Environment

Prepared for:
Superfund Standby Program
NYSDEC
Albany, NY

Prepared by:
AECOM
Chestnut Ridge, NY
60277021
March 2016

Alternatives Analysis Report
Dzus Fasteners Site
Site #1-52-033
Work Assignment No. D007626-17.1

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Paul Kareth

Prepared By: Paul Kareth

Scott Underhill

Reviewed By: Scott Underhill

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1.0 Introduction

AECOM Technical Services Northeast, Inc. (AECOM) has prepared this Alternatives Analysis Report for the Dzus Fasteners facility (Site) in West Islip, New York (Site No. 1-52-033). This work was performed for the New York State Department of Environmental Conservation (NYSDEC) under Work Assignment D007626-17.

During the course of five-quarterly sampling in Willetts Creek, sediment sample SED-5, located in Willetts Creek adjacent to the Beach Street Middle School athletic fields, occasionally exceeded the cleanup goal of 9 milligrams per kilogram (mg/kg) as stipulated in the October 1997 Record of Decision (ROD) for Operable Unit 2 (OU-2). In order to evaluate these exceedances, AECOM proposed to collect additional samples in Willetts Creek.

The focus of these investigations is the portion of Willetts Creek between Union Boulevard and Lake Capri. Three rounds of sediment sampling were performed to establish the vertical and horizontal extent of cadmium contamination in Willetts Creek. This report summarizes the sampling collection efforts in Willetts Creek and presents several alternatives to remediate the creek sediments.

2.0 Site Description and History

The Dzus Fastener Manufacturing Facility (Site) is located at 425 Union Boulevard in West Islip, Suffolk County, New York (Figure 1). The Dzus Fastener facility, a manufacturer of fasteners and springs since 1932, was responsible for the release of oils, heavy metals, and salts via onsite leaching pools used for the disposal of hazardous waste and former discharge into Upper Willetts Creek, located immediately east of the facility. These operations led to soil and groundwater contamination at the Dzus facility and downstream groundwater, sediment, and surface water contamination of nearby Willetts Creek and Lake Capri, an eight-acre man-made lake.

An Interim Remedial Measure (IRM) conducted in 1991 resulted in removal of a leach pool at the eastern side of the Site. The project was divided into two operable units. Operable Unit 1 (OU1) consisted of the manufacturing facility itself. A Record of Decision (ROD) for OU1 was issued for the Site by the NYSDEC in March 1995. The selected remedy consisted of the following:

- In-situ stabilization/solidification for soils containing cadmium at concentrations greater than 10 parts per million (ppm). Three areas on the western portion of the facility were excavated and mixed with the soils to be treated on the eastern portion of the Site;
- Design and installation of a final topsoil/asphalt cover at the eastern portion of the Site, which would protect the treatment cells from erosion;
- Implementation of institutional controls, such as deed restrictions at the Site.

The second operable unit, Operable Unit 2 (OU2) consisted of offsite contamination, including the offsite groundwater contaminant plume, and sediment and surface water contamination of Willetts Creek and Lake Capri. A ROD for OU2 was issued for the Site by the NYSDEC in October 1997. The selected remedy consisted of the following:

- Dredging, dewatering and off-site disposal of contaminated sediments from Lake Capri;
- Excavation and off-site disposal of approximately 100 cubic yards of sediment from Willetts Creek, corresponding to levels of cadmium exceeding 9 ppm;
- A long-term monitoring program to evaluate the effectiveness of the on-site remedy and to verify that existing groundwater plume does not impact public health or environment.

An Operation, Maintenance and Monitoring (OM&M) program for the Site was based on NYSDEC Draft DER-10 – Technical Guidance for Site Investigation and Remediation (December 2002). As part of the OM&M, a long-term monitoring plan (LTMP) was developed for OU1 and OU2 with regard to monitoring of groundwater, surface water, sediment, and the asphalt cover (engineering control) in the manufacturing facility's eastern parking lot. The Final Sampling and Analysis Plan (SAP), dated June 2007, outlines the most recent sample collection procedures.

The primary contaminant of concern at the Site is cadmium, but several other metals including antimony, arsenic, chromium, iron, lead, manganese, sodium, and thallium have been found in exceedance of published standards in soil and groundwater at the Dzus facility and in the water and sediments of nearby Willetts Creek and Lake Capri.

3.0 Summary of Sediment Investigations and Exposure Assessment

3.1 Sediment Investigations

Sediment samples were collected on three separate occasions, April 2013, November 2013 and October 2014, to assess the cadmium contamination in Willetts Creek. A total of 239 samples were collected (plus QA/QC samples).

3.1.1 April 2013 Investigation

During the April 2013 sampling event, surficial sediment samples were collected at approximately 100 foot (ft) intervals in Willetts Creek between Lake Capri and Union Boulevard. The results of the chemical analyses determined that many of the sampled locations were at or above the cleanup goal of 9 ppm as established in the OU-2 ROD. The data indicated that a previously dredged area (located within a roughly 1,100 ft stretch of the creek) still contained cadmium concentrations order of magnitude higher than the cleanup goal. This portion of the creek is roughly bounded by sample locations SED-CR9 and SED-CR20 (Figure 3).

A review of the sediment data found a strong correlation between sediment type and cadmium exceedance as shown on Table 1. Table 1 includes all Willetts Creek sediment samples that exceeded 9 mg/kg, a total of 26 samples out of 70 samples collected in the creek. As shown on Table 1, the higher cadmium concentrations were found most often in samples collected from wetland areas along the creek and in finer grained sediments (described as organic muck and silt); only three exceedances were from material described as sand. Ten of the 26 exceedances were from wetland areas. Sixteen of the 26 exceedances were in samples composed of organic muck.

Of the twelve outfall samples collected, only two had cadmium concentrations exceeding the cleanup criterion (OUTFALL-7 and OUTFALL-13). The outfalls do not appear to be the source of cadmium contamination found during the April 2013 sampling effort.

