

Beazer East, Inc.

CRAWFORD CREEK (SUB-AREA D) SUPPLEMENTAL SEDIMENT INVESTIGATION FINDINGS

Former Koppers Inc. Facility
Superior, Wisconsin

August 2017



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1 INTRODUCTION

On behalf of Beazer East, Inc. (Beazer), Arcadis U.S., Inc. (Arcadis) has prepared this report to summarize the scope and findings of a November 2016 supplemental sediment investigation conducted in a portion of Crawford Creek, located downstream of the Former Koppers Inc. Facility in Superior, Wisconsin. The Facility and affected downgradient areas are collectively referred to as “the Site.” The Facility is also referred to as “the on-property portion of the Site,” whereas the affected downgradient areas are referred to as “the off-property portion of the Site.”

The purpose of the investigation was to further investigate/delineate the presence and extent of creosote-like non-aqueous phase liquid (NAPL) and associated staining/sheens/odors in sediments in the section of Crawford Creek located between the railroad embankment and the Nemadji River (referred to as “Sub-Area D”; Figure 1).

2 PRIOR INVESTIGATIONS/BACKGROUND

In 1999 and 2005, Beazer completed sediment sampling and visual characterization work in Crawford Creek and its floodplain downstream of the railroad embankment (Sub-Area D), including the following:

- Probing at 73 locations (16 transects) within Crawford Creek and 32 locations (8 transects) within the Crawford Creek floodplain for visual classification [1999]
- Collection/laboratory analysis of 58 creek channel sediment samples from 15 locations [1999]
- Collection/laboratory analysis of 5 creek channel sediment samples from 3 locations [2005]

The 1999 and 2005 Beazer investigation findings are summarized in the *Off-Property Investigation Data Summary Report* (Blasland, Bouck & Lee, Inc. 2006). The following classifications were used by Beazer to describe visual observations of NAPL-impacted sediments during the 1999 and 2005 investigations:

- Type 1 – Visibly impacted with creosote-like product
- Type 2 – Visibly impacted with staining or sheens, or exhibits creosote-like odor, but does not contain visible product
- Type 3 – No visible impacts (i.e., staining, sheens, product) or odor

The following bullets summarize the visual observations from the 1999 and 2005 Beazer investigations for the portion of Crawford Creek downstream of the railroad embankment (Sub-Area D):

- Some creek channel sediments with staining, sheens and/or odor (i.e., Type 2) were observed, but no creosote-like product (Type 1) was noted in any of the recovered sediment cores.
- Visual impacts were not observed in any of the 1999 floodplain investigation (the floodplain downstream of the railroad embankment was not investigated in 2005).

In 2014, the United States Environmental Protection Agency (USEPA) Great Lakes National Program Office (GLNPO) completed supplemental sediment sampling and visual characterization work in the portion of Crawford Creek and its floodplain downstream of the railroad embankment (Sub-Area D), including the following:

- Probing at 85 locations (29 transects) within Crawford Creek and 39 locations within the Crawford Creek floodplain for visual classification and to determine sediment thicknesses
- Collection/laboratory analysis of 64 creek channel sediment samples from 29 locations and 35 floodplain samples from 11 locations

Note: while the 2014 GLNPO investigation covered the same general area as the 1999/2005 Beazer investigations, the actual probing/sampling locations were not aligned.

The 2014 GLNPO investigation findings are summarized in the *Final Site Characterization Report – Assessment of Contaminated Sediments in the Crawford Creek/Nemadji River near Superior, Wisconsin, St. Louis River and Bay Area of Concern* (2014 GLNPO Report; CH2M Hill 2014). The following classifications were used by GLNPO to describe visual observations of NAPL-impacted sediments during the 2014 investigation:

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- Category A – Staining, creosote-like product (NAPL), chunks of coal-tar like material, strong creosote odor, NAPL wetted fibers observed in the sediment matrix
- Category B – Sheens, mild odor, trace NAPL observed in the sediment matrix

The following bullets summarize the visual observations from the 2014 GLNPO investigations for the portion of Crawford Creek downstream of the railroad embankment (Sub-Area D):

- Category A impacts were reported for Crawford Creek channel sediments for the first approximately 1,100 feet downstream of the railroad embankment, and at the Nemadji River confluence.
- Category B impacts were reported intermittently from approximately 1,300 to 2,300 feet downstream of the railroad embankment.
- Visible impacts were also reported for two floodplain locations (CF-01-B and FP-01), although the 2014 GLNPO Report has conflicting information regarding the visual observations at these two locations.
- NAPL and sheens were reportedly observed in a small tributary within the floodplain adjacent to CF-01-B.

As discussed in Beazer's comments on the 2014 GLNPO Report (Beazer 2015), differences between the visual impacts reported by Beazer in 1999 and 2005, and the visual impacts reported by GLNPO in 2014, appear to be due to differences in the visual impact classification approaches used, rather than changed conditions. Due to the differences between the Beazer and GLNPO visible impact classification approaches, the two visual observation data sets are not readily comparable. In particular, it was noted that polycyclic aromatic hydrocarbon (PAH) concentrations in 2014 GLNPO sediment samples reported to have visually-identified NAPL impacts (Categories A and B), were several orders of magnitude lower than PAH concentrations in sediment samples collected by Beazer that contained visually-identified NAPL impacts (Types 1 and 2). The visual characterization protocol used by Beazer has shown a correlation between the presence of visual creosote impacts and elevated PAH concentrations.

At a May 12, 2016 meeting with WNDR and GLNPO, based on the differences between the 1999/2005 Beazer and 2014 GLNPO datasets, Beazer proposed to conduct a supplemental sediment investigation at the 2014 GLNPO locations to characterize the nature and extent of visually impacted sediments in Crawford Creek downstream of the railroad embankment in a manner consistent with the 1999/2005 Beazer investigations.

3 NOVEMBER 2016 INVESTIGATION SCOPE

The supplemental sediment investigation work was conducted by Arcadis, on behalf of Beazer, from November 7 to 11, 2016, and consisted of sediment probing/coring at 116 locations along 24 transects within Crawford Creek, and sediment probing/coring at 5 locations within a floodplain tributary. The sediment probing/coring locations are shown on Figure 2.

All of GLNPO's 2014 Crawford Creek sediment investigation transects were located in the field by LHB, Inc., under subcontract to Arcadis, using the location coordinates reported in the 2014 GLNPO Report. Arcadis conducted sediment probing/coring at 19 transects within Crawford Creek where "Category A" or "Category B" NAPL-impacted sediment was reported during the 2014 GLNPO investigation. Based on the sediment observations at these 19 transects, probing/coring was conducted at an additional five transects to achieve delineation of visually impacted sediments.

Sediment probing/coring within Crawford Creek was performed progressing from downstream to upstream, to minimize the potential for upstream activities to affect downstream observations, should creosote-like material be encountered and disturbed during the investigation. Transects were oriented perpendicular to the creek flow, and, in general, probing and coring was conducted at five locations per transect (all directions based on looking downstream):

- A – left bank (edge of water)
- B – between left bank and center of channel
- C – center of channel
- D – between center of channel and right bank
- E – right bank (edge of water)

At contingency transects CC-020, CC-022, and CC-024, coring was only completed at three or four of the five locations, to target the inside creek bends for delineation purposes. At all other transects, sediment cores were collected from all five locations across the width of the creek.

In addition to the sediment probing/coring within Crawford Creek, sediment probing/coring was also performed within a small tributary (drainage channel) located within the Crawford Creek floodplain adjacent to 2014 GLNPO floodplain sample location CF-01-B (see Figure 2), where observations of NAPL and sheens were reported by GLNPO during their 2014 investigation. Within this tributary, probing/coring was conducted at the following five locations (Figure 2):

- At the confluence with Crawford Creek (FPTRIB-00')
- Approximately 15 feet upstream from Crawford Creek (FPTRIB-15')
- Approximately 30 feet upstream from Crawford Creek (FPTRIB-30')
- Approximately 45 feet upstream from Crawford Creek (FPTRIB-45')
- Approximately 70 feet upstream from Crawford Creek (FPTRIB-70')

At each location within Crawford Creek and the floodplain tributary, probing was conducted to determine the approximate thickness of loose depositional material, and then sediment cores were collected for visual characterization. First, a metal rod was manually pushed into the sediments to estimate the depth

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at which loose, depositional material transitions to stiffer underlying soils. Following probing with the metal rod, a 3-inch diameter Lexan tube was manually driven as deep as possible into the creek bottom to retrieve sediment for visual observation and photographic documentation. Water depth was also measured at each probing/coring location.

Sediments recovered during the coring were visually inspected and classified with respect to potential Site-related impacts using the following descriptions used by Beazer during prior investigations:

- Type 1 – Visibly impacted with creosote-like product
- Type 2 – Visibly impacted with staining or sheens, or exhibits creosote-like odor, but does not contain visible product
- Type 3 – No visible impacts (i.e., staining, sheens, product) or odor

Photographs of the recovered sediments are provided in Appendix 1.

