DRAFT
2018 Annual GLOEMMP Report

Globeville Landing Outfall
Vasquez Boulevard and Interstate 70 Superfund Site
Operable Unit 2
Denver, Colorado

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February 6, 2019

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APEX

List of Abbreviations and Acronyms

AOC	Administrative Settlement Agreement and Order on Consent
Apex	Apex Companies, LLC
ACM	asbestos-containing materials
bgs	below ground surface
CABI	Certified Asbestos Building Inspector
CCD	City and County of Denver
CDPHE	Colorado Department of Public Health and Environment
DDPHE	Denver Department of Public Health and Environment
DrillPro	DrillPro Services, Inc.
EPA	Environmental Protection Agency
FOS	factor of safety
Flatirons	Flatirons, Inc.
GIS	Geographic Information System
GLO	Globeville Landing Outfall
GLOEMMP	Globeville Landing Outfall – Environmental Monitoring and Maintenance Plan
NPL	National Priorities List
OU2	Vasquez Boulevard and Interstate 70 Superfund Site, Operable Unit 2
Park	Globeville Landing Park
PID	photoionization detector
RACS	regulated asbestos-containing soil
USCS	Unified Soil Classification System
VB/I-70	Vasquez Boulevard and Interstate 70 Superfund Site

1.0 INTRODUCTION

This Globeville Land Outfall (GLO) Environmental Monitoring and Maintenance Report is for the period from September through December 2018. This report summarizes the findings of the monitoring and maintenance program established in the Globeville Landing Outfall Environmental Monitoring and Maintenance Plan (GLOEMMP) (Loop Environmental Consulting, 2018). The GLO project was a removal action conducted under an Environmental Protection Agency (EPA) Administrative Settlement Agreement and Order on Consent (AOC), July 2015, for the Vasquez Boulevard and I-70 Superfund Site (VB/I-70) Operable Unit 2 (OU2). The field work for the removal action was completed in August 2018.

1.1 Site Description

VB/I-70 OU2 was listed on the EPA National Priorities List (NPL) on July 22, 1999. OU2 consists of the area of the VB/I-70 Superfund Site formerly occupied by the Omaha & Grant Smelter facility. **Figure 1** shows the OU2 boundary. The Omaha and Grant Smelter facility operated from 1882 until 1903. A lead smelting process was employed at the facility to produce gold, silver, copper, and lead. After closure in 1903, the smelter buildings were subsequently demolished.

OU2 is located in the City and County of Denver, Colorado, and encompasses approximately 50 acres and is generally bounded by the Union Pacific Railroad to the northwest, Interstate-70 to the north, the Denver Coliseum and associated parking lot to the northeast, Brighton Boulevard to the east, the southern boundaries of the Globeville Landing Park and the Pepsi Bottling Company facility to the south, and the South Platte River to the west.

The City and County of Denver (CCD) performed a remedial investigation of OU2 in 2009 and a feasibility study in 2010. Development of a proposed plan and record of decision for OU2 has been postponed until additional investigation of groundwater is completed. Previous environmental investigations at OU2 have identified the presence of elevated concentrations of arsenic and lead in soil. CCD is currently working with EPA to scope the revised remedial investigation for OU2.

In 2018, the CCD completed a removal action which allowed for the construction of a stormwater drainage feature, referred to as the Globeville Landing Outfall (EMSI, 2018). Per the 2015 AOC for the removal action, an impermeable barrier system was designed and constructed within the GLO open channel to prevent stormwater from interacting with groundwater and vice versa. As part of the post-removal site control, the GLOEMMP was developed to define the monitoring and maintenance requirements for the impermeable barrier system (liner) installed within the channel, the piezometers used for monitoring groundwater levels adjacent to the channel, and the sheet pile wall south of the channel. This area will collectively be referred to as the Site (**Figure 2**), which is located within Globeville Landing Park.

Globeville Landing Park (Park) is currently being constructed and is anticipated to be open to the public in the spring/summer of 2019. Following construction completion, activities which will occur within the Park and on the Site include Park maintenance activities and maintenance of the stormwater conveyance structure including the open channel and stormwater outfall. These activities are further described in the GLOEMMP.

1.2 GLOEMMP Requirements

The GLOEMMP defines the work tasks, including inspections, maintenance activities, and performance validation measures needed to ensure that the impermeable barrier system continues to prevent contaminated media from adversely impacting the stormwater conveyed by the drainage system, and the stormwater infiltration into contaminated media remaining within the open channel boundaries.

1.2.1 Monitoring

The design of the GLO impermeable barrier system included a specification to prevent buoyancy by monitoring the upward or positive hydraulic pressure of the groundwater on the impermeable barrier system. The design factor of safety (FOS) for the hydraulic pressure was set at 150% of the lower limit, which translates to 3.8 feet of positive groundwater hydraulic pressure. As defined in the GLOEMMP, a positive groundwater hydraulic pressure

of less than 3.8 feet is acceptable. The GLOEMMP outlines notifications when the positive hydraulic pressure of the groundwater on the liner are within 0.5 feet of the FOS elevations for the adjacent liner points. Therefore, the EPA notification elevation is set at 3.3 feet or greater positive hydraulic pressure above the liner elevation.

In order to monitor the positive hydraulic pressure on the impermeable barrier system, three previously surveyed liner elevation points, P51, R44, and P17 (EMSI, 2018), as shown on **Figure 2**, were selected that are equally spaced throughout the channel. Piezometers, PZ-1, PZ-2, and PZ-3, as shown on **Figure 2**, were installed to be in line with those liner elevation points. The positive hydraulic pressure on the liner can be established by subtracting the measured groundwater elevation within the piezometer from the corresponding liner point elevation.

The GLOEMMP requires that quarterly groundwater elevation monitoring at piezometers PZ-1, PZ-2, and PZ-3 occur for two years following project completion, and annually thereafter during the wet season from May through July. Given the GLO project fieldwork completion in August 2018, the fourth quarter 2018 groundwater elevation monitoring was completed in December 2018 and outside the wet season window. The second and third quarterly groundwater elevation monitoring events in 2019 will occur during the wet season.

Though not required per the GLOEMMP, additional groundwater elevation data were collected from all OU2 monitoring wells/piezometers (MW-2, CTL MW-4, CTL MW-5, SWDI-5 and SWDI-6) during the fourth quarter 2018 monitoring event.

1.2.2 Inspections and Maintenance

A visual inspection of the Site will occur quarterly until the Coliseum outlet to the GLO channel is fully operational, which is anticipated in the second quarter of 2019. Thereafter, this inspection will occur annually. Additionally, a vegetation survey of the GLO channel performed by Denver Parks and Recreation will occur annually. These inspections, along with maintenance crew observations in the Park, will provide information regarding potential GLO channel and outlet structural issues, damage to the piezometers or the sheet pile wall, and vegetation and erosion concerns in the channel.

A land survey was conducted in October 2018 to establish the baseline channel wall elevations. This survey will be repeated in 2019 and every five years thereafter to determine if there is excessive settlement of the GLO channel retaining walls. Settlement of greater than 2 inches is considered significant and may impact the geomembrane barrier system.

Preventative maintenance will occur in the channel to seal cracks, remove or replace vegetation, and repair erosion. Should a significant event or damage occur as defined in the GLOEMMP, the EPA and the Colorado Department of Public Health and Environment (CDPHE) will be notified and corrective measures taken in consultation with EPA and CDPHE.

1.2.3 Land Use Restrictions

CCD will implement land use restrictions within the Park to protect the geomembrane barrier system, the piezometers, and the sheet pile wall. The land use restrictions are outlined in the GLOEMMP.

1.2.4 Training

CCD Parks and Recreation, Wastewater, and Arts and Venues maintenance crews, who are involved in maintaining the Park and the Denver Coliseum, will be provided with annual environmental training. This training will encompass specific topics related to the Site including an overview of OU2, the geomembrane barrier system components including the highly visible barrier grid, Site land use restrictions, and a discussion of the regulated asbestos-containing soil (RACS) remaining on Site at depth.

2.0 GLOEMMP MONITORING

This section summarizes the Site monitoring activities that occurred in the fourth quarter of 2018.

2.1 Visual Inspection

A visual inspection of the GLO channel, the outfall, the piezometers, and sheet pile wall area was conducted on November 26, 2018, by Kara Edewaard, CCD Environmental Project Manager. The visual inspection form and photographic log can be found in **Appendix A**.

A walking survey was performed along the entire lined channel area, including the concrete retaining walls, channel outlet aprons, the grouted boulder areas, the channel vegetation area, and around the South Platte River outfall.

2.1.1 GLO Channel Observations

The highly visible barrier grid was not exposed in any areas. There was visible settlement and erosion (photograph 103615, **Appendix A**) at the Arkins Court channel outlet (Arkins outlet) to the northeast of the grouted boulder section. Erosion and settlement repair were completed in December 2018 with the installation of void-filled riprap, which extends 89 feet beyond the grouted boulders within the channel. Repair photographs can be found in **Appendix B**.