Cadmium has accumulated in wetland areas, principally in the wetland south of the strip mall on Union Boulevard, and possibly in other smaller wetland areas along the creek. During large storm events, organic muck washes from the large wetland area south of Union Boulevard into the creek and remains in areas of the creek with low stream flow. In reaches of Willetts Creek more free-flowing, the organic muck is flushed through and cadmium concentrations are lower in the remaining sediment. This fine grained material then settles into Lake Capri bottom.

A second round of sampling was proposed to assess the horizontal and vertical extent of cadmium contamination in these areas in a letter dated September 30, 2013.

3.1.2 November 2013 Investigation

Sample locations from the November 2013 sampling round are shown on Figure 4. A total of 147 samples were collected from Willetts Creek along 17 transects plus two background samples collected north of Orinoco Drive. The field crew noted a change in sediment type between transects 12 and 13 (more organic material) and an increase in the amount of vegetation in the creek. Transect 12/13 was added to collect samples from this transition area. The number of samples collected at each transect was based on the width of the creek as shown on Figure 3.

Samples were analyzed for cadmium by Hampton-Clarke Veritech Laboratories. The Willetts Creek samples are summarized on Table 2. The table includes all the samples collected in the main channel samples from the April 2013 sampling round, the November 2013 sampling event, and the October 2014 sampling event.

As shown on Table 2 and Figure 3, the cadmium concentrations were assigned a color based on the lowest effects level (LEL) and highest effects level (HEL) levels as found in the NYSDEC Technical Guidance for Screening Contaminated Sediments (1999). The color codes are:

- Blue – not detected
- Light blue – less than 0.6 milligrams per kilogram (mg/kg) (LEL criterion)
- Green – 0.6 to 9 mg/kg (HEL criterion and Site cleanup criterion is 9 mg/kg)
- Yellow – 9 to 90 mg/kg
- Orange – 90 to 900 mg/kg
- Red – greater than 900 mg/kg

Two background samples were collected from Willetts Creek during this sampling effort, UP-1 and UP-1A. The two samples were collected in the creek north of Orinoco Drive as shown on Figure 3. The cadmium concentration in both samples was reported as not detected.

Transects CR5 through CR8 are located in a wide wetland area behind the strip mall on Union Boulevard. The bank to bank distances are typically greater than 100 ft. The wetland area soils tend to be very soft organic muck. As shown on Figure 3, the cadmium results from this portion of the creek indicate areas of elevated cadmium concentrations. Areas along each of these four transects indicate cadmium concentrations above 9 mg/kg (site cleanup criterion) with most of the exceedances in the wetland area west of the main channel (the location of the main channel is shown as a light blue dot on Figure 3). Thirty-six surface samples were collected along these four transects: 20 samples were less than 9 mg/kg; nine samples were between 9 and 90 mg/kg, three were between 90 and 900 mg/kg and four were above 900 mg/kg, with a maximum concentration of 8,200 mg/kg at CR8-W2S. Samples from the 1-foot below ground surface (ft bgs) interval indicate that the majority of the cadmium contamination is confined to the surficial sediments: 13 of 20 samples were below the detection limit, five samples were less than 9 mg/kg, one sample was in the 9 to 90 mg/kg range and one sample was greater than 900 mg/kg (CR8-W3D at 2,700 mg/kg).

The highest cadmium concentrations were found along transect CR8 in the wetland area behind the strip mall and immediately north of the middle school athletic fields. Five samples along this transect were above 900 mg/kg (maximum 8,200 mg/kg), four were surface grabs and one was from the 1-ft bgs interval.

Transects CR9 through CR-18 are adjacent to the middle school athletic fields. As shown on Figure 5, almost half of the samples in this portion of the creek (33 of 70 samples) were in the 90 to 900 mg/kg range. Of these 33 samples, only five were from the 1-ft bgs interval. One surface sample concentration was greater than 900 mg/kg (2,600 mg/kg).

Thirty-two samples were collected from the 1-ft bgs interval in transects CR9 through CR-18. Five of these samples were in the 90 to 900 mg/kg range, 14 were in the 9 to 90 mg/kg range, ten were less than 9 mg/kg, and three were not detected.

Three samples were collected from the 2-ft bgs interval in transects CR-9 through CR-18. All three samples were less than 9 mg/kg.

Transects CR19 and CR20 are located south of the athletic fields. The April 2013 sampling had indicated that this was the southern extend of significant cadmium contamination. Sixteen samples were collected from these two transects, five surface grabs and three 1-ft bgs samples each. Of the ten surface grabs, one sample in each transect was in the 90 to 900 mg/kg range, both from the western side of the creek. Seven of the remaining surface grabs were in the 9 to 90 mg/kg range (less than 56 mg/kg) and one sample was less than 9 mg/kg. Of the six 1-ft bgs samples, one was in the 9 to 90 mg/kg range, three were less than 9 mg/kg and two were below the detection limit.

In a letter to NYSDEC dated August 2, 2014, a third round of sampling was proposed to define the cadmium hot spot along transect CR8. Samples would also be collected from the middle school athletic fields adjacent to the Creek to the effects of a major rain event

3.1.3 October 2014 Investigation

Samples were collected in October 2014 to assess the surface soils in the middle school athletic fields. A significant summer storm in August 2014 produced as much as 12-inches of rain in less than 24-hours in Nassau and Suffolk Counties, resulting in widespread flooding. Site reconnaissance the week after the storm showed evidence that Willetts Creek had partially flooded the athletic fields. Additional samples were collected in Willetts Creek to further assess the horizontal and vertical extent of cadmium contamination along transects CR7 and CR8.

Eight surface soil samples were collected from the middle school athletic fields as shown on Figure 3. As shown on Table 2 and Figure 3, the surface soil samples from the athletic fields were all below the 9 mg/kg cleanup criterion.

3.1.4 Summary of Sediment Investigations in Willetts Creek

Cadmium concentrations are summarized on Figure 3 and Table 2.

Cadmium was not detected in either of the two upgradient samples, UP-1 and UP-1A.

Cadmium was either not detected, or below the 9 mg/kg criterion in transects CR1, CR2 and CR3.

Cadmium was not detected in the main channel sample at CR4 or in the outfall sample but was detected at a concentration of 220 mg/kg in the wetland area sample west of the main channel.