No samples were submitted for laboratory analysis as part of this supplemental investigation.

4 NOVEMBER 2016 INVESTIGATION FINDINGS

4.1 Results

The results of the November 2016 supplemental investigation activities are summarized in Table 1 (Crawford Creek) and Table 2 (Floodplain Tributary), which include the following information for each probing/coring location:

- Water depth;
- Probe depth (depth metal rod was pushed into sediment)
- Penetration depth (depth Lexan tube was driven into sediment)
- Recovery depth (thickness of sediments recovered in Lexan tube)
- Classification (Type 1, 2, or 3) and visual description of sediment as a function of depth

The coring results are also depicted visually on Figures 3a through 3e and Figure 4:

- Figures 3a through 3e present cross sections of the coring data from the 24 Crawford Creek coring transects
- Figure 4 presents cross-sections of the coring data from the five floodplain tributary coring locations

4.2 Summary of Key Findings

4.2.1 Crawford Creek

The following bullets summarize the width, water depth, and sediment thicknesses measurements for Crawford Creek downstream of the railroad embankment:

- The width of Crawford Creek ranged from 10 to 27 feet (average of 20.5 feet).
- Water depths in Crawford Creek ranged from 1 to 5 feet (average of 2.5 feet).
- Sediment thicknesses within Crawford Creek ranged from:
 - 0.5 to 6 feet (average of 1.7 feet) – based on depth metal rod was pushed to
 - 1 to 4 feet (average of 1.9 feet) – based on depth Lexan tubes were pushed to
 - 0.4 to 2.6 feet (average of 1.4 feet) – based on sediment recovery in the cores
- In general, the creek width, water depths, and sediment thicknesses increased with distance downstream from the railroad embankment.

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The following table and bullets summarize the visual observations from the 116 sediment cores collected from Crawford Creek downstream of the railroad embankment:

Visual Classification	Percentage of Total Sediment Volume Based on Recovered Core Lengths ¹	
	0-0.5' Depth Interval	>0.5' Depth Interval
Type 1 – Visibly impacted with creosote-like product	1%	2%
Type 2 – Visibly impacted with staining or sheens, or exhibits creosote-like odor, but does not contain visible product	14%	9%
Type 3 – No visible impacts (i.e., staining, sheens, product) or odor	85%	89%

1 - Percentages based on length of Type 1, 2, and 3 sediment in the specified depth interval (for all 116 Crawford Creek cores) divided by the total length of recovered sediments in the specified depth interval (for all 116 Crawford Creek cores).

- 85% of the shallow (0-0.5') sediments and 89% of the deeper (>0.5') sediments were characterized as Type 3 (no visible impacts or odor).
- Only 1% of the shallow (0-0.5') sediments and 2% of the deeper (>0.5') sediments were characterized as Type 1 (visible NAPL).
- For the 0-0.5' depth interval, Type 1 sediments were observed in only 2 of 116 cores.
- For the 0-0.5' depth interval, Type 1 and 2 sediments were primarily observed within the first approximately 500 feet downstream of the railroad embankment, with Transects CC-001A through CC-005 exhibiting Type 1 or 2 sediments in 2-4 of 5 cores per transect. Downstream of CC-005, Type 1 or 2 sediments were observed at 7 of 18 transects, and where present, at only 1 of 5 cores per transect.
- For the >0.5' depth interval, Type 1 and 2 sediments were primarily observed from approximately 250 to 500 feet downstream of the railroad embankment (Transects CC-003, CC-004, and CC-005) and just upstream from the confluence with the Nemadji River (Transect CC-028). At these four transects, Type 1 or 2 sediments were observed in at least 3 of 5 cores per transect. Upstream of CC-003 and between CC-005 and CC-028, Type 1 or 2 sediments were observed at 8 of 20 transects, and where present, at only 1-2 of 5 cores per transect.

4.2.2 Floodplain Tributary

The following bullets summarize the visual observations from the five sediment cores collected from the floodplain tributary:

- Type 1 sediment was observed at 1 of 5 cores (FPTRIB-30' from 0-1.8' below the sediment surface).
- Shallow (0-0.5') sediments had visible impacts at the first three core locations closest to the creek (FPTRIB-00' – Type 2, FPRIB-15' – Type 2, and FPRIB-30' – Type 1); whereas the last two core locations farthest from the creek did not have visible impacts in the 0-0.5' depth interval.

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- Deeper (>0.5') sediments had visible impacts at the three core locations farthest from the creek (FPTRIB-30' – Type 2, FPTRIB-45' – Type 2, and FPTRIB-70' – Type 2); whereas the first two core locations closest to the creek did not have visible impacts at depths greater than 0.5 feet.

5 CONCLUSIONS

The November 2016 supplemental sediment investigation has delineated the presence and extent of creosote-like NAPL and associated staining/sheens/odors in sediments in the section of Crawford Creek located between the railroad embankment and the Nemadji River (Sub-Area D).

Differences between the visual impacts reported by Beazer in 1999/2005 and in this report, and the visual impacts reported by GLNPO in 2014, appear to be due to differences in the visual impact classification approaches used, rather than changed conditions.

6 REFERENCES

Beazer East, Inc. 2015. Comments on *Final Site Characterization Report – Assessment of Contaminated Sediments in the Crawford Creek/Nemadji River near Superior, Wisconsin, St. Louis River and Bay Area of Concern*. May 15.

Blasland, Bouck & Lee, Inc. 2016. *Off-Property Investigation Data Summary Report*. February.

CH2M Hill. 2014. *Final Site Characterization Report – Assessment of Contaminated Sediments in the Crawford Creek/Nemadji River near Superior, Wisconsin, St. Louis River and Bay Area of Concern*. December.

TABLES



Table 1 - November 2016 Crawford Creek Sediment Coring Results

Transect ID	Creek Width (feet)	Core Location ID	Water Depth (feet)	Probe Depth (feet)	Penetrate Depth (feet)	Recovery Depth (feet)	Depth Interval (feet)	Class.	Description
CC-001A Nov. 10, 2016	18	A	0.0	1.5	1.5	1.1	0-1.1	3	Dark brown CLAY/ORGANICS
		B	2.5	0.5	1.5	1.1	0-0.4	2	Dark brown CLAY/SAND, sheen
							0.4-1.1	3	Dark brown CLAY
		C	2.0	1.0	1.0	0.9	0-0.5	2	Dark brown CLAY, sheen
							0.5-0.9	3	Dark brown CLAY
D	2.5	0.5	1.0	0.6	0-0.6	3	Dark brown CLAY		
E	0.0	0.5	1.5	1.0	0-1	3	Dark brown CLAY		
CC-001 Nov. 10, 2016	15	A	0.0	2.0	1.5	1.0	0-1	3	Dark brown CLAY/ORGANICS
		B	2.0	1.0	1.5	1.0	0-0.5	2	Dark brown CLAY, sheen, creosote-like odor
							0.5-1	3	Dark brown CLAY
		C	2.0	1.0	1.0	0.9	0-0.3	2	Dark brown CLAY/ORGANICS, sheen, creosote-like odor
							0.3-0.9	3	Dark brown CLAY
		D	2.5	0.5	1.0	0.7	0-0.2	2	Dark brown CLAY, sheen
							0.2-0.7	3	Dark brown CLAY
E	0.0	1.0	1.5	1.4	0-0.1	2	Dark brown CLAY/ORGANICS, sheen		
					0.1-1.4	3	Dark brown CLAY		
CC-002 Nov. 10, 2016	10	A	0.0	2.0	2.5	0.9	0-0.9	3	Dark brown CLAY/ORGANICS
		B	2.5	1.0	1.5	1.2	0.0.8	2	Dark brown CLAY, sheen, creosote-like odor
							0.8-1.2	3	Dark brown CLAY
		C	2.5	1.0	1.5	0.9	0-0.5	2	Dark brown CLAY, sheen, creosote-like odor
							0.5-0.9	3	Dark brown CLAY
D	2.5	1.0	1.5	0.8	0-0.8	3	Dark brown CLAY		
E	0.0	0.5	1.5	1.1	0-1.1	3	Dark brown CLAY/ORGANICS		
CC-003 Nov. 10, 2016	15	A	0.0	1.0	1.5	1.1	0-1.1	2	Dark brown CLAY, sheen, creosote-like odor
		B	2.0	1.0	1.0	1.0	0-0.2	1	Dark brown CLAY/SILT, product, sheen, strong creosote-like odor
							0.2-1	2	Dark brown CLAY, creosote-like odor
		C	1.5	1.0	1.0	0.8	0-0.8	2	Dark brown CLAY, sheen, creosote-like odor
							0-0.2	3	Dark brown GRAVEL/CLAY
		D	1.5	1.0	1.5	0.8	0.2-0.8	2	Dark brown CLAY/ORGANICS, creosote-like odor
0-0.9	3						Dark brown CLAY/ORGANICS		
E	0.0	2.0	2.0	1.4	0.9-1.4	2	Dark brown CLAY, sheen, creosote-like odor		
CC-004 Nov. 9, 2016	18	A	0.0	1.5	1.5	1.5	0-0.4	3	Dark brown SILT/SAND
							0.4-0.6	2	Dark brown SILT/ORGANICS, sheen, creosote-like odor
							0.6-1.5	3	Dark brown CLAY
		B	1.0	2.0	1.5	1.1	0-0.7	3	Dark brown SILT/CLAY
							0.7-1.1	2	Dark brown CLAY, creosote-like odor
		C	2.0	2.0	2.0	1.3	0-0.3	2	Dark brown SILT/SAND, sheen
							0.3-1.3	3	Dark brown CLAY
		D	2.5	0.5	1.0	0.6	0-0.1	2	Dark brown SILT, sheen, creosote-like odor
							0.1-0.4	3	Dark brown CLAY
@0.4	2						Dark brown CLAY, sheen, creosote-like odor		
0.4-0.6	3						Dark brown CLAY		
E	0.0	1.0	1.0	1.1	0-1.1	2	Dark brown SILT/CLAY, sheen, creosote-like odor		