There was minor ponding noted in the channel (photograph 101746, **Appendix A**). Ron Frobel, liner expert, confirmed on January 23, 2019, that ponding is not a concern for the liner system. Generally, the native grass vegetation is establishing well in the channel with the exception of the Arkins outlet side and along some sections of the channel walls. Grass plugs will be installed within the void-filled riprap area near the Arkins outlet in the spring of 2019. Grass seeding along the walls will also occur at that time. No structural issues were observed along the GLO channel walls or around the channel outlets. The south lateral drain boxes were blocked per the June 2018 Storm Event Memorandum (Merrick, 2018).

2.1.2 Outfall Observations

No structural issues were noted for the South Platte River outfall structure. The grouted boulder areas at the outfall were inspected for significant cracks, and none were observed. No groundwater seeps were noted at the outfall area, or along the side slopes around the outfall.

2.1.3 Piezometer and Sheet Pile Wall Area

The piezometer pads, the metal casings, and the well seals were inspected for PZ-1, PZ-2, and PZ-3. No deterioration of the pad, the well housing, or the seals was noted. The buried sheet pile wall area was undisturbed.

2.2 Vegetation Survey

A vegetation inspection of the GLO channel occurred on November 26, 2018, by Scott Bartell, CCD Natural Resources Technician. The vegetation inspection form can be found in **Appendix C**. Erosion was noted at the Arkins outlet to the northeast of the grouted boulders. As a result of this erosion, the southwest end of the channel near the Arkins outlet is not well vegetated. Grass plugs and additional seeding will be completed in the spring of 2019 to enhance the vegetation within the channel. A few cottonwood tree saplings were identified in the channel. The saplings will be removed in the spring of 2019.

2.3 Land Survey

Apex Company, LLC (Apex) contracted a Colorado-licensed surveyor, Flatirons, Inc. (Flatirons), to conduct the baseline survey of the top of the channel wall, on October 4, 2018. The BM Ellis and Merrick YPC local benchmarks were used to established 17 survey points on the channel wall (WW-1 through WW-9 and EW-1 through EW-8), as shown in **Figure 2**. These channel wall locations were marked and will be resurveyed in 2019. The survey data is provided in **Table 1**.

2.4 Groundwater Elevation Monitoring

The following sections summarize the groundwater elevation monitoring implemented in 2018.

2.4.1 Piezometer Installation Summary

On December 20, 2018, Apex installed three piezometers (PZ-1, PZ-2, and PZ-3) adjacent to three surveyed liner points (P51, R44, and P17) between the channel wall and the sheet pile wall, as depicted on **Figure 2**. Apex's

licensed driller, DrillPro Services, Inc. (DrillPro), used a hollow-stem auger drill rig to advance the three soil borings (PZ-1 through PZ-3). Soil borings were advanced to depths from 19 to 22 feet below ground surface (bgs).

Apex provided a geologist/Certified Asbestos Building Inspector (CABI) to oversee the drilling operation and observe soil conditions. The geologist documented the lithology in accordance with the Unified Soil Classification System (USCS), color, and relative moisture content. Additionally, the Apex geologist field screened soil samples using an organic vapor meter equipped with a calibrated photoionization detector (PID), and noted observations indicative of environmental impacts (staining, odors, etc.) in the boring logs. Drilling details and observations are presented on the soil boring logs provided in **Appendix D**.

Apex's geologist/CABI did not identify suspected asbestos-containing materials (ACM), other than ash during the drilling activities. The observation of ash in each of the three soil borings rendered the accumulated soil cuttings to be RACS. The volume of soil disturbed during the drilling, based on a calculation of the diameter of the auger and depth of the soil borings, was less than the de minimis amount of 1 cubic yard per the Colorado Solid Waste Regulations CCR 1007-2 Part 1, Section 5.5.

The piezometers were constructed of 2-inch diameter polyvinyl chloride (PVC) with 10 feet of 0.001-inch, factory-slotted well screen across the water table, and solid PVC casing to approximately 2.5 feet above ground surface. A filter pack of 10-20 silica sand was placed in the annular space to approximately 2 feet above the top of the screen interval. The piezometers were sealed with hydrated bentonite to 1.5 feet below the ground surface, and then filled with clean sand to grade. Piezometers were completed as stick-ups to approximately 2.5 feet above ground surface with a yellow steel protective casing. The protective casing was installed in a 2-feet by 2-feet by 6-inches thick concrete pad, sloped with the grade. Lockable, water-tight J-plugs were used to maintain the integrity of the piezometers. Well construction details are presented on the soil boring logs provided in **Appendix D**.

The top of the casing for the newly installed piezometers were surveyed by a Colorado-licensed surveyor.

2.4.2 Groundwater Elevation Summary

On December 26, 2018, Apex measured the depth to groundwater in PZ-1 through PZ-3, and in the OU2 monitoring wells/piezometers located to the east of the Site (MW-2, CTL MW-4, CTL MW-5, SWDI-5 and SWDI-6). At PZ-1 through PZ-3, groundwater elevations were between 5,147.85 and 5,150.19 feet above mean sea level (amsl). The groundwater elevations during the fourth quarter of 2018, as compared to the adjacent liner point elevation, were as follows:

- PZ-1 groundwater elevation was 5.38 feet below liner point P51, or -5.38 feet positive hydraulic pressure;
- PZ-2 groundwater elevation was 4.47 feet below liner point R44, or -4.47 feet positive hydraulic pressure; and,
- PZ-3 groundwater elevation was 5.22 feet below liner point P17, or -5.22 feet positive hydraulic pressure.

The groundwater positive hydraulic pressures were below the FOS value of 3.8 feet and the EPA notification trigger value of 3.3 feet of positive hydraulic pressure on the liner. Groundwater measurement data and corresponding liner points are summarized on **Table 2**. The groundwater elevation data from all OU2 piezometers and monitoring wells were used to develop a groundwater surface map on **Figure 3**. Based on the monitoring results, the groundwater flows northwest towards the South Platte River with a gradient of 0.028 feet per foot, as calculated between piezometers CTL MW-5 and PZ-1.

3.0 GLOBEVILLE LANDING OUTFALL MAINTENANCE

A site meeting was held on September 6, 2018, with representatives from Merrick & Company (GLO project design engineer), the Architerra Group (the GLO project landscape architect), and Great Ecology (the GLO project ecological consultant) to evaluate the establishment of the wetland grasses in the channel bottom. It was noted that the grasses in the channel bottom between the Coliseum outlet and the channel drop inlet structure were well established and that the grasses in the channel bottom between the Arkins outlet and the drop inlet structure were doing moderately well; however, the grasses along the trickle channel near the Arkins outlet were not establishing well due to the sustained relatively high low flow conditions during the summer of 2018. It was observed that the

erosion control seeding blanket and topsoil along a section of the trickle channel immediately downstream of the grouted boulders had washed away during a previous storm event. It was decided that replacing the topsoil along the bottom of the low flow channel with a layer of void-filled riprap would help with the establishment of the wetland grasses. Additionally, wetland grass plugs should be planted along the edges of the low flow channel to help accelerate the establishment of the grasses.

Ames Construction implemented this erosion control measure in December 2018. Eighteen inches of topsoil were removed along the trickle channel and replaced with a layer of void-filled riprap for 89 feet beyond the grouted boulders at the Arkins outlet (see **Appendix B**). Grass plugs and additional seeding will be completed in the spring of 2019.

No additional site maintenance activities occurred in the fourth quarter of 2018.

It is anticipated that the Park will open in the spring/summer of 2019 following construction completion. Prior to the Park opening, piezometers, PZ1, PZ-2, and PZ-3, which were completed as stick-ups to approximately 2.5 feet above ground surface, will be flush mounted. Additionally, Site maintenance activities planned in 2019 include the installation of grass plugs within the void-filled riprap area and additional channel seeding in the spring.

4.0 TRAINING AND LAND USE RESTRICTIONS IMPLEMENTATION

The following sections summarize the 2019 CCD training activities and implementation of the GLOEMMP land use restrictions.

4.1 CCD Employee Training

CCD maintenance crews that work in the Park and at the Denver Coliseum will receive annual environmental training. Training for these personnel will occur in the spring of 2019 prior to the Park opening. Training content is noted in **Section 1.2.4**.

4.2 Land Use Restrictions

CCD has defined the following actions to implement the land use restrictions defined in the GLOEMMP.

- Geographic Information System (GIS) Mapping: CCD will generate a Globeville Landing Park GIS layer, which defines the land use restrictions for the lined area of the GLO channel and the piezometer and sheet pile area. This layer will be provided to the Denver Department of Public Health and Environment (DDPHE), the Parks and Recreation Department, and the Public Works department so that planners are aware of these restrictions when reviewing new CCD projects. This task is underway and expected to be completed by March 2019.

- CCD Project Environmental Reviews: DDPHE performs environmental reviews of all CCD projects particularly where soil disturbing activities are occurring. DDPHE and the CCD OU2 Project Manager will vet these projects to ensure they are not in conflict with the land use restrictions. This activity is ongoing.

- Globeville Landing Park Operations and Maintenance (O&M) Plan: The Globeville Landing Park O&M Plan is currently being developed in conjunction with Denver Parks and Recreation, Wastewater, and DDPHE. This plan will include a summary of the Site land use restrictions and other environmental components. All maintenance supervisors over seeing activates in the Park will get a copy of this plan. This plan is currently being developed and is expected to be completed by May 2019.

5.0 SUMMARY AND RECOMMENDATIONS

The following summary and recommendations are based on the inspections and field measurements conducted at the Site from September to December 2018.