The creek/wooded area widens significantly south of transect CR4 encompassing most of the area behind the strip mall. North of CR4, the wooded area along the creek is approximately 40 ft wide, expanding to over 300 ft wide behind the strip mall; the bank to bank distance is approximately 130 ft at its widest point.

Samples collected on the western side of the channel at transect CR5 ranged in concentration from 11 mg/kg to 370 mg/kg; the western-most samples were below the cleanup criterion. The samples collected from the main channel and eastern side of the creek were all below the cleanup criterion.

Transect CR6 is in the widest area of the creek. The samples on westernmost side of transect CR6 are below the criterion. The four samples immediately west of the main channel, and the 1 ft bgs sample from the main channel, are above the criterion, ranging in concentration from 15 mg/kg to 230 mg/kg. Although the surface sample from the main channel was ND, the cadmium concentration in the 1 ft bgs sample was 11, slightly above the cleanup criterion. The samples east of the main channel were below the criterion.

A similar pattern is found along transect CR7. Samples along the western bank of the creek are below criterion. Several samples west of the main channel (an area approximately 70 ft wide) are above criterion, ranging in concentration from 12 mg/kg to 1,600 mg/kg (SED-CR07A). Sample locations CR7A and CR7B were collected to assess the northern extent of the hot spot; the four samples were below the criterion.

Transect CR8 is just north of the middle school athletic fields. The area exhibited the highest concentrations of cadmium found during these investigations. The wooded area is approximately 150 ft wide and the bank to bank creek width is approximately 90 ft. One sample, CR8-4 was collected west of the creek in the wooded area to assess the western extent of contamination; the cadmium concentration was 12 mg/kg. Samples on the western side of the creek ranged in concentration from 3.4 mg/kg to 8,200 mg/kg, with four samples above 900 mg/kg. The maximum depth of contamination was not established in this area as the 3-4 ft sample collected at CR8W 3ft had a cadmium concentration of 81 mg/kg. Sample CR7/8 was collected to assess the northern extent of this hot spot but both samples were significantly above the criterion, 4,000 mg/kg for the surface sample and 280 mg/kg for the 1-2 ft bgs sample. Sample CR8/9 was collected south of the hot spot; the surficial sample had a cadmium concentration of 1,000 mg/kg while the 1-2 ft bgs sample was at 13 mg/kg. Field observations indicate that the depth of mucky sediment is almost two ft deep in this area. Although most of the samples collected in the main channel and to the east of the main channel were below criterion, the surface sample at CR8-E3S had a cadmium concentration of 1,20-0 mg/kg.

The stream channel and wooded area narrow again along transect CR9 with the wooded area approximately 50 ft wide and the bank to bank distance approximately 25 ft. All three surface samples were above the criterion ranging in concentration from 76 to 460 mg/kg. The 1-2 ft bgs sample from the western bank was at 56 mg/kg.

Samples from transect CR10 indicate that most of the bank to bank area is above the criterion with surface cadmium concentrations ranging from 190 mg/kg to 2,600 mg/kg. The 1-2 ft bgs samples ranged in concentration from 24 mg/kg to 160 mg/kg. The 2-3 ft bgs sample from the main channel had a concentration of 6.6 mg/kg.

The three surface samples at transect CR11 ranged in concentration form 140 mg/kg to 780 mg/kg. The three 1-2 ft bgs samples ranged in concentration from 14 mg/kg to 39 mg/kg.

At transect CR12, the western bank sample and the main channel sample were both above the criterion (220 mg/kg and 370 mg/kg). The 1-2 ft bgs sample on the western bank was slightly above the criterion at 10 mg/kg while the two subsurface samples in the main channel and the two western bank samples were below the criterion.

The three surface samples at transect CR12/13 were all above the criterion ranging in concentration from 100 mg/kg to 340 mg/kg. The three 1-2 ft bgs samples ranged in concentration from 3.9 mg/kg to 12 mg/kg.

An outfall is present between transects CR12/13 and CR13. The origin of the outfall is unknown. The surface sample had a cadmium concentration of 210 mg/kg.

Two of three surface samples at transect CR13 were above the criterion ranging in concentration from 120 mg/kg to 350 mg/kg; the main channel surface sample was 5.5 mg/kg. The three 1-2 ft bgs samples ranged in concentration from 0.65 mg/kg to 90 mg/kg.

The three surface samples at transect CR14 were all above the criterion ranging in concentration from 110 mg/kg to 240 mg/kg. The 1-2 ft bgs main channel sample had a cadmium concentration of 470 mg/kg. The western 1-2 ft bgs sample was at 28 mg/kg and the eastern 1-2 ft bgs sample was below the criterion at 1.3 mg/kg.

The three surface samples at transect CR15 were all above the criterion ranging in concentration from 180 mg/kg to 250 mg/kg. The 1-2 ft bgs main channel sample had a cadmium concentration of 190 mg/kg. The western 1-2 ft bgs sample was below the criterion at 7.4 mg/kg and the eastern 1-2 ft bgs sample was at 190 mg/kg.

As the creek is very narrow at transect CR16, only two surface samples were collected. The two surface sample locations had cadmium concentrations of 57 mg/kg and 130 mg/kg. The two 1-2 ft bgs samples had concentrations of 1.4 mg/kg and 18 mg/kg.

Three of four surface samples at transect CR17 were above the criterion ranging in concentration from 160 mg/kg to 250 mg/kg, with the eastern bank sample at 10 mg/kg, slightly above the criterion. Two of the three 1-2 ft bgs samples were below the criterion; however, the eastern bank 1-2 ft bgs sample had a cadmium concentration of 210 mg/kg. A surface sample was also collected in a wetland area just south of transect CR17 along the eastern bank; the cadmium concentration was 210 mg/kg.

All five surface samples along transect CR18 were above the criterion with concentrations ranging from 56 mg/kg to 440 mg/kg. Two of three 1-2 ft bgs samples were also above the criterion; both the eastern and western bank samples were above the criterion at concentrations of 27 mg/kg and 48 mg/kg while the main channel 1-2 ft bgs sample was below the criterion.