Table 1 - November 2016 Crawford Creek Sediment Coring Results

Transect ID	Creek Width (feet)	Core Location ID	Water Depth (feet)	Probe Depth (feet)	Penetrate Depth (feet)	Recovery Depth (feet)	Depth Interval (feet)	Class.	Description
CC-005 Nov. 9, 2016	16	A	2.0	1.0	1.5	1.5	0-0.6	2	Dark brown SILT/CLAY, sheen, creosote-like odor
							0.6-1.5	1	Dark brown CLAY, trace specks of creosote-like product, sheen, odor
		B	3.0	1.0	1.5	1.1	0-1.1	2	Dark brown SILT/CLAY, sheen, creosote-like odor
							@1.1	1	Dark brown CLAY, trace specks of creosote-like product
		C	3.0	1.0	1.5	1.2	0-1.2	3	Dark brown SAND/SILT/CLAY
							@1.2	1	Dark brown CLAY, trace specks of creosote-like product, sheen, odor
D	2.5	0.5	1.0	0.7	0-0.7	3	Dark brown SAND/SILT/CLAY		
					@0.7	1	Dark brown CLAY, trace specks of creosote-like product, sheen, odor		
E	0.0	1.0	1.5	1.0	0-1	3	Dark brown SILT/CLAY		
CC-006 Nov. 9, 2016	23	A	0.0	1.5	1.0	0.5	0-0.5	3	Dark brown SILTY CLAY
		B	2.5	1.0	1.5	0.8	0-0.8	3	Dark brown SILT/CLAY
		C	3.0	1.0	1.5	1.1	0-1.1	3	Dark brown CLAY
		D	3.0	1.0	1.0	0.7	0-0.7	3	Dark brown SILT/CLAY
		E	0.0	2.0	1.0	0.7	0-0.7	3	Dark brown SILT/CLAY
CC-007 Nov. 9, 2016	22	A	1.0	1.0	2.0	2.0	0-1.0	3	Dark brown SILT/CLAY
							1.0-1.1	2	Dark brown VERY FINE SAND, sheen, faint creosote-like odor
							1.1-2.0	3	Dark brown CLAY
		B	1.5	1.0	2.0	1.9	0-1.1	3	Dark brown SILT
							1.1-1.2	2	Dark brown SILT, faint creosote-like odor
		C	2.5	0.5	1.5	1.4	0-1.4	3	Dark brown SILT/COARSE SAND/CLAY
							D	2.5	0.5
E	0.0	0.5	1.0	0.6	0-0.6	3	Brown CLAY		
CC-008 Nov. 9, 2016	19	A	1.5	0.5	1.0	0.8	0-0.8	3	Dark brown SILT/CLAY
		B	3.0	0.5	1.0	0.9	0-0.9	3	Dark brown SILT/CLAY
		C	3.0	1.0	1.5	0.8	0-0.8	3	Dark brown SILT/CLAY
		D	2.5	2.0	2.5	1.9	0-1.9	3	Dark brown SILT/CLAY
		E	0.0	2.0	2.5	2.0	0-2.0	3	Dark brown SILT/CLAY
CC-009 Nov. 9, 2016	21	A	0.0	1.5	1.5	1.1	0-1.1	3	Brown SILT/CLAY
		B	2.0	1.0	2.0	1.3	0-1.3	3	Dark brown SILT/CLAY
		C	2.5	1.5	2.0	1.5	0-1.5	3	Dark brown SILT/CLAY
		D	2.0	2.0	2.0	1.8	0-0.3	3	Dark brown SILT/ORGANICS
							@0.3	2	Dark brown SILT/ORGANICS, slight sheen, very faint creosote-like odor
							0.3-1.8	3	Dark brown CLAY
E	0.0	1.0	2.0	1.5	0-1.5	3	Dark brown SILT/CLAY		
CC-010 Nov. 9, 2016	21	A	0.0	2.0	2.0	0.9	0-0.9	3	Brown to dark brown SILT
		B	3.0	1.0	1.0	1.0	0-1.0	3	Brown to dark brown SILT/CLAY
		C	3.0	1.0	1.5	1.5	0-0.5	1	Dark brown SILT, trace specks of creosote-like product, sheen, odor
							0.5-1.5	3	Dark brown CLAY/SILT
		D	2.5	1.0	2.0	1.1	0-1.1	3	Dark brown SILT/CLAY
E	0.0	2.0	2.0	1.2	0-1.2	3	Dark brown SILT/CLAY		

Table 1 - November 2016 Crawford Creek Sediment Coring Results

Transect ID	Creek Width (feet)	Core Location ID	Water Depth (feet)	Probe Depth (feet)	Penetrate Depth (feet)	Recovery Depth (feet)	Depth Interval (feet)	Class.	Description
CC-011 Nov. 9, 2016	20	A	0.0	2.5	2.5	1.8	0-1.8	3	Brown to dark brown SILT/CLAY
		B	3.0	2.0	2.0	1.6	0-1.6	3	Dark brown SILT
		C	3.0	1.0	1.5	1.0	0-1	3	Brown to dark brown SILT/CLAY
		D	2.0	1.0	1.0	0.7	0-0.1	2	Dark brown SILT, trace sheen
							0.1-0.7	3	Dark brown CLAY
E	0.0	1.5	2.0	0.9	0-0.9	3	Dark brown SILT/CLAY		
CC-013 Nov. 8, 2016	18	A	0.0	2.5	2.0	1.7	0-1.7	3	Dark brown SILT/CLAY
		B	2.0	1.0	2.0	1.9	0-1.9	3	Dark brown SILT/CLAY
		C	2.0	1.0	2.0	1.5	0-1.5	3	Dark brown SILT/CLAY
		D	2.5	0.8	1.5	1.3	0-1.3	3	Dark brown SILT/CLAY
		E	0.0	1.0	1.0	0.9	0-0.9	3	Dark brown SILT/CLAY
CC-014 Nov. 8, 2016	22	A	0.0	1.0	2.0	1.6	0-1.6	3	Dark brown SILT/ORGANICS/CLAY
		B	2.0	3.0	2.0	2.2	0-1.0	2	Dark brown to black SILT/ORGANICS, sheen, creosote-like odor
							1-2.2	3	Dark brown SILT
		C	3.0	2.0	3.0	2.0	0-2.0	3	Dark brown SILT
		D	3.0	0.5	1.0	0.8	0-0.8	3	Dark brown SILT/CLAY
E	0.0	1.0	2.0	1.2	0-1.2	3	Dark brown CLAY		
CC-015 Nov. 8, 2016	20	A	0.0	1.5	1.5	1.1	0-1.1	3	Dark brown SILT/CLAY
		B	3.0	1.0	1.5	1.1	0-1.1	3	Dark brown SILT/CLAY
		C	3.0	2.0	2.0	1.0	0-1.0	3	Dark brown SILT
		D	2.5	2.5	2.0	1.1	0-1.1	3	Dark brown SILT/CLAY
		E	0.0	3.0	2.0	1.8	0-1.8	3	Dark brown to black SILT/ORGANICS/CLAY
CC-018 Nov. 8, 2016	23	A	0.0	2.5	3.0	2.0	0-2.0	3	Dark brown SILT/ORGANCS/FINE SAND
		B	2.5	2.5	2.0	1.6	0-1.6	3	Dark brown SILT/ORGANICS
		C	3.0	1.0	2.0	1.1	0-1.1	3	Dark brown SILT/ORGANICS/CLAY
		D	2.0	1.0	1.5	0.9	0-0.9	3	Dark brown SILT
		E	0.0	1.0	2.0	1.6	0-1.6	3	Dark to light brown SILT
CC-019 Nov. 8, 2016	23	A	0.0	3.0	2.0	1.6	0-1.4	3	Dark brown SILT
							1.4-1.6	2	Dark brown SILT, sheen, creosote-like odor
		B	3.0	1.0	1.5	1.3	0-0.4	3	Dark brown SILT/CLAY
							0.4-0.7	2	Dark brown to black SILT, sheen, creosote-like odor
							0.7-1.1	3	Dark brown CLAY
		C	3.5	1.0	1.0	0.8	1.1-1.3	1	Dark brown to black CLAY/SILT/ORGANICS, product coating organics, moderate odor
							0-0.8	3	Medium brown SILT/ORGANICS/CLAY
D	2.5	2.5	2.0	1.9	0-1.9	3	Dark brown SILT/ORGANICS/CLAY		
E	0.0	3.0	2.0	1.9	0-1.9	3	Dark brown SILT/CLAY and medium brown FINE SAND		