5.1 Summary of 2018 Activities

The visual inspection of the Site indicated no concerns with the outfall structures, the piezometers, or the buried sheet pile wall area.

During the vegetation inspection of the GLO channel, erosion was noted at the Arkins outlet to the northeast of the grouted boulders. Generally, the grass within the channel is well established with a few noted areas that need reseeding. Additionally, a few cottonwood tree saplings were identified in the channel.

The baseline survey of the top of the channel wall was completed to established 17 survey points on the channel wall.

Three piezometers were installed to monitor groundwater elevation relative to the liner. Localized groundwater was measured to be between 5,147.85 and 5,150.19 feet amsl, and was determined to flow to the northwest, towards the South Platte River. The groundwater positive hydraulic pressures measured in all three piezometers were below the FOS value of 3.8 feet, and below the EPA notification trigger value of 3.3 feet of positive hydraulic pressure on the liner during the fourth quarter of 2018.

5.2 Recommendations

A visual inspection of the Site will occur quarterly until the Coliseum outlet to the GLO channel is fully operational, which is anticipated in the second quarter of 2019. Thereafter, this inspection will occur annually.

To address the erosion and subsequent lack of vegetation at the Arkins outlet, grass plugs and additional seeding will be completed in the spring of 2019 to enhance the vegetation within the channel. The cottonwood tree saplings will be removed in the spring of 2019.

The channel wall locations will be resurveyed in 2019 and every five years thereafter to assess the GLO channel retaining walls for settling.

CCD Parks and Recreation, Wastewater, and Arts and Venues maintenance crews, who are involved in maintaining the Park and the Denver Coliseum, will be provided with annual environmental training. This training will encompass specific topics related to the Site including an overview of OU2, the geomembrane barrier system components including the highly visible barrier grid, Site land use restrictions, and a discussion of the regulated asbestos-containing soil (RACS) remaining onsite at depth.

Groundwater monitoring will be conducted on a quarterly basis during 2019. The second and third quarterly groundwater elevation monitoring events in 2019 will occur during the wet season, which is typically when groundwater levels are at their highest elevations. Notifications to the EPA will be made per the GLOEMMP, if hydraulic pressure trigger values on the channel liner are exceeded.

CCD will complete the GIS mapping and Globeville Landing Park O&M Plan and continue to conduct environmental review to comply with the land use resections defined in the GLOEMMP.

6.0 REFERENCES

EMSI, 2018. Construction Completion Report Globeville Landing Outfall Project Removal Action, Vasquez Boulevard/Interstate 70 Site, Operable Unit 2. November 28, 2018.

Loop Environmental Consulting, 2018. Globeville Landing Outfall Environmental Monitoring and Maintenance Plan, Vasquez Boulevard/Interstate 70 Site Operable Unit 2. December 2018.

Merrick and Company, 2018. Mike Galluzzi, PE. Globeville Landing Outfall Phase 1A – June 2018 Storm Event Assessment, Modeling Validation and Design Modification, September 20, 2018.

FIGURES

LEGEND

Operable Unit 2 Boundary

Map Source:
Commerce City, Colorado
USGS 7.5-minute Topographic Maps

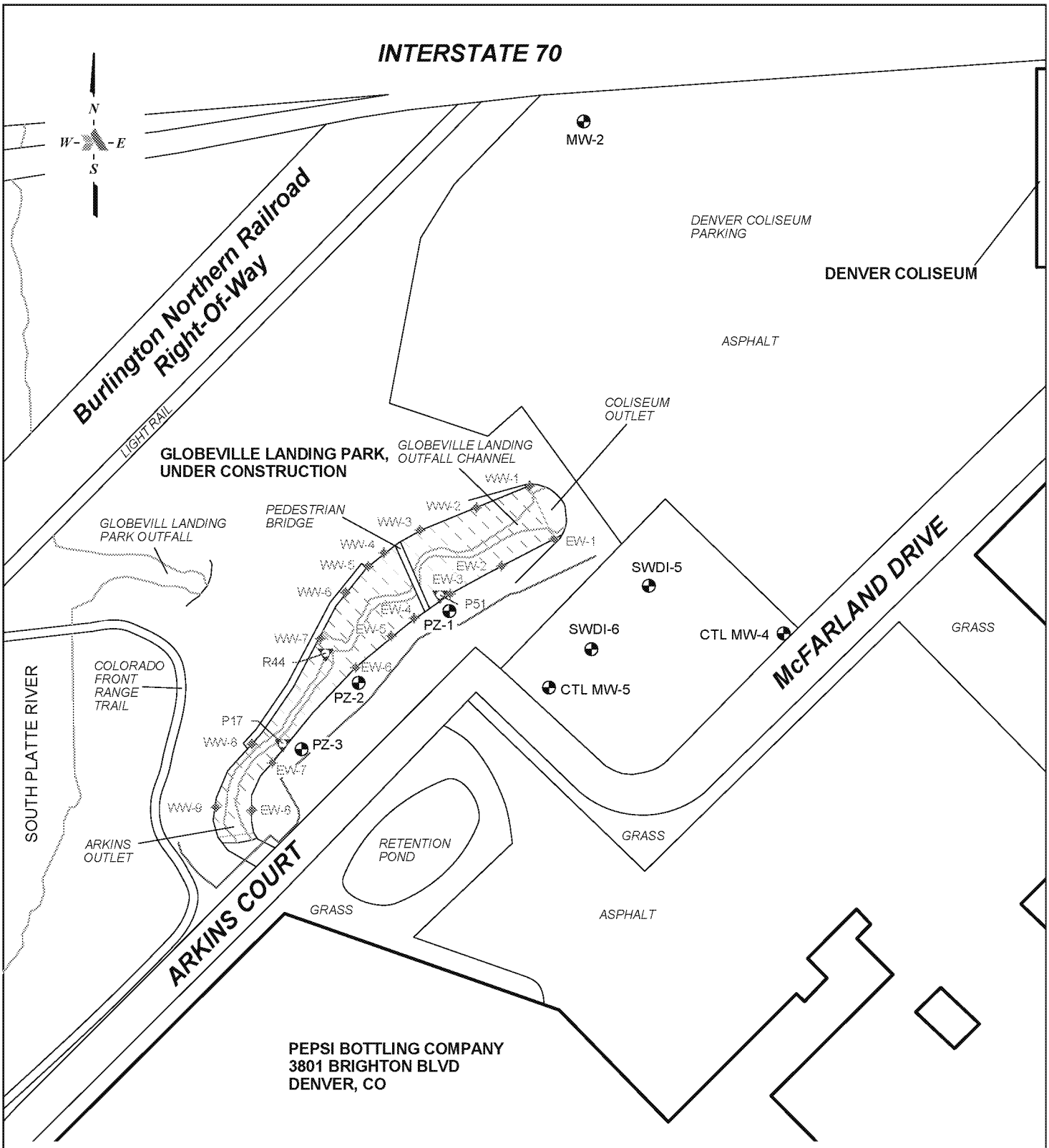
FIGURE 1 - Site Location Map

Vasquez Boulevard / Interstate 70 Superfund Site Operable Unit 2, Denver, CO

Apex Job No. 5622

DATE - 01/22/19 (JR)
FILE - F1 - Site Location.dc

APEX



LEGEND

- PZ-1 Piezometer location
- EW-1 Channel wall survey point
- P17 Liner point and location
- Sheet pile wall
- Liner