A surface sediment sample was collected near an outfall just north of transect CR19. The concentration was below the criterion.

All five surface samples collected along transect CR19 were above the criterion raging on concentration from 14 mg/kg to 650 mg/kg. Two of three 1-2 ft bgs samples were below the criterion while the 1-2 ft bgs sample along the western bank had a cadmium concentration of 31 mg/kg.

Six surface sediment samples were collected along transect CR20. Five of the six samples were above the criterion with concentrations ranging from 12 mg/kg to 310 mg/kg; only the eastern bank sample was below the criterion. All three 1-2 ft bgs samples were below the criterion.

The samples collected south of transect CR20 were mainly center channel surface samples with a few wetland area samples and locations adjacent to drainage outfalls. A total of 42 samples were collected in Willetts Creek south of CR20 and Lake Capri: 23 main channel samples, ten wetland samples, and nine outfall locations. Of these, eight samples exceeded the criterion. Two were main channel samples and appear to be isolated hits (CR31 and CR-31). Six exceedances were noted in the wetland samples, four of which were in the wetland area at the foot of Dubois Road in the wetland area along the western side of the creek (CR-23A, CR23B, CR24A and CR24B): The other two appear to be isolated occurrences (CR28A and CR34A). None of the nine outfall samples south of CR20 exceeded the criterion. No exceedances were noted in creek sediment samples south of CR34.

Ten surface soil samples were collected from the Beach Street Middle School athletic field to evaluate the soil conditions adjacent to Willetts Creek. Samples were collected a few feet into the grass adjacent to creek transects as shown on Figure XX. Only two samples exceeded the criterion. Sample AF-16 slightly exceeded the criterion at a concentration of 9.8 mg/kg (the main channel sample at transect CR16 had a cadmium concentration of 130 mg/kg). A 1-2 ft bgs sample was collected at location SL1; cadmium was not detected in the surface soil sample but the 1-2 ft bgs sample had a cadmium concentration of 31 mg/kg.

3.2 Exposure Assessment

The portion of Willetts Creek between Union Boulevard and Lake Capri is a narrow band of trees and bounded by residential housing and the Beach Street Middle School athletic fields. The wooded area along the creek is typically less than 50 ft, although there are several areas that are up to 200 ft wide, the widest of which is behind the strip mall off Union Boulevard. The creek is very shallow, typically less than a few inches deep and less than 10 ft wide. The bank to bank distance is typically 50 ft to 60 ft wide, ranging from 20 ft to over 120 ft in isolated areas. Flow is restricted through the area by two footbridges at Burling Lane and Edmore Lane. The creek flow is directed to concrete pipes beneath the footbridges resulting in debris and mucky sediment building up behind the pipes. Observed flow in the creek was very low and at time was observed to be dry.

The potential receptors include small animals and birds that use the creek as a drinking water source. The creek is too shallow to support a fish population. Potential human receptors include adult workers who enter the creek to maintain drainage at the footbridge crossings and children who might enter the creek off the middle school athletic fields. Residents may also enter the creek through back yards.

These receptors represent potentially completed pathways for cadmium through contact with contaminated sediments in the creek.

4.0 Remedial Goals and Remedial Action Objectives

4.1 Remedial Goals

The goal of this alternatives analysis report is to identify potential remedies that remove cadmium contaminated sediments from the creek and reduce potential human exposure to contaminated sediments.

Guidance

Since the implementation of the 1997 ROD and during the preparation of this report, the NYSDEC revised the Guidance on Screening and Assessment of Contaminated Sediment, finalizing the document in June 2014. Among the changes made to the guidance are a change in the terminology of the sediment chemistry screening concentrations used, changes in some of the sediment concentration criteria, and further explanation on the application of the guidance.

Freshwater Sediment Guidance Values (SGV) as presented in Table 5 of the Guidance are now divided into three “classes.” Class A sediments are considered to be of low risk to aquatic life. Class B sediments are slightly to moderately contaminated and additional testing is required to evaluate the potential risks to aquatic life. Class C sediments are considered to be highly contaminated and likely to pose a risk to aquatic life.

The guidance values for cadmium have changed between the two versions of the guidance. In the 1999 guidance the Lower Effects Level for cadmium was 0.6 mg/kg, while in the 2014 guidance the upper limit of Class A sediments is 1.0 mg/kg. In the 1999 version the Severe Effects Level was 9 mg/kg, while in the 2014 version the lower limit of Class C sediments is 5 mg/kg.

The 2014 guidance, while not changing the intent, greatly expanded the discussion on the application of the sediment criteria, including in the document Section 5-The Screening, Classification, and Assessment Process; and Section 11 - Decision-making Process Regarding Contaminated Sediment. Of particular note is the Sediment Quality Triad decision matrix in Table 4. The overall point of these discussions is that the SGVs are screening values, not *a priori* cleanup values. Sediment with concentrations above Class A should cause initiation of further studies, with Class B sediment focusing on assessing impacts to biota, and Class C sediment focusing on feasibility of remediation. As stated in the guidance, “*Any meaningful assessment of sediment quality needs to involve consideration of multiple lines of evidence, typically from sediment chemistry, ecotoxicology, and benthic ecology. Additional lines of evidence are particularly useful when predictions of toxicity from bulk sediment dry weight concentrations and toxicity test results do not agree.*” Additional lines of evidence cited include “*biota tissue samples and bioaccumulation/biomagnification.*”

Application of Guidance in the Alternatives Analysis

While the remedial activities detailed in the 1997 ROD specified a SGV (i.e., 9 mg/kg Cd) from the 1999 guidance as a cleanup goal, this report continues to encompass the intent of the 1999 and 2014 guidance revisions. This alternatives analysis screened the initial sediment chemistry results for further examination, examined the potential for impacts from Class B and C sediments using biological data, and assessed the feasibility of removal at the various concentrations.