Table 1 - November 2016 Crawford Creek Sediment Coring Results

Transect ID	Creek Width (feet)	Core Location ID	Water Depth (feet)	Probe Depth (feet)	Penetrate Depth (feet)	Recovery Depth (feet)	Depth Interval (feet)	Class.	Description
CC-020* Nov. 8, 2016	23	A	0.0	2.0	--	--	--	--	No core collected
		B	2.0	1.5	2.0	1.4	0-1.4	3	Dark brown SILT/CLAY
			0-0.3	3	Medium brown SILT				
		C	3.0	1.0	2.0	1.0	0.3-0.8	2	Medium brown SILT, creosote-like odor
							0.8-1.0	3	Medium brown SILT
		D	2.0	1.5	2.0	1.9	0-1.9	3	Dark brown SILT
E	0.0	3.0	2.0	1.3	0-1.3	3	Dark brown SILT/CLAY		
CC-022* Nov. 8, 2016	23	A	0.0	2.0	--	--	--	--	No core collected
		B	2.5	2.0	--	--	--	--	No core collected
		C	3.5	1.0	1.5	0.6	0-0.6	3	Medium brown SILT/CLAY
		D	3.0	1.0	1.0	0.6	0-0.6	3	Medium brown SILT
		E	0.0	2.0	3.0	2.5	0-2.5	3	Medium brown SILT
CC-023 Nov. 7, 2016	23	A	0.0	2.0	3.0	1.6	0-1.6	3	Medium to dark brown SILT/CLAY
		B	2.3	2.0	3.0	1.9	0-1.9	3	Dark brown SILT
		C	2.5	2.5	3.0	1.8	0-1.8	3	Dark brown SILT/CLAY
							0-1.2	3	Dark brown SILT
		D	2.0	3.0	3.0	1.7	1.2-1.4	1	Dark brown SILT, product, sheen, strong creosote-like odor
							1.4-1.7	3	Dark brown CLAY
E	0.0	3.0	3.0	2.2	0-2.2	3	Dark brown SILT		
CC-024* Nov. 7, 2016	23	A	0.0	1.5	--	--	--	--	No core collected
		B	3.0	1.0	2.0	0.4	0-0.4	3	Dark brown SILT
		C	4.0	2.0	2.0	1.9	0-1.9	3	Dark brown SILT
							0-1.1	3	Dark brown to black SILT
		D	2.0	2.0	3.0	2.5	1.1-1.3	2	Dark brown SILT/MEDIUM SAND, sheen, creosote-like odor
							1.3-2.5	3	Dark brown SILT
E	0.0	2.5	3.0	2.0	0-2	3	Dark brown to black SILT		
CC-026* Nov. 7, 2016	27	A	0.0	2.0	1.5	0.7	0-0.7	3	Medium brown CLAY
		B	2.0	4.0	3.5	2.0	0-2	3	Dark brown SILT
		C	3.0	3.0	3.0	2.1	0-2.1	3	Dark brown SILT/CLAY
							0-0.4	3	Dark brown SILT
		D	2.0	2.0	2.5	1.6	0.4	2	Dark brown SILT, thin lens w/ sheen
							0.4-1.6	3	Dark brown SILT
E	0.0	2.5	3.0	2.3	0-2.3	3	Medium to dark brown SILT/CLAY		
CC-027* Nov. 7, 2016	23	A	0.0	3.0	3.0	0.8	0-0.8	3	Dark brown SILT
							0-1.1	3	Dark brown SILT
		B	2.5	3.0	3.0	2.8	1.1-1.2	2	Dark brown SILT, sheen, creosote-like odor
							1.2-1.6	3	Dark brown SILT
							1.6-1.9	2	Dark brown to black, FINE to MEDIUM SAND/SILT, sheen, creosote-like odor
							1.9-2.8	3	Dark brown SILT
		C	3.0	3.0	2.5	1.3	0-1.3	3	Medium brown SILT
		D	3.0	1.0	3.0	0.9	0-0.9	3	Medium brown SILT/CLAY
E	0.0	3.0	3.0	1.8	0-1.8	3	Medium brown SILT/CLAY		

Table 1 - November 2016 Crawford Creek Sediment Coring Results

Transect ID	Creek Width (feet)	Core Location ID	Water Depth (feet)	Probe Depth (feet)	Penetrate Depth (feet)	Recovery Depth (feet)	Depth Interval (feet)	Class.	Description	
CC-028 Nov. 7, 2016	27	A	0.0	5.0	4.0	2.9	0-2.9	3	Dark brown SILT	
							0-1.6	3	Dark brown SILT	
		B	4.0	3.5	3.5	3.5	3.5	1.6-2.1	2	Tan, gray, black, wood, creosote-like odor
								2.1-2.5	3	Dark brown SILT
								2.5-3	2	Dark brown FINE SAND/SILT, sheen, creosote-like odor
								3-3.5	3	Dark brown FINE SAND/SILT
								0-1	3	Dark brown FINE SAND
		C	5.0	4.0	3.6	3.6	3.6	1-1.3	2	Dark brown SILT, sheen, creosote-like odor
								1.3-2.1	3	Dark brown SILT
								2.1-2.6	2	Dark brown SILT, sheen, creosote-like odor
								2.6-3.6	3	Dark brown FINE SAND
		D	3.0	6.0	3.5	2.2	2.2	0-1	3	Dark brown FINE SAND
								1-1.5	2	Dark brown SILT, sheen, creosote-like odor
								1.5-1.8	1	Dark brown to black SILT, product, sheen, strong creosote-like odor
		E	0.0	4.0	3.5	3.2	3.2	1.8-2.2	2	FINE SAND/SILT, sheen, creosote-like odor
								0-3.2	3	Dark brown SILT/FINE SAND

Table 1 - November 2016 Crawford Creek Sediment Coring Results

Notes:

* Contingency transect

Probe depth = depth metal rod was manually pushed into the sediment

Penetrate depth = depth Lexan tube was manual driven into the sediment

Recovery depth = depth of sediment recovered in Lexan tube

Location IDs (looking downstream):

A - left bank (edge of water)

B - between left bank and center of channel

C - center of channel

D - between center of channel and right bank

E - right bank (edge of water)

Classifications (See Note 1):

1 - Visibly impacted with creosote-like product
2 - Visibly impacted with staining or sheens, or exhibits creosote-like odor, but does not contain visibly product
3 - No visible impacts (staining, sheens, product) or odor

1. Unless specifically noted, odor, staining, sheens and/or product were not observed.

Table 2 - November 2016 Floodplain Tributary Sediment Coring Results

Transect ID	Tributary Width (feet)	Core Location ID	Water Depth (feet)	Probe Depth (feet)	Penetrate Depth (feet)	Recovery Depth (feet)	Depth Interval (feet)	Class.	Description
FPTRIB-00' Nov. 10, 2016	2	C	0.5	1.5	2.0	1.5	0-0.5	2	Dark brown CLAY/ORGANICS, sheen, creosote-like odor
							0.5-1.5	3	Dark brown CLAY
FPTRIB-15' Nov. 10, 2016	3	C	0.5	0.5	1.5	0.9	0-0.2	2	Dark brown CLAY, sheen
							0.2-0.9	3	Dark brown CLAY
FPTRIB-30' Nov. 10, 2016	1	C	0.5	3.5	3.0	2.5	0-1.8	1	Dark brown CLAY/ORGANICS, product, creosote-like odor
							1.8-2.5	2	Dark brown CLAY, creosote-like odor
FPTRIB-45' Nov. 10, 2016	0	C	0.0	1.0	2.0	1.7	0-0.5	3	Dark brown CLAY/ORGANICS
							0.5-1.7	2	Black to very dark black CLAY/ORGANICS, black staining, creosote-like odor
FPTRIB-70' Nov. 10, 2016	0	C	0.0	--	2.0	1.4	0-0.9	3	Dark brown CLAY/ORGANICS
							0.9-1.4	2	Dark brown to black CLAY/ORGANICS, creosote-like odor

Notes:

Probe depth = depth metal rod was manually pushed into the sediment

Penetrate depth = depth Lexan tube was manual driven into the sediment

Recovery depth = depth of sediment recovered in Lexan tube

Classifications:

- 1 - Visibly impacted with creosote-like product
- 2 - Visibly impacted with staining or sheens, or exhibits creosote-like odor, but does not contain visibly product
- 3 - No visible impacts (staining, sheens, product) or odor

Unless specifically noted, odor, staining, sheens and/or product were not observed

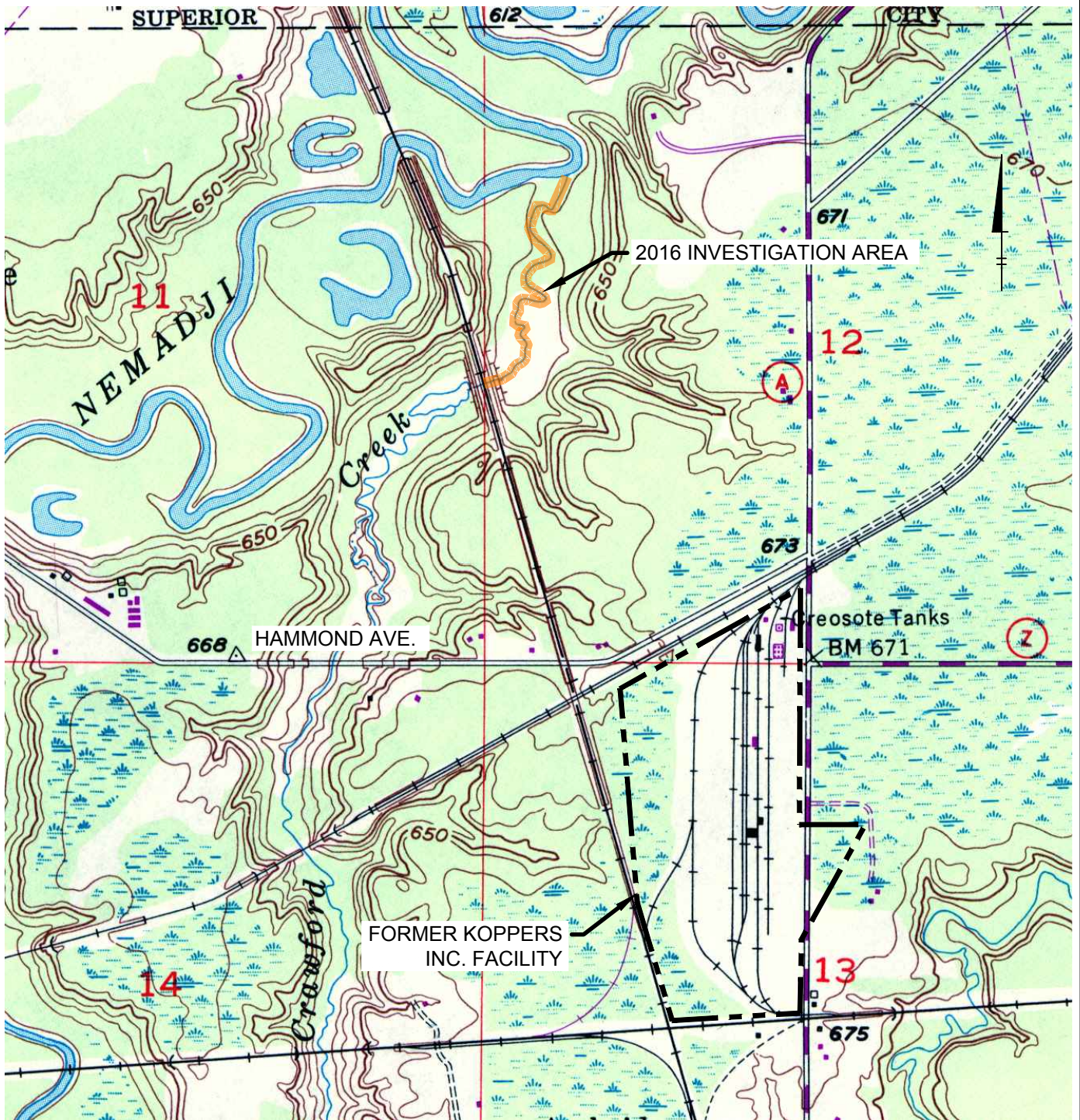
Location IDs (looking downstream):

C - center of channel

FIGURES





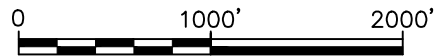
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BASE MAP SOURCE: USGS 7.5 MIN TOPO QUAD., SUPERIOR, WIS-MINN., 1954 (PHOTO REVISED 1993)

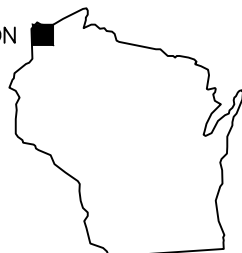
LEGEND:

-  APPROXIMATE PROPERTY BOUNDARY
-  2016 INVESTIGATION AREA



APPROXIMATE GRAPHIC SCALE

AREA LOCATION



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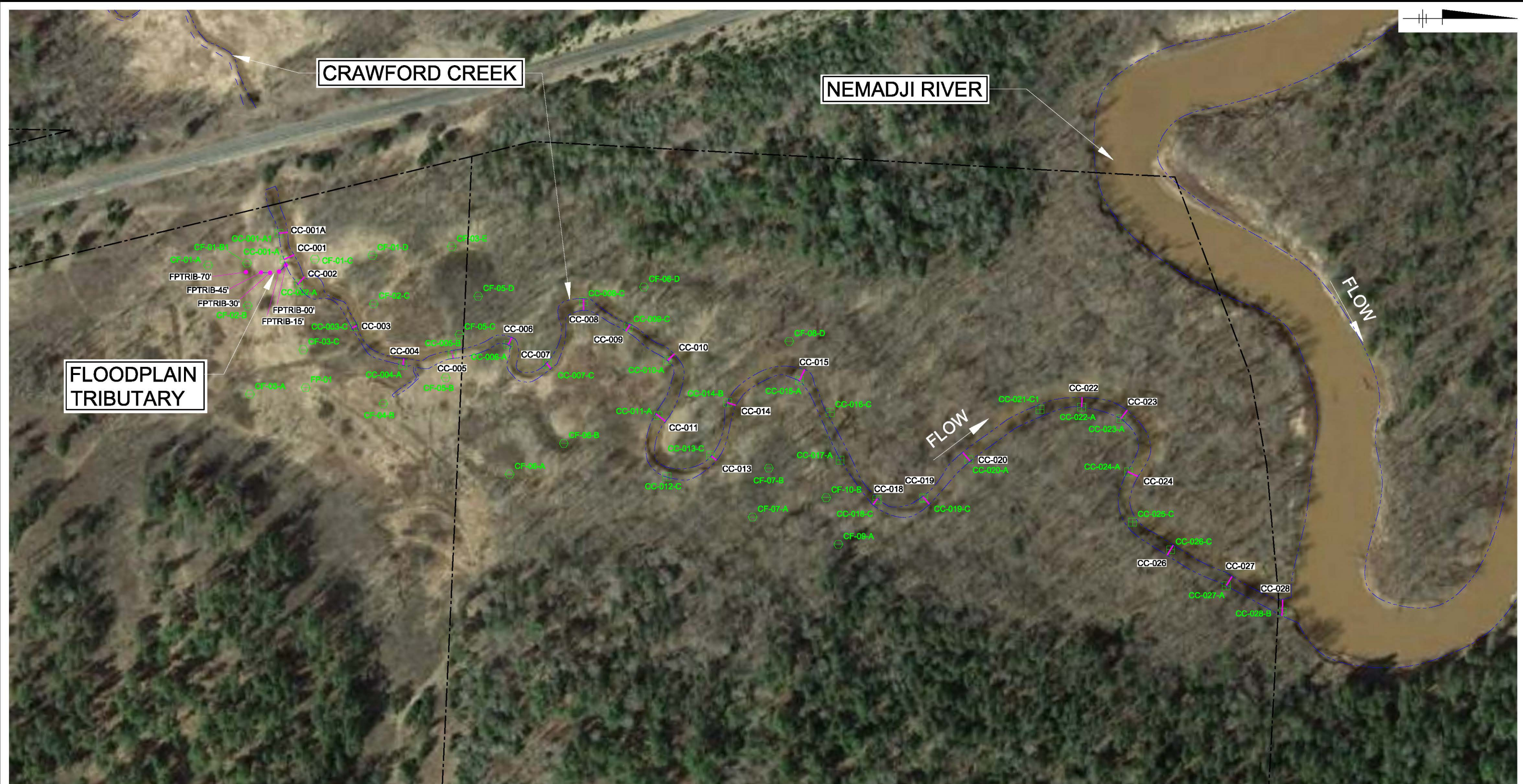
SITE LOCATION MAP



FIGURE

1

CITY: MINNEAPOLIS, MN DIV/GROUP: ENV/CAD DB: R. OBERLANDER PM: J. HOLDEN TM: D.BESSINGPAS Lyr:(ORION) OFF=REF
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- LEGEND:**
- CRAWFORD CREEK AND NEMADJI RIVER
 - DOUGLAS COUNTY TAX MAP PARCEL BOUNDARY
 - CC-004-A 2014 GLNPO SEDIMENT SAMPLE LOCATION
 - CF-01-D 2014 GLNPO FLOODPLAIN SAMPLE LOCATION
 - CC-020 2016 SEDIMENT CORING TRANSECT
 - 2016 FLOODPLAIN TRIBUTARY SEDIMENT CORING LOCATION

NOTE:
 1. GOOGLE EARTH PRO AERIAL DATED 4/15/2015.