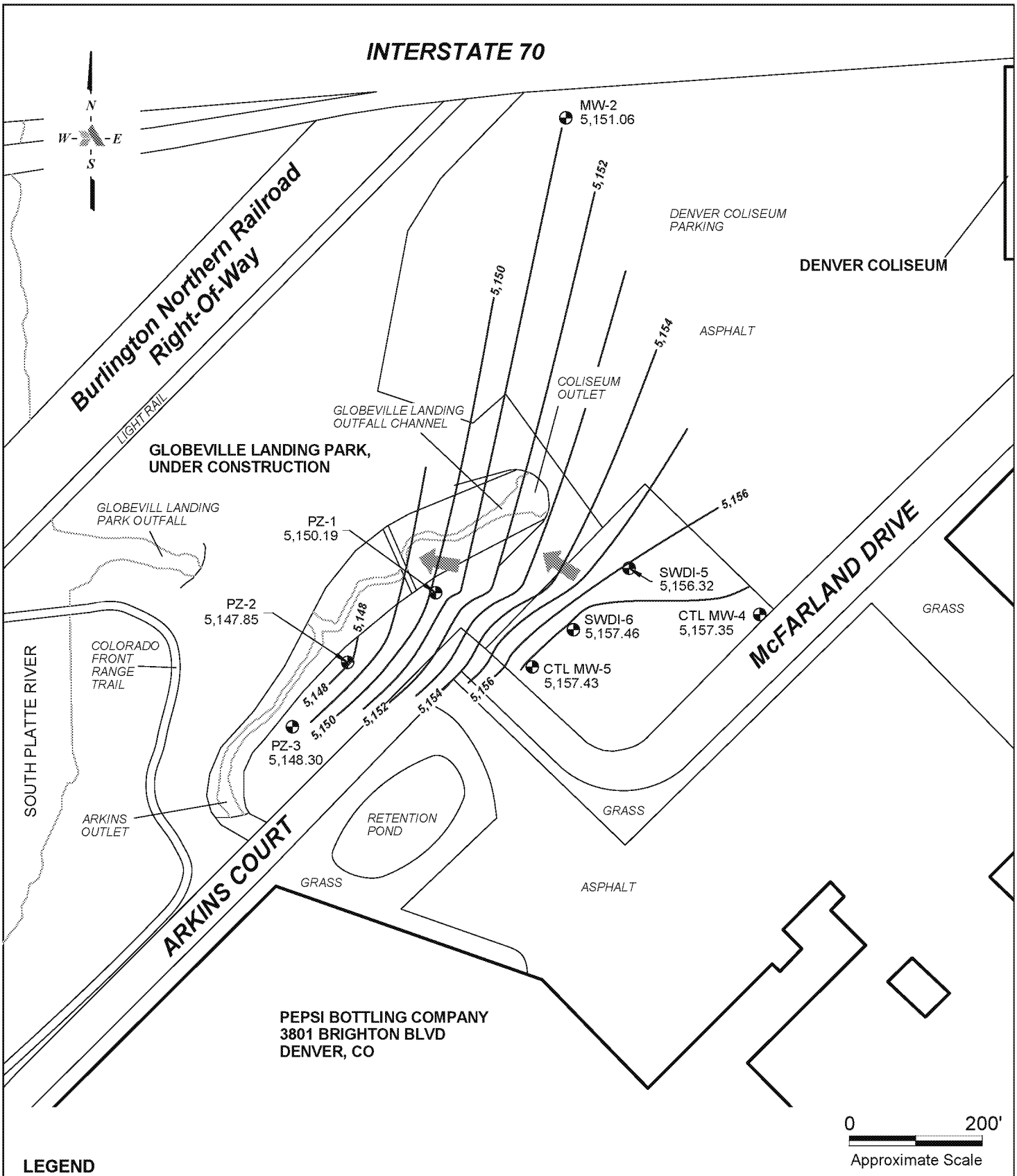
FIGURE 2 - Site Plan

Vasquez Boulevard / Interstate 70 Superfund Site Operable Unit 2, Denver, CO

Apex Job No. 5622

DATE - 1/22/19 (JR)
FILE - 5622 - F2.dc

APEX



LEGEND

PZ-1 5,150.19 — Piezometer location and groundwater elevation

5,154 — Inferred groundwater elevation contour and flow direction. Contour interval = 1.0 feet

FIGURE 3 - Groudwater Surface Elevation Map

Vasquez Boulevard / Interstate 70 Superfund Site Operable Unit 2, Denver, CO

Apex Job No. 5622

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APEX

TABLES

Table 1
Channel Wall Survey Data
Globeville Landing Outfall, VB/I70 Superfund OU2

Channel Wall Survey Point ID		Channel Wall	Location Description	Northing	Easting	Elevation (ft amsl)	Latitude	Longitude
EW-1	8003	East Wall	Center of the 2nd concrete panel south of the northern end	1708518.397	3147556.466	5163.531	39.77752	-104.97502
EW-2	8004		Center of the 8th concrete panel south of the northern end	1708477.546	3147476.516	5163.396	39.77741	-104.97530
EW-3	8005		Center of the 14th concrete panel south of the northern end	1708434.746	3147398.218	5163.244	39.77729	-104.97558
EW-4	8006		Center of the 1st concrete panel south of the bridge	1708397.994	3147343.434	5163.280	39.77719	-104.97578
EW-5	8007		Center of the 4th concrete panel south of the bridge	1708370.830	3147308.286	5159.330	39.77712	-104.97591
EW-6	8008		Center of the 9th concrete panel south of the bridge	1708323.114	3147254.463	5159.173	39.77699	-104.97610
EW-7	8009		Center of the 9th concrete panel north of the southern end	1708178.139	3147127.714	5160.104	39.77659	-104.97655
EW-8	8010		Center of the 4th concrete panel north of the southern end	1708106.836	3147097.167	5160.700	39.77640	-104.97666
WW-1	8019	West Wall	Center of the 2nd concrete panel south of the northern end	1708599.047	3147519.486	5163.572	39.77774	-104.97515
WW-2	8018		Center of the 8th concrete panel south of the northern end	1708566.106	3147438.212	5163.415	39.77765	-104.97544
WW-3	8017		Center of the concrete panel immediately north of the bridge	1708531.907	3147352.311	5163.258	39.77756	-104.97575
WW-4	8016		Center of the concrete panel immediately south of the bridge	1708497.727	3147297.420	5163.303	39.77747	-104.97594
WW-5	8015		Center of the 1st concrete panel south of the northern end of the sidewalk	1708476.869	3147273.401	5159.580	39.77741	-104.97603
WW-6	8014		Center of the 3rd concrete panel north of the inlet	1708437.332	3147239.283	5159.293	39.7773	-104.97615
WW-7	8013		Directly above the flow inlet	1708367.036	3147200.562	5158.714	39.77711	-104.97629
WW-8	8012		Center of the 1st, southern-most concrete panel of the sidewalk	1708206.993	3147096.497	5160.086	39.77667	-104.97666
WW-9	8011		Center of the 4th concrete panel north of the southern end	1708110.463	3147041.668	5160.597	39.77641	-104.97686

ft amsl - feet above mean sea level
Datum NAD 1983, Zone Colorado Central 0502
Latitude/Longitude data transformation to WGS84

Table 2
Groundwater Elevation Data
Globeville Landing Outfall, VB/I70 Superfund OU2

Piezometer ID	Top of Casing Elevation (ft amsl)	Date Measured	Depth to Groundwater (ft btoc)	Groundwater Elevation (ft amsl)	Associated Liner Point	Associated Liner Point Elevation (ft amsl)	Hydraulic Pressure [1] (ft)	Factor of Safety [2] (< 3.8 ft)	Observation
PZ-1	5168.55	12/26/18	18.36	5150.19	P51	5155.57	-5.38	Acceptable	
PZ-2	5163.98	12/26/18	16.13	5147.85	R44	5152.32	-4.47	Acceptable	
PZ-3	5164.37	12/26/18	16.07	5148.30	P17	5153.52	-5.22	Acceptable	
MW-2	5161.45	12/26/18	10.39	5151.06	---	---	---	---	
CTL MW-4	5169.77	12/26/18	12.42	5157.35	---	---	---	---	
CTL MW-5	5169.69	12/26/18	12.26	5157.43	---	---	---	---	Dark brown fluid, possible LNAPL, on the water level indicator tape, ~0.25 feet
SWDI-5	5166.75	12/26/18	10.43	5156.32	---	---	---	---	
SWDI-6	5168.43	12/26/18	10.97	5157.46	---	---	---	---	

ft amsl - feet above mean sea level
ft btoc - feet below top of casing
Hydraulic Pressure - elevation of the groundwater in the piezometer minus the elevation of the assoicated liner point.
[2] Factor of Safety (FOS), as defined in the Draft GLOEMMP (June 2018), is a positive hydraulic head of less than 3.8 feet. Notification is required when the groundwater elevation is within or greater than 0.5 feet of the 3.8 feet hydraulic head FOS.
LNAPL - light nonaqueous phase liquid
Note: Survey data is presented in Datum NAD 1983, Zone Colorado Central 0502.
Note: MW-1 and MW-3 were previously abandoned and will be reinstalled.

APPENDIX A

Visual Inspection Form and Photographic Log

Visual Inspection Form - Globeville Landing Outfall

General Information

Inspector Name: Kara Edewaard Title: Environmental Project Mgr

Date of Inspection: 11/26/2018 Time: 9 AM MST

Weather Conditions (temperature, wind, precipitation, etc): Clear, sunny, 40°F

Condition of Site:

Lined area condition (indicate areas inspected, any ponding, exposure of visible barrier grid, settlement, rodent holes, etc):

Any erosion observed (describe extent, depth and indicate locations of any eroded areas on map):

The entire channel was inspected from the Coliseum outlet to the Arkins Court outlet. The barrier grid was not exposed in any areas. There was some visible settlement and erosion (photo 103615) at the Arkins Court outlet to the northeast of the grouted boulders. This erosion and settlement will be repaired in December 2018 with the installation of void-filled riprap which will extend 89' beyond the grouted boulders in the trickle channel. There was some minor ponding (photo 101746). Ron Frobel, liner expert, confirmed on 1/23/19, that ponding is not a concern for the liner system.

Condition of vegetation (describe vegetation types, any deep-rooted species, vegetated coverage, etc.):

Generally, the native grass vegetation is establishing well throughout the channel with the exception of the Arkins Court outlet side of the channel where we had several high velocity scouring events in the summer of 2018. Grass plugs will be installed between the void-filled riprap in the spring of 2019. Denver Parks and Recreation representatives performed a vegetation inspection and assessment on 11/26/18. Their assessment information will be included in the GLOEMMP Report.

Retaining wall condition (indicate if cracks, settling, movement, liner pull-away, etc.):

The GLO channel retaining wall looked good throughout, no structural issues were noted. Baseline channel wall survey elevations were taken in October 2018. Settling will be assessed in 2019 following the annual land survey per the GLOEMMP requirements. Survey marks on the channel walls indicating the baseline survey points were inspected to ensure the markings have not faded.