The data assessment plotted the sediment data collected in Willetts Creek and Lake Capri using intervals including 0.6 mg/kg (LEL, which is similar to and more protective to the 1 mg/kg Class A limit), 5 mg/kg (Class C lower limit), and 9 mg/kg (SEL). Much of Willetts Creek far exceeds the Class C lower limit of 5 mg/kg, clearly indicating a need for remediation.

Due to the fact that Willetts Creek is somewhat intermittent (drying almost completely out in the summer), there is likely limited benthic community, and therefore limited exposure to a benthic community in the creek. Therefore, the use of toxicity testing and benthic community assessment would not provide the most appropriate assessment of impacts for multiple lines of evidence and required in the guidance. Rather the NYSDEC collected data on a more appropriate exposure, the fish in Lake Capri. Data on cadmium in fish have been collected in 1994 (prior to remediation), 2006, 2007, 2010, and 2012.

Prior to remediation the average concentration of cadmium exceeded 1 mg/kg in carp and was about 0.2 mg/kg in other species (carp are known for accumulating cadmium due to their diet being primarily vegetation). These concentrations in 1994 were elevated compared to other waters in the state, with the carp leading the NYSDOH to recommend restrictions on consumption of carp from Lake Capri. The concentrations of cadmium in fish from Lake Capri since the remediation are similar to those prior (with the exception that carp were not collected), indicating that cadmium in the sediments in the system are still a cause for concern. The remedial action being taking is focused on those sediments with the highest (by orders on magnitude) cadmium concentrations which are also most likely to be mobilized in Willetts Creek. Ongoing fish monitoring will continue to provide data for the decision making process discussed in the guidance, and document whether this action was sufficient to lower the bioaccumulation and risk in the fish of Lake Capri.

4.2 Remedial Action Objectives

The remedial action objectives (RAOs) for the site are as follows:

1. Prevent human and ecological exposure to sediment containing cadmium at concentrations in excess of the cleanup goals to the extent practicable;

2. Maintain human and ecological protection by implementing remedial activities that minimize disruption to the surrounding community, to the extent practicable; and

3. Ensure Suffolk County can continue routine maintenance of the creek by minimizing exposure to sediment containing cadmium at concentrations in excess of cleanup goals to the extent practicable.

5.0 Development and Analysis of Alternatives

5.1 Technologies

5.1.1 No Further Action

The No Further Action alternative is the baseline or standard against which other alternatives are measured. Aside from the previously implemented 2000 sediment removal project, no further action will be taken to address the presence of cadmium-impacted material at the site. This alternative will not result in any additional removal of the existing cadmium-impacted material.

5.1.2 Capping

Capping is a type of engineering control that creates a physical barrier or passive mechanism to contain or stabilize contamination and/or eliminate potential exposure pathways from contaminated medium. Capping can be accomplished through the use of a covering/capping system that reduces potential exposures by preventing direct contact with impacted media. Covering/capping process options include: rip-rap, asphalt/concrete caps, multi-layered engineered caps, and permeable soil covers.

Given the proximity of the creek to two public schools, the construction phase of the work will occur during the summer months to limit the disruption to students. Areas exhibiting cadmium concentrations above 9 mg/kg will be capped. Because the creek profile cannot be raised by the cap placement, existing sediment and creek bank soil will need to be removed to a depth of 18 inches. Prior to the start of construction, all vegetation in the affected areas will be removed and disposed offsite. Standard excavation techniques will be employed to remove the contaminated material. Stream diversion measures will be employed during excavation of the main channel to maintain flow during the construction period. In many areas of the creek, the removal of 18 inches of contaminated material will result in the removal of all contaminated material and capping will not be required. For these areas, post-excavation samples will be collected to verify that all contaminated material has been removed prior to any restoration work. In these areas, clean backfill will be placed to restore the original creek profile. Riprap will be placed over any remaining contaminated sediments and bank soils.

Excavation activities can create increased dust and volatile organic compound emissions at and near the site. A Community Air Monitoring Plan will be implemented to monitor those emissions and address any detection in excess of New York State Department of Health (NYSDOH) recommended response levels. To minimize elevated levels, fugitive dust and volatile organic compound emissions will be minimized and controlled during this process by use of water sprays during excavation, by covering stockpiles of material (including excavated material and clean material brought on site for restoration), and by covering the trucks used for transporting material.

The use of these controls will minimize the potential for any short-term human and environmental negative impact due to the unearthing and transporting of contaminants off site.

The excavated material will be stockpiled at the site. During previous remedial work in the creek in 2000, excavated material was stockpiled on the middle school parking lot prior to offsite disposal. The material will be tested and disposed offsite at a permitted landfill in accordance with state and federal regulations. Ex-situ treatment options are discussed further in Section 5.1.5.

Capping will result in the reduction of cadmium mobility and reduce the potential for exposure. However, it will not reduce the toxicity or reduce the volume of contaminated material remaining at the Site except in those areas where excavation completely removes all contaminated material. Capping will require the implementation of institutional controls to prevent future exposure. Capping is retained for use in the remedial alternatives for the site.

5.1.3 In-Situ Treatment

In-situ treatment encompasses a variety of technologies that could be utilized to treat the soil in place (i.e., without excavation). Below is a brief summary of *in-situ* treatment technologies that were evaluated for use at this site.

- Phytoremediation is an innovative technology that uses plants to remove, transfer, stabilize, or destroy contaminants.
- Electrokinetic separation involves the application of low intensity direct current between electrodes placed in the sediment.
- Soil flushing involves the use of water or water containing an additive to enhance contaminant solubility and to flush the contaminants into the groundwater.
- In-situ solidification/stabilization and vitrification are both mobility-reducing technologies. Their objective is to immobilize the contaminants through either encapsulation within a stabilized mass and/or addition of chemical binders (solidification/stabilization), or through the application of high temperatures to the soil matrix resulting in a vitreous mass (vitrification). Additives used for solidification technologies can also result in a significant increase in volume of material after treatment.