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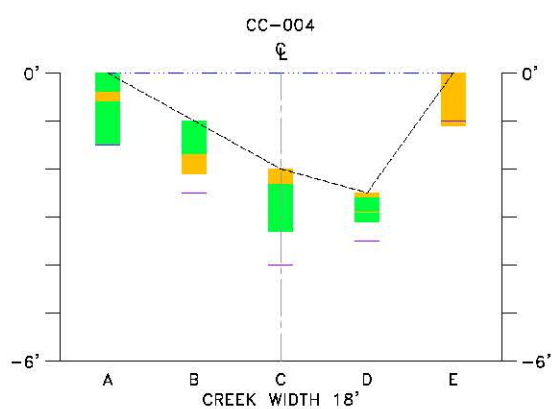
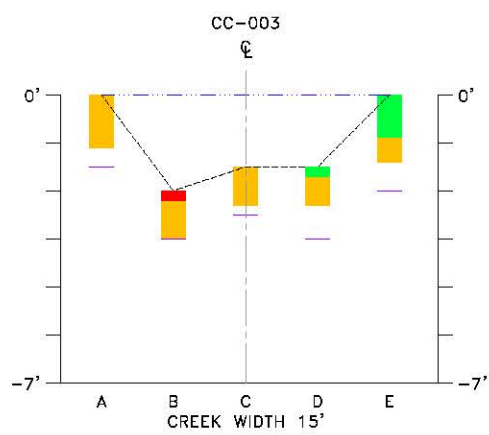
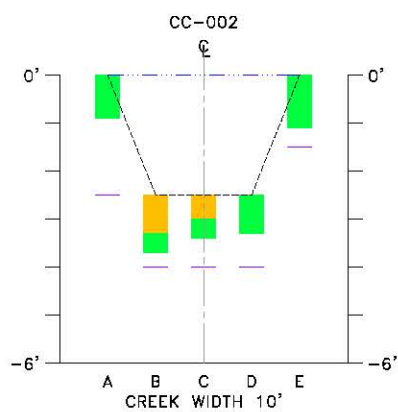
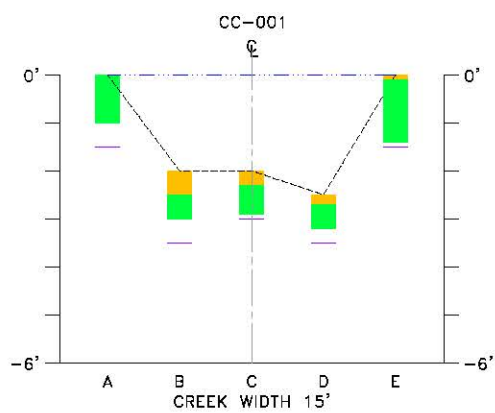
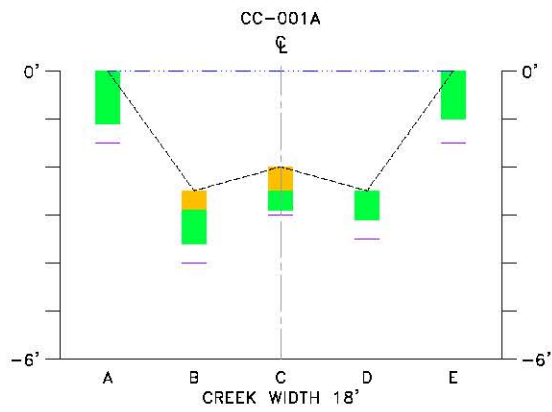
**CRAWFORD CREEK AND FLOODPLAIN
 TRIBUTARY SEDIMENT CORING
 LOCATIONS**

ARCADIS Design & Consultancy
for natural and
built assets

FIGURE
2

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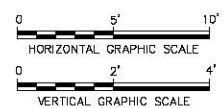
CRAWFORD CREEK
 (LOOKING DOWNSTREAM)



- LEGEND**
- LEXAN TUBE PENETRATION DEPTH
 - WATER SURFACE
 - TOP OF SEDIMENT
- VISUAL OBSERVATIONS OF RECOVERED SEDIMENT**
- TYPE 1—VISIBLY IMPACTED WITH CREOSOTE-LIKE PRODUCT.
 - TYPE 2—VISIBLY IMPACTED WITH STAINING OR SHEENS, OR EXHIBITS CREOSOTE-LIKE ODOR, BUT DOES NOT CONTAIN VISIBLE PRODUCT.
 - TYPE 3 — NO VISIBLE IMPACTS (STAINING, SHEENS, PRODUCT) OR ODOR
- A B C D E** CORING LOCATION ID
- A = LEFT BANK
 - B = HALFWAY BETWEEN LEFT BANK AND CENTER OF CHANNEL
 - C = CENTER OF CHANNEL
 - D = HALFWAY BETWEEN CENTER OF CHANNEL AND RIGHT BANK
 - E = RIGHT BANK
- (ALL LOOKING DOWNSTREAM)

NOTE:

1. AT EACH LOCATION, A LEXAN TUBE WAS DRIVEN TO THE PENETRATION DEPTH INDICATED BY THE BLUE SOLID LINE. THE RED, ORANGE, AND GREEN COLORING REPRESENT THE VISUAL OBSERVATIONS OF THE RECOVERED SEDIMENT (RECOVERED SEDIMENT DEPTH OFTEN LESS THEN LEXAN PENETRATION DEPTH).

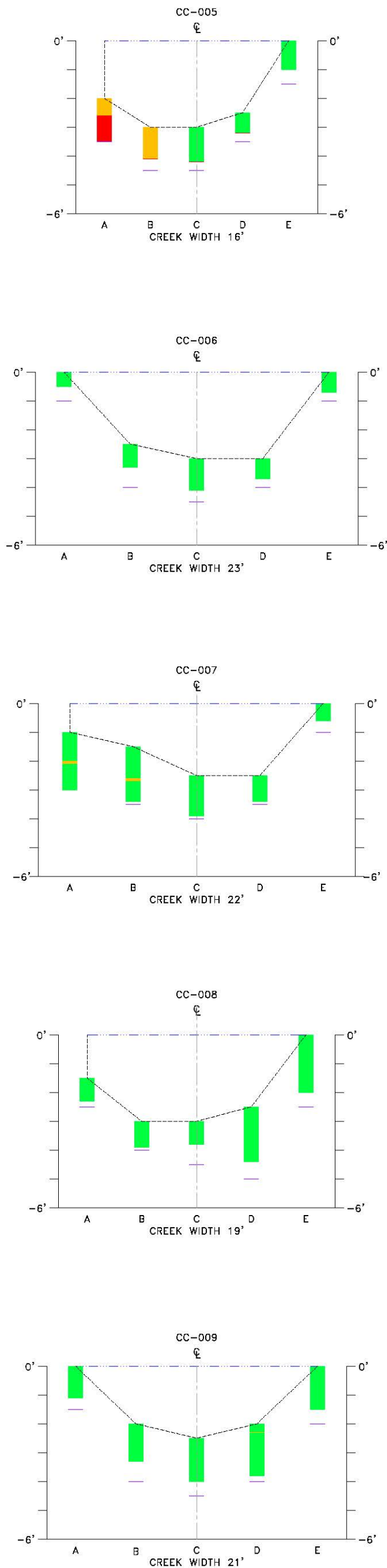


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2016 SEDIMENT CORING CROSS SECTIONS - CRAWFORD CREEK

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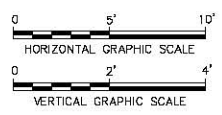
CRAWFORD CREEK
 (LOOKING DOWNSTREAM)



- LEGEND**
- LEXAN TUBE PENETRATION DEPTH
 - WATER SURFACE
 - TOP OF SEDIMENT
- VISUAL OBSERVATIONS OF RECOVERED SEDIMENT**
- TYPE 1—VISIBLY IMPACTED WITH CREOSOTE-LIKE PRODUCT.
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NOTE:

- AT EACH LOCATION, A LEXAN TUBE WAS DRIVEN TO THE PENETRATION DEPTH INDICATED BY THE BLUE SOLID LINE. THE RED, ORANGE, AND GREEN COLORING REPRESENT THE VISUAL OBSERVATIONS OF THE RECOVERED SEDIMENT (RECOVERED SEDIMENT DEPTH OFTEN LESS THAN LEXAN PENETRATION DEPTH).