Condition of apron areas, outlet structure, piezometers, and sheet pile wall area:

The GLO outlets, Coliseum and Arkins Court outlets, the S. Platte River outlet from the channel, and their corresponding aprons all appeared to have no structural issues. No structural issues were noted at the S. Platte River outfall. The grouted boulder areas at both the outfall and the Arkins outlet were inspected for cracks and none were observed. The irrigation boxes which house the electrical wires used for electrical leak location surveys were also inspected and no issues noted. The piezometer pads, the metal casings, and the well seals were inspected. No deterioration of the pad, the well

Other notes:

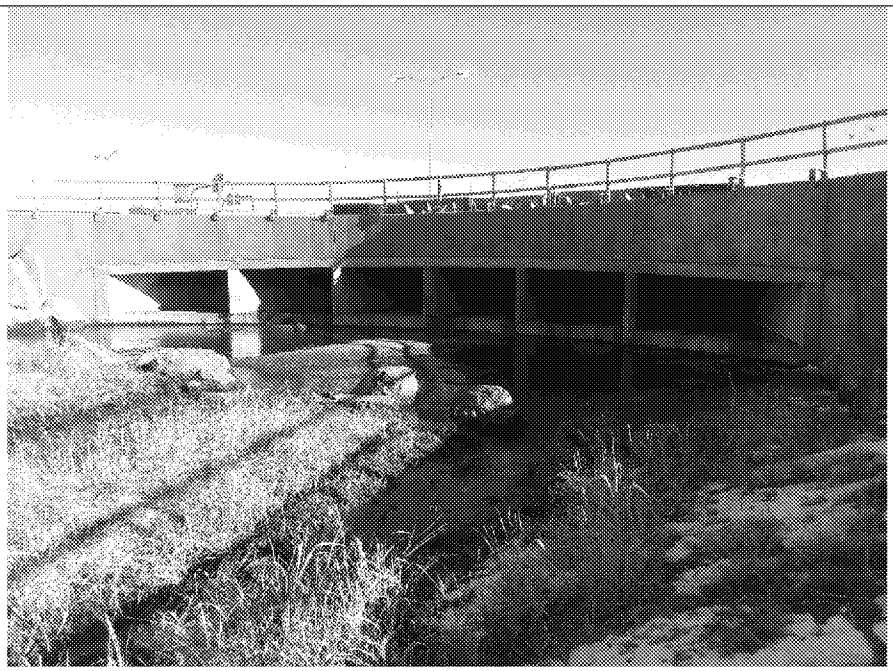
Denver Department of Public Health and Environment

Inspection Date: 11/26/2018 (4th Quarter 2018 Inspection)

Site Name: VB/I-70 Operable Unit 2

Project: Globeville Landing Outfall Visual Inspection

Photographic Log

Photograph ID: 094522	
Photo Location: Coliseum outlet – GLO channel	
Direction: Northeast	
Inspection Date: 11/26/2018	
Comments: The storm water drainage system is not fully connected upstream of the Coliseum outlet. Minimal flow observed.	
Photograph ID: 101632	
Photo Location: Looking toward Coliseum outlet	
Direction: Southeast	
Inspection Date: 11/26/2018	
Comments: Grasses are well established near the trickle channel. Some additional seeding may be needed along the channel walls.	

Denver Department of Public Health and Environment

Inspection Date: 11/26/2018 (4th Quarter 2018 Inspection)

Site Name: VB/I-70 Operable Unit 2

Project: Globeville Landing Outfall Visual Inspection

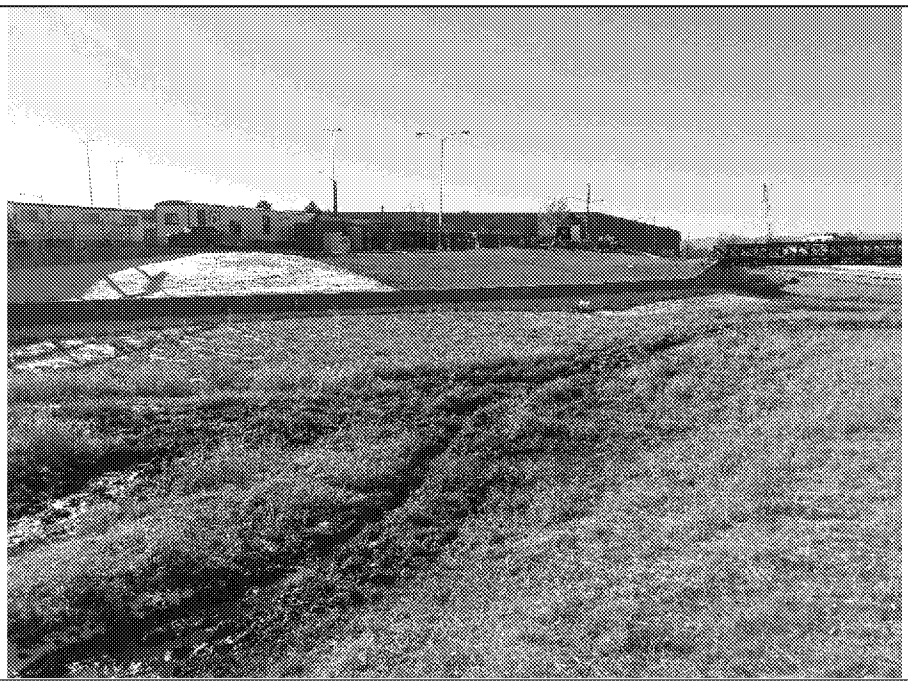
Photographic Log

Photograph ID: 101156 **Photo Location:** Coliseum outlet – Electrical Leak Location Copper Wire Box **Direction:** Aerial (down) **Inspection Date:** 11/26/2018 **Comments:** Batten bar copper wire and central GLO channel copper wire labeled and protected in the irrigation box.	
Photograph ID: 101232 **Photo Location:** Coliseum outlet – Electrical Leak Location Copper Wire Box **Direction:** Aerial (down) **Inspection Date:** 11/26/2018 **Comments:** Batten bar copper wire and central GLO channel copper wire labeled and protected in the irrigation box.	

Denver Department of Public Health and Environment | **Inspection Date: 11/26/2018 (4th Quarter 2018 Inspection)**

Site Name: VB/I-70 Operable Unit 2 | **Project: Globeville Landing Outfall Visual Inspection**

Photographic Log

Photograph ID: 110210 **Photo Location:** GLO channel – looking toward Arkins outlet **Direction:** Southwest **Inspection Date:** 11/26/2018 **Comments:** Grasses well established in the trickle channel. Some additional seeding may be needed along channel walls. Some depressions noted within the island areas.	
Photograph ID: 101136 **Photo Location:** GLO channel – looking toward pedestrian bridge **Direction:** Southwest **Inspection Date:** 11/26/2018 **Comments:** Grasses well established in the trickle channel	

Denver Department of Public Health and Environment

Inspection Date: 11/26/2018 (4th Quarter 2018 Inspection)

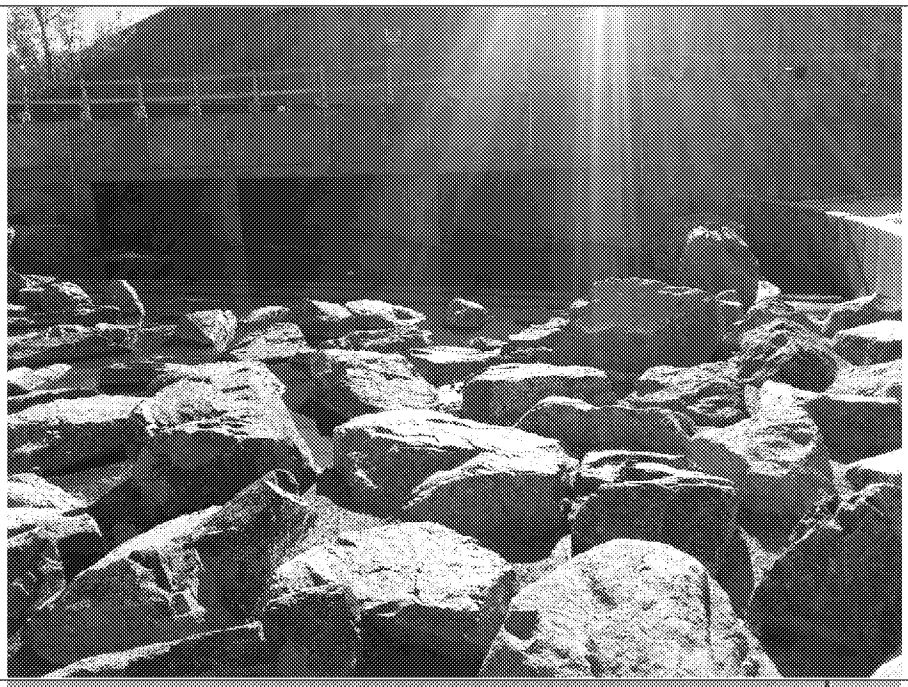
Site Name: VB/I-70 Operable Unit 2

Project: Globeville Landing Outfall Visual Inspection

Photographic Log

Photograph ID: 101718 **Photo Location:** Pedestrian bridge and GLO channel wall **Direction:** Northwest **Inspection Date:** 11/26/2018 **Comments:** No structural issues noted for the GLO channel walls.	
Photograph ID: 101746 **Photo Location:** GLO channel – ponding area **Direction:** Southwest **Inspection Date:** 11/26/2018 **Comments:** Slight ponding observed within the GLO channel. Ron Frobel, liner expert, confirmed on 1/23/19 that ponding is not a concern for the liner system.	