In-situ treatment technologies are not readily available and/or their effectiveness is only demonstrated at limited scale. The construction and operation of an in-situ treatment facility at the site will negatively impact adjacent property owners and the surrounding community, and its implementation is limited due to space constraints. Also, the implementation of an in-situ treatment technology may negatively impact the drainage characteristics of the creek. Phytoremediation is impractical at the Site as repeated plantings would take years to complete and be highly disruptive to the neighborhood. Soil flushing is also impractical in a stream setting; there is insufficient space available to construct a treatment system for groundwater. Although solidification/stabilization could be implemented at the Site, it would radically alter the streambed and adjacent wetland areas, unsuitable for vegetation. Solidification technologies would result in a significant increase in soil volume (up to 30 percent); increased elevations would limit the creek's ability to absorb minor flooding events. The increase in final soil volume would need to be addressed as the Army Corps of Engineers would most likely not allow the excess soil to be placed back in the stream channel if it reduced the flood capacity of the creek; excess soil would have to be disposed off-site. Therefore, in-situ treatment technologies are not retained for use in the remedial alternatives for the site.

5.1.4 Excavation

Under this process, contaminated soil will be excavated and transported to an authorized facility for treatment and/or disposal. On-site treatment (ex-situ solidification/stabilization – see Section 5.1.5 for a description of this process) of some of the soil prior to transport may be necessary to control moisture content. Excavation operations are standard and care would be taken to protect human health and the environment during excavation and transport activities. In this process, contaminated soil will be removed from the site and disposed of at an authorized facility, thereby reducing the on-site contaminant volume and toxicity.

Prior to the start of construction, all vegetation will be removed and disposed offsite. Given the proximity of the creek to two public schools, the construction phase of the work will occur during the summer months to limit the disruption to students. Three scenarios were developed for the excavation alternative: removal of sediments with greater than 9 mg/kg cadmium concentrations; removal of sediments with greater than 90 mg/kg cadmium concentrations; and removal of sediments with greater than 900 mg/kg cadmium concentrations. Prior to the start of construction, all vegetation in the affected areas will be removed and disposed offsite. Standard excavation techniques will be employed to remove the contaminated material. Stream diversion measures will be employed during excavation of the main channel to maintain flow during the construction period. Post-excavation samples will be collected and analyzed to verify that all contaminated materials have been removed prior to restoration activities.

Excavation activities can create increased dust and volatile organic compound emissions at and near the site. A Community Air Monitoring Plan will be implemented to monitor those emissions and address any detection in excess of NYSDOH recommended response levels. To minimize elevated levels, fugitive dust and volatile organic compound emissions will be minimized and controlled during this process by use of water sprays during excavation, by covering stockpiles of material (including excavated material and clean material brought on site for restoration), and by covering the trucks used for transporting material. The use of these controls will minimize the potential for any short-term human and environmental negative impact due to the unearthing and transporting of contaminants off site.

As excavation depth increases, water management and excavation sidewall stability become increased factors. For excavations below the water table and adjacent to Willetts Creek, water management activities will be a necessary remedial component. Options for water management include the following:

- Use of submersible pumps (either in dewatering wells or in sumps constructed within an excavation) to transfer water to temporary storage tanks prior to either transportation off site for subsequent treatment and disposal, or on-site treatment (treatment may be required to remove suspended solids) prior to discharge. On-site discharge will require obtaining permits and approval from Federal, State, and local agencies or authorities. Submersible pumps could be utilized alone or in combination with other water management techniques.
- Use of temporary diversion dams, pumps, and piping to re-route the Willetts Creek during excavation.
- Stockpiling of excavated soils and sediments to allow them to dewater naturally. In addition, absorbent material such as sawdust, wood chips, or manufactured liquid absorbing product could be added to the stockpiles to facilitate the dewatering process.

Restoration activities can proceed once the results of the post-excavation samples have been reviewed. Clean fill will be placed back in the excavation areas. Bank material will be of similar composition to the existing bank material. Stream backfill will be similar to that found in the creek bed. A mix of trees and grass will be planted along the banks to restore the area to its pre-construction condition.

Excavation will result in the removal of cadmium contaminated sediments from the environment, eliminating the future exposure potential if the 9 mg/kg goal is used. If one of the other two options, 90 mg/kg or 900 mg/kg, are selected, excavation will result in a reduction of volume but not a reduction in toxicity. If the 90 mg/kg or 900 mg/kg options are selected, institutional controls will need to be implemented to prevent future exposure to contaminated sediments. Excavation is retained for use in the remedial alternatives for the site.

5.1.5 Ex-Situ Treatment

Ex-situ treatment encompasses a variety of technologies that can be utilized to treat soil after it has been excavated. Although ex-situ treatment has been utilized to treat contaminated materials prior to reuse, it is only being evaluated at the site for preparation of the material for subsequent off-site transportation and disposal. Ex-situ treatment technologies that have been evaluated to treat cadmium-impacted soil at the site include soil washing/chemical extraction, separation/soil screening, and solidification/stabilization.

Soil washing/chemical extraction utilizes various extractants (including water, detergents, and acids) to separate contaminants from the contaminated matrix. Waste contaminated soil and extractant are mixed to solubilize the contaminants. The extracted solution is then placed in a separator, where the contaminants and extractant are separated for treatment and further use. Soil washing/chemical extraction is generally not well suited for soils with high organic content similar to those found at the site. Application of this technology will require a significant amount of space, which is not available at the site. Soil washing/chemical extraction is not retained for use in the remedial alternatives for the site.

Ex-situ solidification/stabilization is similar to in-situ solidification/stabilization, except that the soil being treated has been excavated and placed on a pad and mixed or into a pug mill or rotary drum to be mixed. Ex-situ solidification/stabilization is a conventional means of treating impacted soil. This process may result in a significant increase in the volume of soil to be disposed (typically, up to a 30% increase). Ex-situ solidification/stabilization is commonly used in conjunction with excavation and off-site disposal as a means of preparing wet soil for on-highway transportation and disposal at a landfill. Ex-situ solidification/stabilization is retained for use in the remedial alternatives for the site as part of the excavation alternative.