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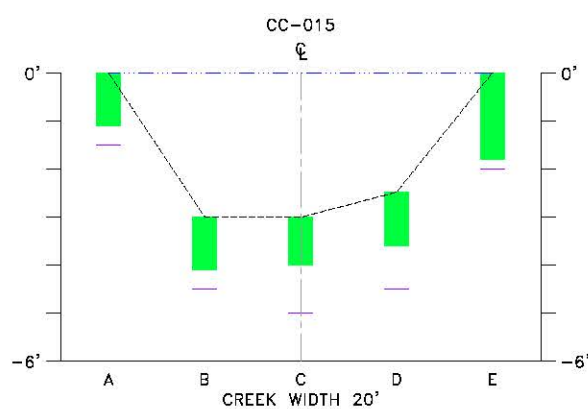
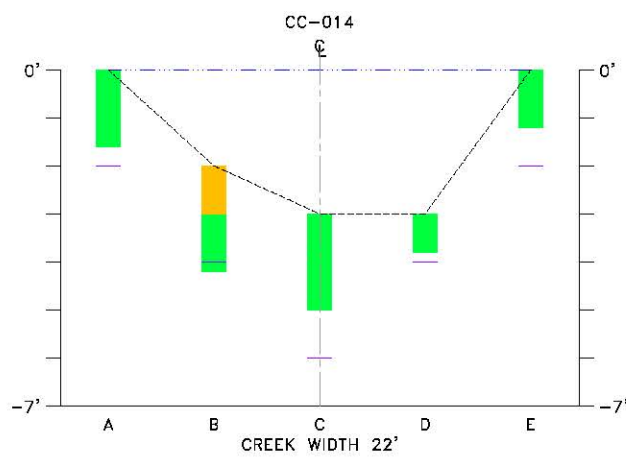
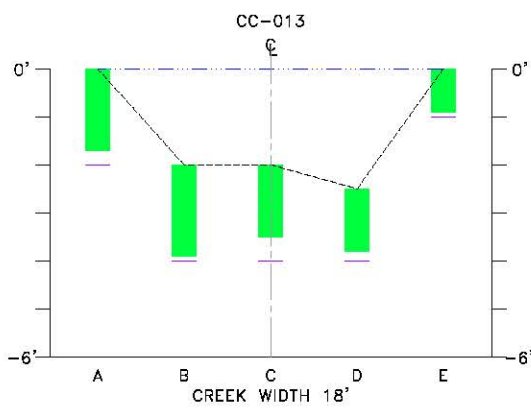
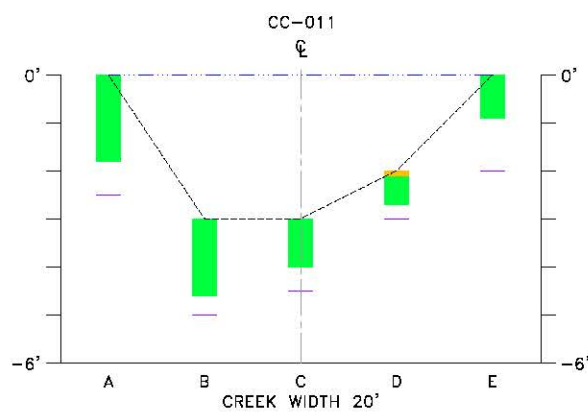
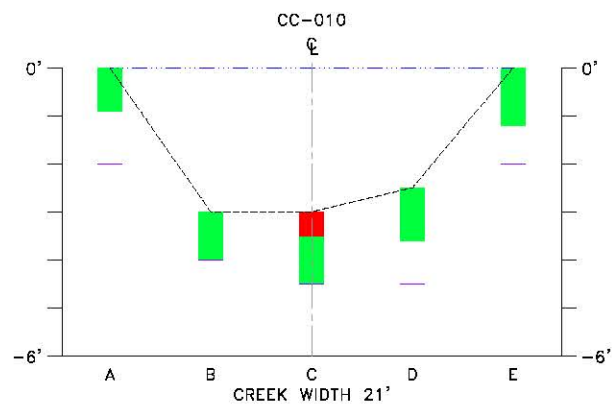
2016 SEDIMENT CORING CROSS SECTIONS - CRAWFORD CREEK

ARCADIS Design & Consultancy for natural and built assets

FIGURE
3b

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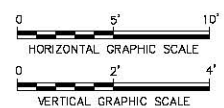
CRAWFORD CREEK
 (LOOKING DOWNSTREAM)



- LEGEND**
- LEXAN TUBE PENETRATION DEPTH
 - WATER SURFACE
 - TOP OF SEDIMENT
- VISUAL OBSERVATIONS OF RECOVERED SEDIMENT**
- TYPE 1—VISIBLY IMPACTED WITH CREOSOTE-LIKE PRODUCT.
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- A B C D E** CORING LOCATION ID
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 - D = HALFWAY BETWEEN CENTER OF CHANNEL AND RIGHT BANK
 - E = RIGHT BANK
(ALL LOOKING DOWNSTREAM)

NOTE:

1. AT EACH LOCATION, A LEXAN TUBE WAS DRIVEN TO THE PENETRATION DEPTH INDICATED BY THE BLUE SOLID LINE. THE RED, ORANGE, AND GREEN COLORING REPRESENT THE VISUAL OBSERVATIONS OF THE RECOVERED SEDIMENT (RECOVERED SEDIMENT DEPTH OFTEN LESS THAN LEXAN PENETRATION DEPTH).

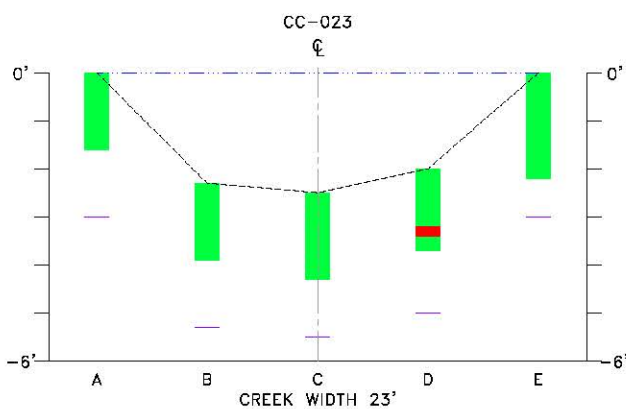
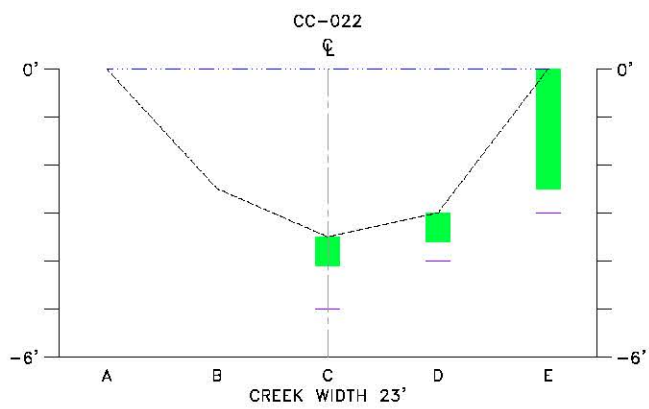
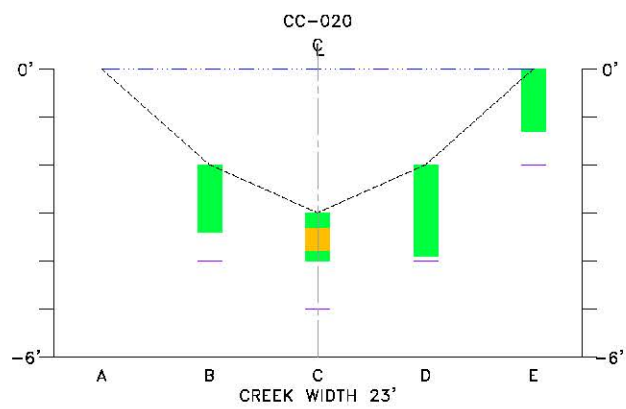
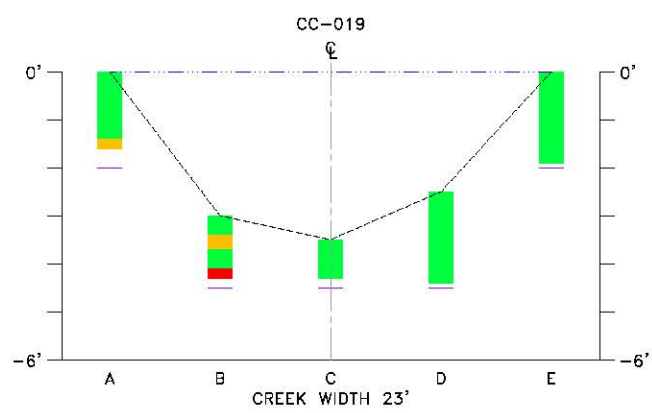
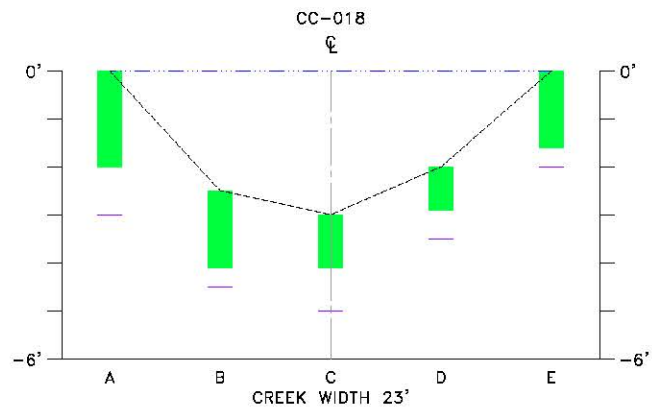