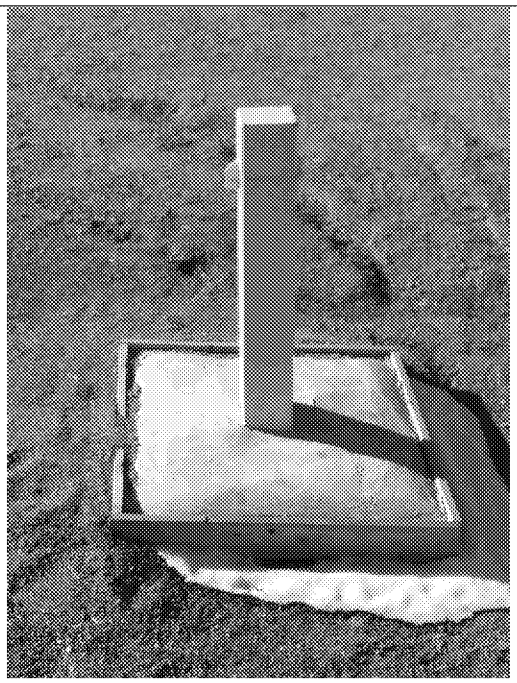
Photographic Log

Photograph ID: 103512 **Photo Location:** Arkins Court outfall **Direction:** South **Inspection Date:** 11/26/2018 **Comments:** Moderate flow. No cracks observed in the channel walls. No cracks observed within the grouted boulder section.	
Photograph ID: 103556 **Photo Location:** Arkins Court outfall – grouted boulder section **Direction:** East **Inspection Date:** 11/26/2018 **Comments:** No cracks observed within the grouted boulders.	

Photographic Log

Photograph ID: 103615 **Photo Location:** Arkins Court outfall **Direction:** Southeast **Inspection Date:** 11/26/2018 **Comments:** Erosion observed following installation of grouted boulders and buried riprap in July 2018. The barrier grid is not visible. Additional channel modifications were completed on 12/3/18 which included placement of void-filled riprap in the trickle channel for 89' beyond the grouted boulders at the Arkins outlet.	
Photograph ID: 103625 **Photo Location:** Arkins Court outfall **Direction:** Northeast **Inspection Date:** 11/26/2018 **Comments:** Erosion observed following installation of grouted boulders and buried riprap in July 2018. The barrier grid is not visible. Additional channel modifications were completed on 12/3/18 which included placement of void-filled riprap in the trickle channel for 89' beyond the grouted boulders at the Arkins outlet.	

Photographic Log

Photograph ID: 105800 **Photo Location:** Piezometer – PZ-1 **Direction:** Aerial (down) **Inspection Date:** 11/26/2018 **Comments:** No piezometer damage observed.	
Photograph ID: 105910 **Photo Location:** South of GLO Channel – piezometers (PZ-2 and PZ-3) **Direction:** Northwest **Inspection Date:** 11/26/2018 **Comments:** No piezometer damage observed.	

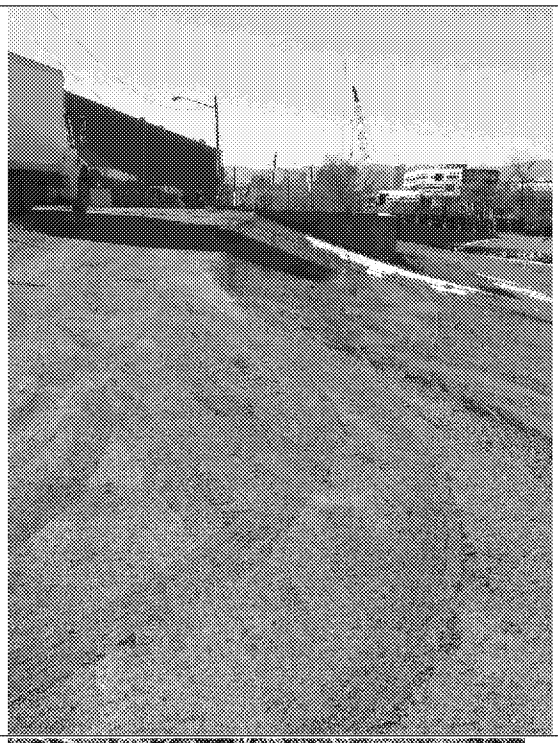
Denver Department of Public Health and Environment

Inspection Date: 11/26/2018 (4th Quarter 2018 Inspection)

Site Name: VB/I-70 Operable Unit 2

Project: Globeville Landing Outfall Visual Inspection

Photographic Log

Photograph ID: 105856 **Photo Location:** Sheet pile wall area **Direction:** Southwest **Inspection Date:** 11/26/2018 **Comments:** No drilling, grading, or excavation activities observed near the sheet pile wall area or piezometers.	
Photograph ID: 101046 **Photo Location:** GLO channel wall survey point **Direction:** Arial (down) **Inspection Date:** 11/26/2018 **Comments:** GLO channel wall survey markers clearly visible at all survey locations.	

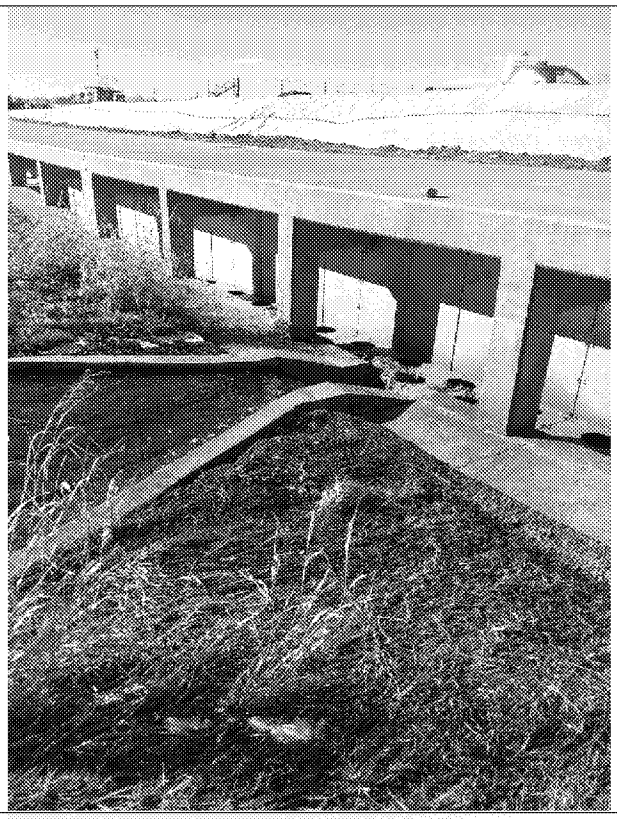
Denver Department of Public Health and Environment

Inspection Date: 11/26/2018 (4th Quarter 2018 Inspection)

Site Name: VB/I-70 Operable Unit 2

Project: Globeville Landing Outfall Visual Inspection

Photographic Log

Photograph ID: 102915	
Photo Location: GLO channel outlet to South Platte River	
Direction: Northwest	
Inspection Date: 11/26/2018	
Comments: No damage observed to the channel structure. Some additional grass seeding needed along channel wall. South lateral drain boxes partially blocked.	
Photograph ID: 100150	
Photo Location: South Platte River outfall	
Direction: East	
Inspection Date: 11/26/2018	
Comments: No structural damage observed. No seeps visible around the outfall structure, grouted boulder area, and the slope side.	

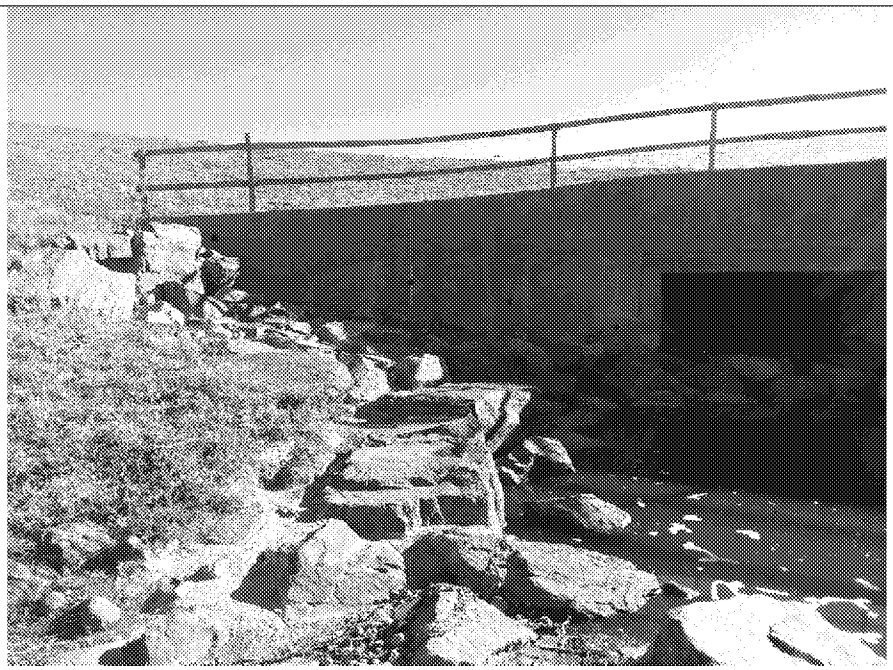
Denver Department of Public Health and Environment

Inspection Date: 11/26/2018 (4th Quarter 2018 Inspection)

Site Name: VB/I-70 Operable Unit 2

Project: Globeville Landing Outfall Visual Inspection

Photographic Log

Photograph ID: 100648	
Photo Location: South Platte River outfall	
Direction: Southeast	
Inspection Date: 11/26/2018	
Comments: No structural damage observed. No seeps visible around the outfall structure, grouted boulder area, and the slope side.	