5.2 Evaluation of Selected Alternatives

The three alternatives retained for evaluation (no further action, capping and excavation) are evaluated using the nine criteria described in Section 4.2 of DER-10 Technical Guidance for Site Investigation and Remediation (NYSDEC, 2010). The three alternatives that are evaluated in this section are:

- Remedial Alternative 1: No Further Action;
- Remedial Alternative 2: Capping of cadmium impacted areas; and
- Remedial Alternative 3: Excavation and Off-Site Disposal of sediment based on cadmium concentrations.

The evaluation provides information to facilitate the comparison of the alternatives and the selection of a final remedy (summarized in Section 6.0). The comparative analysis is three-tiered and in accordance with DER-31 Green Remediation (NYSDEC, 2010) includes consideration of green remediation and sustainability concepts to minimize negative environmental impacts.

The first tier is comprised of threshold factors for the overall protection of human health and the environment and compliance with cleanup goals. Any selected remedy must result in overall protection of human health and the environment. Similarly, the cleanup goals must be complied with unless site conditions make compliance not possible.

- **Overall Protection of Human Health and the Environment -** The analysis of potential remedies using this criterion involves assessing each alternative for the degree to which potentially completed exposure pathways for human and ecological receptors are eliminated, reduced, or controlled. These factors were considered during the development of RAOs for the site.
- **Compliance with standards, criteria and guidance (SCGs) -** An evaluation to this criterion indicates the compliance of each alternative with SCGs.

The second tier is comprised of the six criteria listed below. The relative merits and challenges associated with meeting these factors must be balanced in selecting a final remedy.

- **Short-term Effectiveness -** The effectiveness of an alternative in protecting human health and the environment during construction and implementation of the remedial alternative is assessed under short-term effectiveness. This criterion encompasses concerns about short-term impacts, as well as the length of time required to implement the alternative. Factors such as cross-media impacts, the need to transport impacted material through populated areas, usage of fuel and other natural resources, current site operations, and the potential disruption of neighborhoods and ecosystems may be pertinent. Due to the affinity of cadmium to preferentially adsorb to soil, excavation remedies that release dust could create potential short-term risks through the inhalation pathway. The health and safety issues associated with the implementation of any remedial action involving excavation and transport of sediment are included under this criterion.
- **Long-term Effectiveness -** The long-term effectiveness of a remedial alternative is evaluated under this criterion with particular focus on the residual contamination remaining in a particular medium after completion of the remedial alternatives and the degree to which a remedial measure provides a permanent remedy for the site. Additionally, an effective remedy will reduce long-term risk without significantly impacting the environment. The long-term integrity of containment options is also evaluated.
- **Reduction in Toxicity, Mobility and Volume -** The focus of this criterion is to evaluate the ability of the remedial alternatives to address the impacted material on site, the irreversibility of the process employed, the nature and movement of the impacted materials, and the mass of material destroyed or treated.
- **Implementability -** The alternatives are evaluated to this criterion with respect to performance, reliability and technical implementability. Performance and reliability focus on the ability of the alternative to meet specific goals or remedial levels. The technical implementability of an alternative addresses construction and operation with regard to site-specific conditions, including the impact on existing on-site activities and habitat, and the ability to safely and practically implement the alternative. Administrative implementability focuses on the time and effort required in obtaining appropriate approvals and addressing other administrative issues.
- **Cost -** Evaluation of costs include design and construction costs, remedial action operation, monitoring and maintenance (OM&M) costs, other capital and short-term costs and costs of field and project management associated with the implementation of the remedial alternatives. Estimates of permitting costs have also been included where appropriate.
- **Land Use -** The alternatives are evaluated to this criterion by reviewing the impact of remedial actions to the current, intended, and reasonably anticipated future use of the properties within and surrounding the site. The evaluation should take into consideration Federal, State, and local laws, plans, zoning, and land use designations; public comments; environmental justice concerns; and natural resources, geography, and geology. The final use determination for the site must be made to complete the remedy selection.

The third tier is comprised of agency and community acceptance. Satisfaction of these criteria will be determined after submittal of this alternatives analysis plan; community acceptance will be addressed following the submittal of a remedial action work plan and the public comment period for the proposed plan. Thus, the third tier criteria are not specifically evaluated in this document.

5.2.1 Overall Protection of Human Health and the Environment

The overall protection of human health and the environment is evaluated for Remedial Alternatives 2 and 3 based the successful achievement of RAOs. The RAOs for the site are as follows:

- Prevent human and ecological exposure to soil containing cadmium at concentrations in excess of the SCLs and to sediment containing cadmium, to the extent practicable;
- Maintain human and ecological protection by implementing remedial activities that minimize disruption to the surrounding community, to the extent practicable; and
- Ensure Suffolk County can continue routine maintenance of Willetts Creek by minimizing exposure to sediment containing cadmium at concentrations in excess of cleanup criterion and to sediment containing cadmium, to the extent practicable.

5.2.2 Compliance with Standards, Criteria and Guidance

With the application of cleanup criterion discussed in Section 3.3 at the site, Remedial Alternatives 2 and 3 will achieve compliance with applicable SCGs. Remedial Alternative 1 will not achieve compliance with applicable SCGs.

5.2.3 Short Term Effectiveness

The implementation of Remedial Alternative 1 will not have any short-term impacts since no remedial activities are included in that alternative.

The implementation of Remedial Alternative 2 will result in fewer short-term impacts that can be more reasonably managed than Remedial Alternative 3. The scope of work for Remedial Alternative 2 will be less disruptive to individual property owners than Remedial Alternative 3.

The implementation of Remedial Alternative 3 will result in significantly greater short-term impacts than Remedial Alternative 2 due to the greater depth, area and volume of excavations. Transportation-related risks will also be higher with this alternative. There will be a longer time period of disturbance to individual property owners and the environment.

5.2.4 Long Term Effectiveness

The comparative evaluation of long-term effectiveness focuses on the reduction in residual risk and adequacy and reliability of controls provided by each alternative. Remedial Alternative 1 will not reduce residual risk of contact with cadmium-impacted material. Remedial Alternative 2 will reduce long-term risks associated with exposure to residual cadmium in the soil with reliance on engineering and institutional controls while minimizing negative environmental impacts. Remedial Alternative 3 will reduce long-term risks without the implementation of engineering and/or institutional controls but will significantly increase impacts to the environment with increased natural resource consumption, waste, habitat disturbance, and greenhouse gas emissions.