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2016 SEDIMENT CORING CROSS SECTIONS - CRAWFORD CREEK

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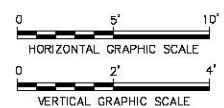
CRAWFORD CREEK
 (LOOKING DOWNSTREAM)



- LEGEND**
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- VISUAL OBSERVATIONS OF RECOVERED SEDIMENT**
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- (ALL LOOKING DOWNSTREAM)

NOTE:

1. AT EACH LOCATION, A LEXAN TUBE WAS DRIVEN TO THE PENETRATION DEPTH INDICATED BY THE BLUE SOLID LINE. THE RED, ORANGE, AND GREEN COLORING REPRESENT THE VISUAL OBSERVATIONS OF THE RECOVERED SEDIMENT (RECOVERED SEDIMENT DEPTH OFTEN LESS THEN LEXAN PENETRATION DEPTH).

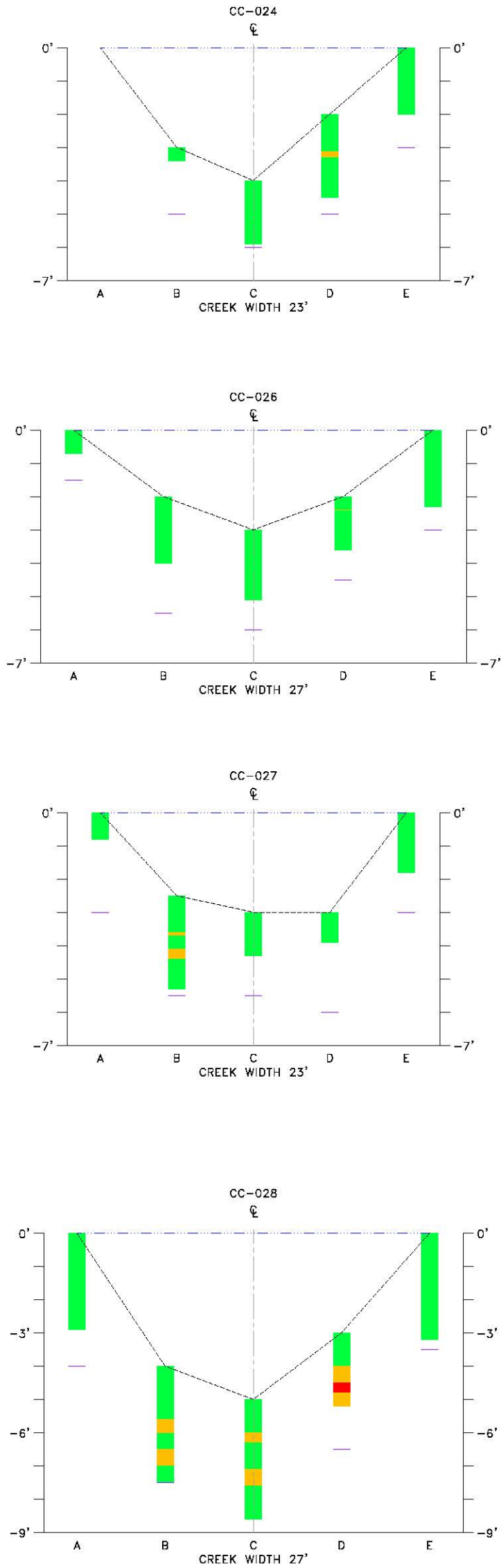


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 FORMER KOPPERS INC. FACILITY
 SUPERIOR, WISCONSIN

2016 SEDIMENT CORING CROSS SECTIONS - CRAWFORD CREEK

XREFS: IMAGES: PROJECTNAME: ---
 39325X0P

CRAWFORD CREEK
 (LOOKING DOWNSTREAM)



LEGEND

- LEXAN TUBE PENETRATION DEPTH
- WATER SURFACE
- TOP OF SEDIMENT

VISUAL OBSERVATIONS OF RECOVERED SEDIMENT

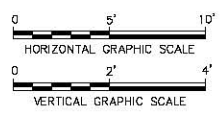
- █ TYPE 1—VISIBLY IMPACTED WITH CREOSOTE-LIKE PRODUCT.
- █ TYPE 2—VISIBLY IMPACTED WITH STAINING OR SHEENS, OR EXHIBITS CREOSOTE-LIKE ODOR, BUT DOES NOT CONTAIN VISIBLE PRODUCT.
- █ TYPE 3 — NO VISIBLE IMPACTS (STAINING, SHEENS, PRODUCT) OR ODOR

A B C D E CORING LOCATION ID

- A = LEFT BANK
- B = HALFWAY BETWEEN LEFT BANK AND CENTER OF CHANNEL
- C = CENTER OF CHANNEL
- D = HALFWAY BETWEEN CENTER OF CHANNEL AND RIGHT BANK
- E = RIGHT BANK (ALL LOOKING DOWNSTREAM)

NOTE:

1. AT EACH LOCATION, A LEXAN TUBE WAS DRIVEN TO THE PENETRATION DEPTH INDICATED BY THE BLUE SOLID LINE. THE RED, ORANGE, AND GREEN COLORING REPRESENT THE VISUAL OBSERVATIONS OF THE RECOVERED SEDIMENT (RECOVERED SEDIMENT DEPTH OFTEN LESS THEN LEXAN PENETRATION DEPTH).



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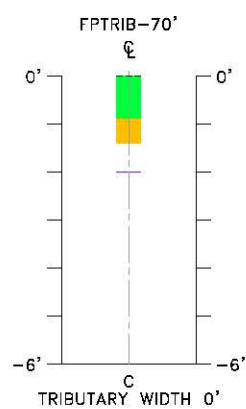
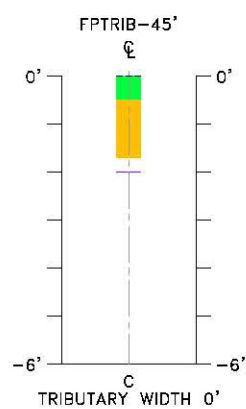
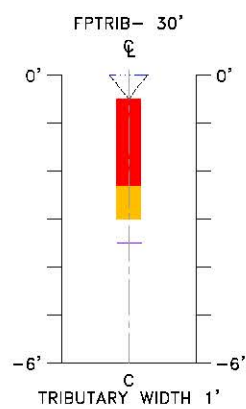
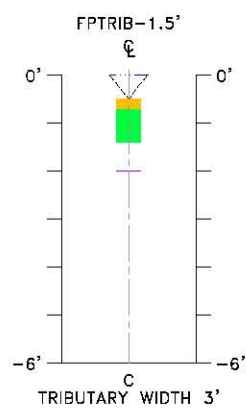
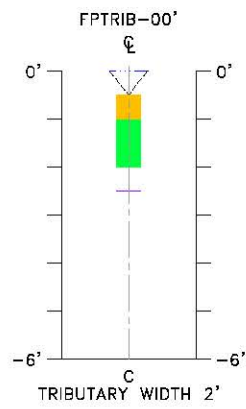
2016 SEDIMENT CORING CROSS SECTIONS - CRAWFORD CREEK

Design & Consultancy
for natural and built assets

FIGURE
3e

XREFS: IMAGES: PROJECTNAME: ---
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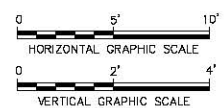
(LOOKING DOWNSTREAM)



- LEGEND**
- LEXAN TUBE PENETRATION DEPTH
 - WATER SURFACE
 - TOP OF SEDIMENT
- VISUAL OBSERVATIONS OF RECOVERED SEDIMENT**
- TYPE 1—VISIBLY IMPACTED WITH CREOSOTE-LIKE PRODUCT.
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2016 SEDIMENT CORING CROSS SECTIONS - FLOODPLAIN TRIBUTARY

APPENDIX A

November 2016 Investigation Photographs