APPENDIX B

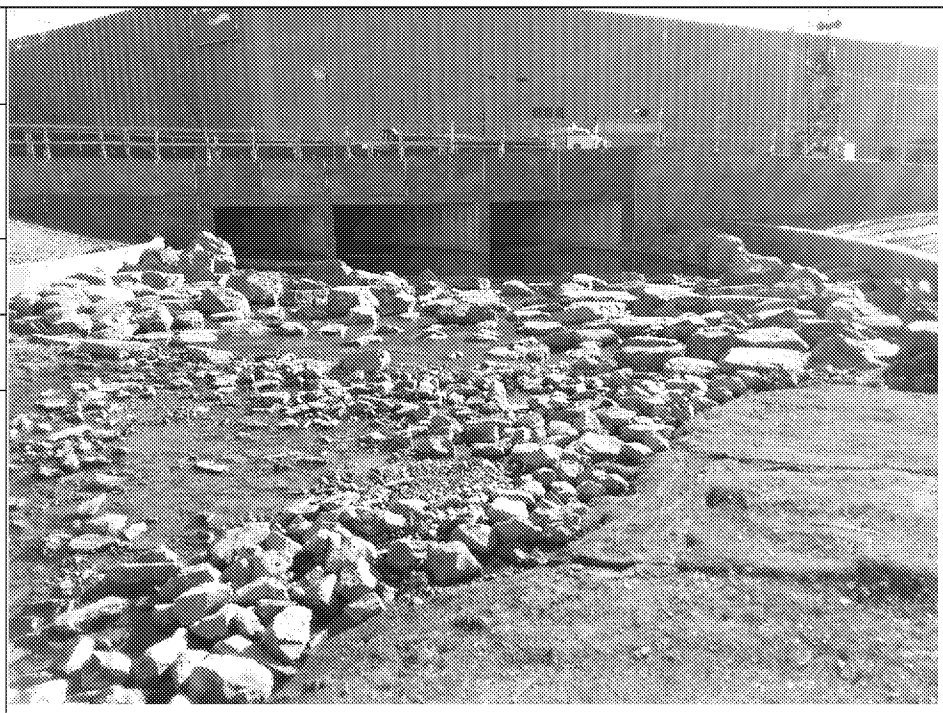
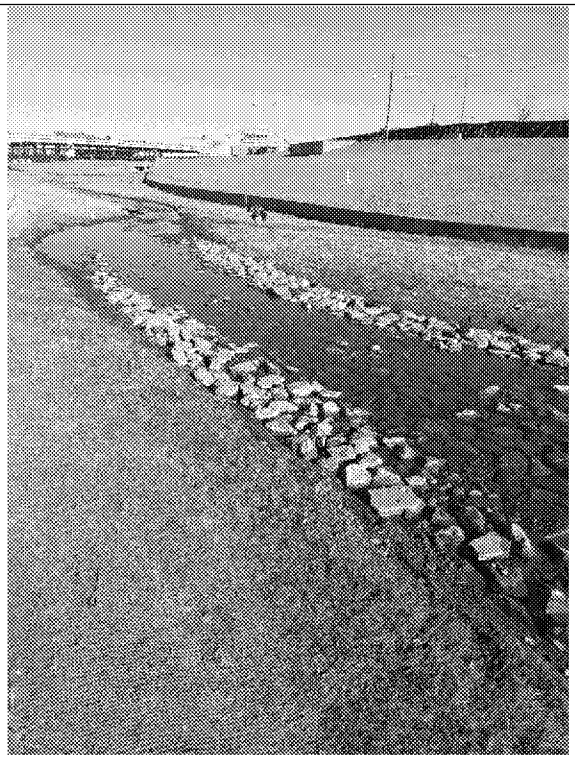
Arkins Court Outlet Erosion Repair Photographic Log

Denver Department of Public Health and Environment

Inspection Date: 12/7/2018

Site Name: VB/I-70 Operable Unit 2

Project: Globeville Landing Outfall Arkins Outfall Erosion Repair

Photograph ID: 133316 **Photo Location:** Arkins Court Outlet GLO Channel **Direction:** Southwest **Inspection Date:** 12/7/2018 **Comments:** Erosion Repair	
Photograph ID: 133323 **Photo Location:** Arkins Court Outlet GLO Channel **Direction:** East **Inspection Date:** 12/7/2018 **Comments:** Erosion Repair	

APPENDIX C

Vegetation Survey Form and Photographic Log

Globeville Landing Park - Open Channel Vegetation Inspection Form

Inspector: Scott Bartell Date: 11/26/2018

Title: Environmental Project Mgr Time: 9 AM MST

Open Channel Region	Condition of Grasses	Visual Evidence of Erosion		Describe Erosion Impact on Channel Vegetation, if Present	Unwanted Vegetation Present*		Describe Unwanted Vegetation* and Location
East Channel[1] - Coliseum	Grass conditions are good. Grass gets thinner near the channel wall areas.	Yes ☐	No ☐		Yes ☐	No ☐	
Center Channel[2]	Grass conditions are good. There are some bare areas near the trickle channel.	Yes ☐	No ☐	No erosion present though some vegetation loss near the trickle channel. See photo 1.	Yes ☐	No ☐	Some cottonwood tree saplings visible. Saplings will be removed in the spring 2019.
West Channel[3] - Arkins	There is little vegetation near the trickle channel at the far west side of the channel.	Yes ☐	No ☐	Erosion visible past the grouted boulders on the far west side of the channel. Vegetation is thin in the trickle channel as a result. See photo 2.	Yes ☐	No ☐	

*Vegetation that has deeper roots or the potential for deeper roots that could impact the channel liner (e.g., tree saplings)

[1]East Channel = north of pedestrian bridge to Denver Coliseum outlet

[2]Center Channel = south of pedestrian bridge (between bridge and channel outlet to the S. Platte River)

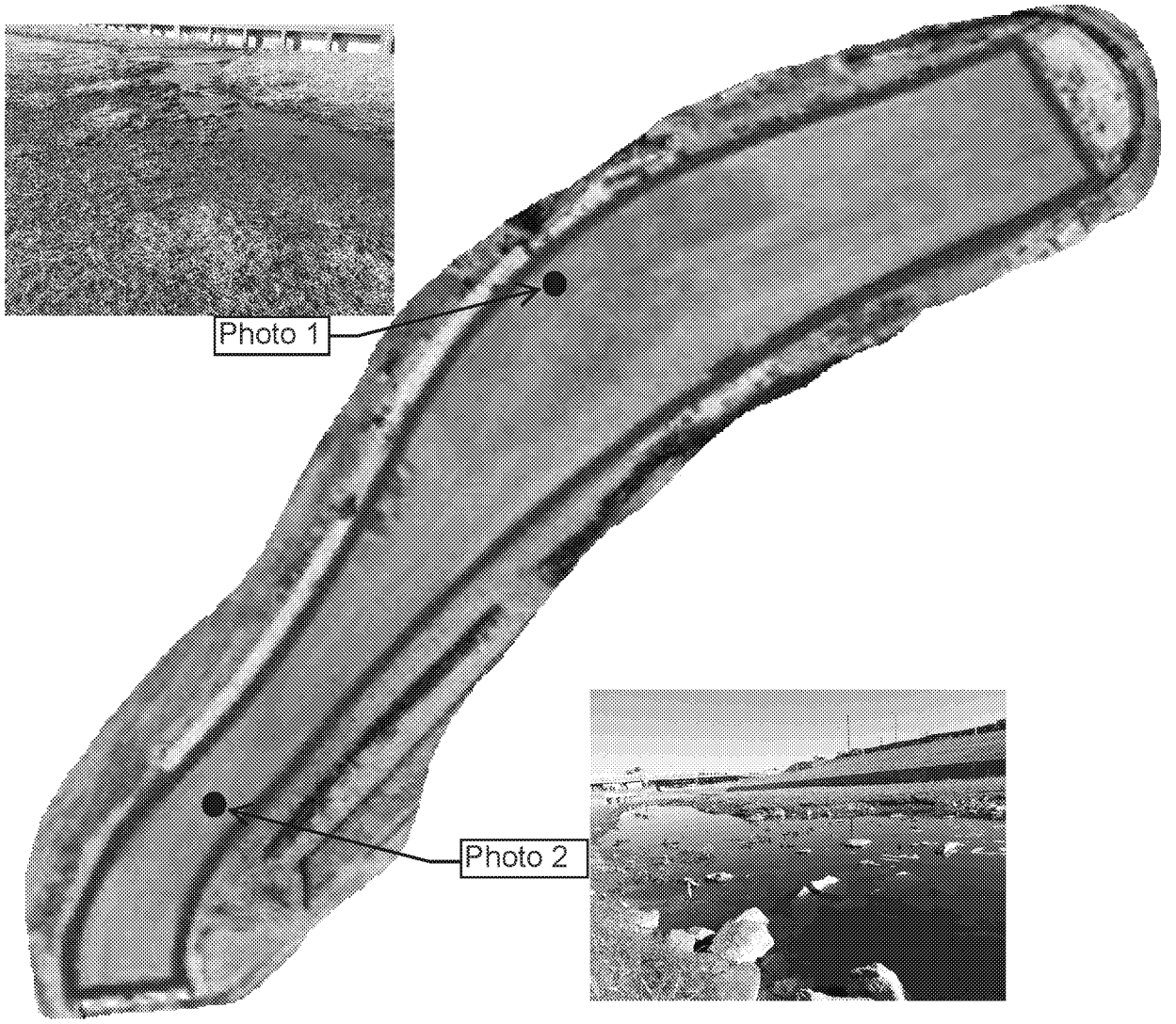
[3]West Channel = south of the channel outlet to the S. Platte River up to the grouted boulder area near the Arkins Court outlet

