure that no trash, tools, and other unwanted materials are trapped beneath geomembrane and that scraps of geomembrane material are removed from the work area prior to completion of installation.

3.09 SUPPLEMENT

A. The supplement listed below, following “End of Section,” are a part of this Specification.

1. Geomembrane Installer’s Certification of Subsurface Acceptability.

END OF SECTION

GEOMEMBRANE INSTALLER'S CERTIFICATION OF SUBSURFACE ACCEPTABILITY

Geomembrane installer, _____
for the Lincoln Park/Milwaukee River Channel Sediment Site, hereby certify that supporting surfaces are acceptable for installation of geomembrane, undersigned having personally inspected condition of constructed surfaces. This certification is for areas shown on Attachment or defined as follows:

_____

_____

_____

_____

Condition of supporting surfaces in defined area meets or exceeds minimum requirements for installation of geomembrane.

Signed: _____
(Representative of Geomembrane Installer)

_____
(Position)

Date: _____

Witness: _____

SECTION 40 80 01
PROCESS PIPING LEAKAGE TESTING

PART 1 GENERAL

1.01 SUBMITTALS

A. Informational Submittals:

1. Testing Plan: Submit prior to testing and include at least the information that follows.
   a. Testing dates.
   b. Piping systems and section(s) to be tested.
   c. Test type.
   d. Method of isolation.
   e. Method of filling and draining pipe to be tested using harbor water.
   f. Calculation of maximum allowable leakage for piping section(s) to be tested.
2. Certifications of Calibration: Testing equipment.
3. Certified Test Report.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 PREPARATION

A. Notify Contractor in writing 5 days in advance of testing. Perform testing in presence of Contractor.

B. Pressure Piping:

1. Install temporary thrust blocking or other restraint as necessary to protect adjacent piping or equipment and make taps in piping prior to testing.
2. Wait 5 days minimum after concrete thrust blocking is installed to perform pressure tests. If high-early strength cement is used for thrust blocking, wait may be reduced to 2 days.
3. Prior to test, remove or suitably isolate appurtenant instruments or devices that could be damaged by pressure testing.
4. New Piping Connected to Existing Piping:
   a. Isolate new piping with grooved-end pipe caps, spectacle blinds, blind flanges, or as acceptable to Contractor.

5. Test Pressure: 1.5 times the system design pressure at the lowest elevation in the section under test

C. Test section may be filled with water and allowed to stand under low pressure prior to testing.

D. Gravity Piping:

1. Perform testing after service connections, manholes, and backfilling have been completed between stations to be tested.
2. Determine groundwater level at time of testing by exploratory holes or other method acceptable to Contractor.
3. Pipe 42 Inches Diameter and Larger: Joint testing device may be used to isolate and test individual joints.

3.02 HYDROSTATIC TEST FOR PRESSURE PIPING

A. Fluid: Clean water of such quality to prevent corrosion of materials in piping system.

B. Exposed Piping:

1. Perform testing on installed piping prior to application of insulation.
2. Maximum Filling Velocity: 0.25 foot per second, applied over full area of pipe.
3. Vent piping during filling. Open vents at high points of piping system or loosen flanges, using at least four bolts, or use equipment vents to purge air pockets.
4. Maintain hydrostatic test pressure continuously for 30 minutes, minimum, and for such additional time as necessary to conduct examinations for leakage.
5. Examine joints and connections for leakage.
6. Correct visible leakage and retest as specified.

C. Buried Piping:

1. Test after backfilling has been completed.
2. Expel air from piping system during filling.
3. Apply and maintain specified test pressure with hydraulic force pump. Valve off piping system when test pressure is reached.
4. Maintain hydrostatic test pressure continuously for 2 hours minimum, reopening isolation valve only as necessary to restore test pressure.
5. Determine actual leakage by measuring quantity of water necessary to maintain specified test pressure for duration of test.

6. Maximum Allowable Leakage:

$$L = \frac{SD(P)^{1/2}}{133{,}200}$$

where:

L = Allowable leakage, in gallons per hour.
S = Length of pipe tested, in feet.
D = Nominal diameter of pipe, in inches.
P = Test pressure during leakage test, in pounds per square inch.

7. Correct leakage greater than allowable, and retest as specified.

3.03 HYDROSTATIC TEST FOR GRAVITY PIPING

A. Testing Equipment Accuracy: Plus or minus 1/2-gallon water leakage under specified conditions.

B. Maximum Allowable Leakage: 0.16 gallons per hour per inch diameter per 100 feet. Include service connection footage in test section, subjected to minimum head specified.

C. Gravity Sanitary and Roof Drain Piping: Test with 15 feet of water to include highest horizontal vent in filled piping. Where vertical drain and vent systems exceed 15 feet in height, test systems in 15-foot vertical sections as piping is installed.

D. Defective Piping Sections: Replace or test and seal individual joints, and retest as specified.

3.04 FIELD QUALITY CONTROL

A. Test Report Documentation:

1. Test date.
2. Description and identification of piping tested.
3. Test fluid.
4. Test pressure.
5. Remarks, including:
   a. Leaks (type, location).
   b. Repair/replacement performed to remedy excessive leakage.
6. Signed by Subcontractor and Contractor to represent that test has been satisfactorily completed.

END OF SECTION