Maintenance Actions Required / Comments / Photo Log:

Channel erosion repair at the far west side will occur in December 2018. Grass plugs will be installed in the spring of 2019 along with additional seeding in bare areas along the channel walls and near the trickle channel.

Cottonwood tree saplings within the channel will be removed in the spring of 2019.

Indicate any vegetation or erosion areas of concern on the Globeville Landing Outfall Open Channel depiction below:



Additonal Comments:

The GLO channel retaining wall looked good throughout, no structural issues were noted. Baseline channel wall survey elevations were taken in October 2018. Settling will be assessed in 2019 following the annual land survey per the GLOEMMP requirements. Survey marks on the channel walls indicating the baseline survey points were inspected to ensure the markings have not faded.

APPENDIX D

Soil Boring Logs and Well Construction Details

PROJECT: Globeville Landing Outfall	LOCATION ID: **PZ-1**	
SITE LOCATION: Vasquez Blvd. / Interstate 70 Superfund Site	TOP OF CASING ELEVATION: 5168.55 ft	
DRILLING CONTRACTOR: Drill Pro Services, Inc.	DATE STARTED: 12/20/18	DATE FINISHED: 12/20/18
DRILLING METHOD: Pothole/Direct Push	TOTAL DEPTH: 20.22 ft bgs	SCREEN INTERVAL: 12.0-22.0 ft
DRILLING EQUIPMENT: Geoprobe 6610	DEPTH TO WATER:15.7 ft bgs	CASING: 2" Sch. 40 PVC
SAMPLING METHOD: Continuous-core	LOGGED BY: Jonathan Anstey / Apex Companies	
NORTHING: 1708407.909 / EASTING: 3147398.333	PROJECT MANAGER: Jonathan Anstey	

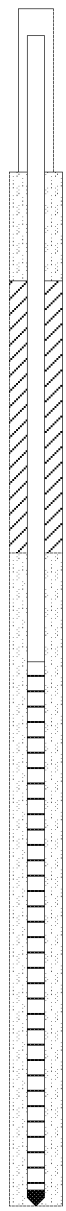
DEPTH (FT)	SAMPLE DEPTH (FT)	SAMPLE INTERVAL	PID READING (PPM)	SOIL DESCRIPTION USCS name, gradation or plasticity, particle size and distribution, color, moisture content, density or consistency, soil structure, mineralogy, stain or odor	DEPTH (FT)	LITHOLOGY	Well Construction Details and/or drilling remarks
-2					-2		A 3 ft tall monument was installed
0					0		
2	Potholing		NM	Potholing	2	FILL	
4					4		
6					6		Hydrated bentonite chip seal
8	6-10		1120	Fill, sand, gray and black staining, brick and glass debris, some gravel, dry, poorly graded	8	FILL	
10					10		
12	10-14		53.7	Fill, sand, brick and wood, black staining, clay at 12', gray, soft, moist, some glass debris	12	FILL	
14					14		2" diameter, 0.010" slot, Schedule 40 PVC screen
16	14-16		168.8	Clay, black staining, landfill debris, wet, soft	16	FILL	
18					18		10/20 filter pack sand
20				Weathered claystone	20	BRCS	
22					22		

APEX

Project No: 5622

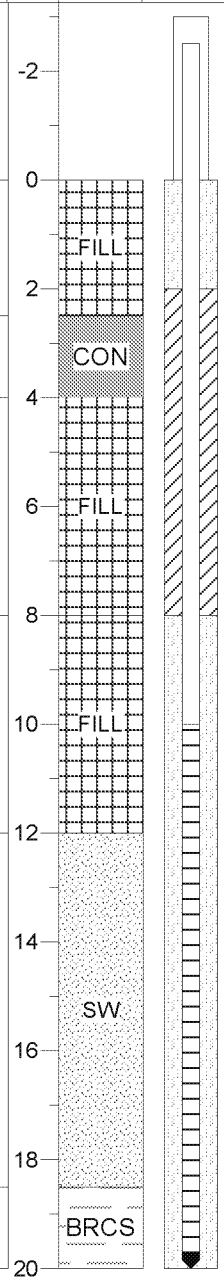
PROJECT: Globeville Landing Outfall	LOCATION ID: **PZ-2**	
SITE LOCATION: Vasquez Blvd. / Interstate 70 Superfund Site	TOP OF CASING ELEVATION: 5163.98 ft	
DRILLING CONTRACTOR: Drill Pro Services, Inc.	DATE STARTED: 12/20/18	DATE FINISHED: 12/20/18
DRILLING METHOD: Pothole/Direct Push	TOTAL DEPTH: 19.0 ft bgs	SCREEN INTERVAL: 9.0-19.0 ft
DRILLING EQUIPMENT: Geoprobe 6610	DEPTH TO WATER:13.8 ft bgs	CASING: 2" Sch. 40 PVC
SAMPLING METHOD: Continuous-core	LOGGED BY: Jonathan Anstey / Apex Companies	
NORTHING: 1708298.967 / EASTING: 3147259.464	PROJECT MANAGER: Jonathan Anstey	

DEPTH (FT)	SAMPLE DEPTH (FT)	SAMPLE INTERVAL	PID READING (ppm)	SOIL DESCRIPTION USCS name, gradation or plasticity, particle size and distribution, color, moisture content, density or consistency, soil structure, mineralogy, stain or odor	DEPTH (FT)	LITHOLOGY	Well Construction Details and/or drilling remarks
-2					-2		A 3 ft tall monument was installed
0					0		
2	Potholing		NM	Potholing	2	FILL	
4				Concrete	4	CON	Hydrated bentonite chip seal
6	6-8		0	Fill, sand, burnt, black, soft, dry	6	FILL	
8					8		
10	8-12		0	Fill, sand, black staining, moist, wood debris	10	FILL	2" diameter, 0.010" slot, Schedule 40 PVC screen
12					12		
14	12-16		0	Clay, gray staining, soft, wet, sand at 15', brown, wet, well graded	14	CL	10/20 filter pack sand
16					16		
18				Weathered claystone	18	BRCS	



PROJECT: Globeville Landing Outfall	LOCATION ID: **PZ-3**	
SITE LOCATION: Vasquez Blvd. / Interstate 70 Superfund Site	TOP OF CASING ELEVATION: 5164.37 ft	
DRILLING CONTRACTOR: Drill Pro Services, Inc.	DATE STARTED: 12/20/18	DATE FINISHED: 12/20/18
DRILLING METHOD: Pothole/Direct Push	TOTAL DEPTH: 20.0 ft bgs	SCREEN INTERVAL: 10.0-20.0 ft
DRILLING EQUIPMENT: Geoprobe 6610	DEPTH TO WATER:13.8 ft bgs	CASING: 2" Sch. 40 PVC
SAMPLING METHOD: Continuous-core	LOGGED BY: Jonathan Anstey / Apex Companies	
NORTHING: 1708197.829 / EASTING: 3147172.765	PROJECT MANAGER: Jonathan Anstey	

DEPTH (FT)	SAMPLE DEPTH (FT)	SAMPLE INTERVAL	PID READING (ppm)	**SOIL DESCRIPTION** USCS name, gradation or plasticity, particle size and distribution, color, moisture content, density or consistency, soil structure, mineralogy, stain or odor
-2				
0				
2	Potholing		NM	Potholing
				Concrete
4				
6	4-8		75.2	Fill, sand, black staining, debris, soft, dry
8				
10	8-12		180.1	Fill, sand, black, wet, stained debris, clay at 11', gray, wet, soft
12				
14	12-16		60.2	Sand, brown, well graded, wet at 15'
16				
18				
20				Weathered claystone to claystone



Well Construction
Details and/or drilling remarks

A 3 ft tall monument was installed

Hydrated bentonite chip seal

2" diameter, 0.010" slot, Schedule 40 PVC screen

10/20 filter pack sand