5.2.5 Reduction of Toxicity, Mobility and Volume

The comparative evaluation of reduction of toxicity, mobility and volume focuses on the ability of the alternative to address the impacted material on site, the irreversibility of the process employed, the nature and movement of the residual materials, and the mass of material destroyed or treated.

Remedial Alternative 1 does not include any remediation, and therefore, will not reduce the toxicity, mobility or volume of cadmium-impacted material at the site.

Remedial Alternatives 2 and 3 rely on excavation and off-site disposal at a permitted landfill to reduce toxicity, mobility and volume of cadmium-impacted material at the site. Additional reduction in toxicity, mobility and volume associated with the implementation of Remedial Alternative 3 is due to removal of soils at depths that are not readily accessible and results in a significant increase in negative environmental impacts (e.g., increased energy consumption and greenhouse gas emissions).

5.2.6 Implementability

This criterion focuses on the technical implementability of construction and operation of each alternative, the administrative implementability including obtaining the appropriate approvals and addressing other administrative issues (e.g., property access, applicable permits, and the availability of required disposal facilities).

Remedial Alternative 1 involves no remedial action and is readily implementable.

Remedial Alternative 2 and 3 are both technically implementable, with equipment and labor necessary to implement these remedial alternatives expected to be readily available. However, Remedial Alternative 3 will make be more difficult to implement since given the deeper and more extensive excavations.

With regard to administrative implementability, Remedial Alternatives 2 and 3 will require the cooperation of property owners for access to implement the remedial action and perform post-construction monitoring. Since residual cadmium will remain at depth within certain portions of the creek under Remedial Alternative 2 and if material greater than 9 mg/kg remains for the excavation options, a Site Management Plan will be required to manage future disturbance resulting in potential exposure.

5.2.7 Cost

The comparative evaluation of the cost of remediation is based on the net present worth of each alternative. The cost of implementing Remedial Alternative 1 was not determined as it is minimal. The total capital, OM&M, and present worth costs of Remedial Alternatives 2 and 3 are presented in

Tables 3 and 4. A detailed list of the assumptions used to prepare the cost estimates is included in Appendix A. The capping alternative assumes that all material greater than 9 mg/kg will be capped and that the cap will not reduce the current stream volume. The estimated cost for the capping alternative is $9,487,000. Three excavation alternatives were evaluated for cost as shown on Table 4: removal of material greater than 9 mg/kg (the cleanup criterion); removal of material greater than 90 mg/kg; and removal of material greater than 900 mg/kg as shown on Table 4C. The greater than 9 mg/kg option estimated cost is $13,154,000; the greater than 90 mg/kg option estimated cost is $9,342,000; and the greater than 900 mg/kg option is $3,572,000.

5.2.8 Land Use

As described in Section 2.2.3, the portion of Willetts Creek between Union Boulevard and Lake Capri consists of the stream channel and wooded areas adjacent to the creek. Land use adjacent to the creek consists of residential housing and public school property (Beach Street Middle School and West Islip Senior High School).

Under all three remedial alternatives, the current intended and reasonably anticipated future use of the properties within and surrounding the site would not be affected. With the implementation of Remedial Alternatives 2 and 3, the potential for future exposure to cadmium-impacted soil is reduced with removal of cadmium-containing soils and, where necessary, the proper management of soils remaining on site with residual cadmium. Remedial Alternative 1 will not reduce any future exposure. Remedial Alternative 2 offers the protection from future exposure to cadmium-impacted soil and is less intrusive and disruptive than Remedial Alternative 3.

6.0 Recommended Remedy

Excavation and off-site disposal of contaminated sediments is the recommended remedy (Remedial Alternative 3).

Three potential scenarios were developed for Remedial Alternative 3:

- Excavation of cadmium contaminated sediments greater than 9 mg/kg
- Excavation of cadmium contaminated sediments greater than 90 mg/kg
- Excavation of cadmium contaminated sediments greater than 900 mg/kg

6.1 Items to be Addressed in the Remedial Action Work Plan

6.1.1 Surveying

The creek and adjacent wooded area along the creek will need to be surveyed prior to the start of work to establish stream gradients and to design the creek restoration. The origin of the 12 outfalls along the creek between Union Boulevard and Lake Capri should be established.

6.1.2 Tree and brush removal

Prior to excavation, all trees and brush will need to be removed to allow access for excavation equipment. Vegetation will need to be hauled off site for disposal.

6.1.3 Stream Diversion

Stream flow diversion will be required during excavation activities, especially in the area between CR9 and CR16 where the excavation will encompass the entire bank to bank width (less than 20 ft). The amount of water to be diverted will be dependent on actual flow conditions encountered during the construction period. Field observations have noted periods of near-dry conditions in the creek. Flow in the creek appears to be highly dependent on precipitation.

6.1.4 Burling Road Footbridge

The footbridge connecting Burling Road with the Middle School is in a >90 mg/kg excavation area. Cadmium contamination appears to be greater than 2-ft deep based on samples collected along transect CR15. Care will need to be taken when excavating around the footbridge to avoid undermining the foundation. Flow beneath the footbridge is restricted to two concrete pipes.

6.1.5 Restoration

Restoration options include grass covered banks and planting new trees. If vegetation is the selected option, backfill material would need to be suitable for trees and grass and meet the requirements of SCO unrestricted use.

Another option would be to line the portion of Willetts Creek from the strip mall (near CR4) to the southern extent of cadmium contamination near CR21 (the southern end of the West Islip High School property) with concrete or an enclosed stormwater pipe. This option would be similar to capping the creek sediment and would prevent further erosion of sediment into Lake Capri from the upper reach of the stream.

Restoration should take into consideration the recommendations of the West Islip NY Rising Community Reconstruction Plan. The plan recommends the rehabilitation of Willetts Creek to mitigate flooding. Action items include removing stream flow blockages, siltation and culvert blockages. The plan also proposes the construction of a community walking and bike path along the western side of the creek between Montauk Highway and Union Boulevard.

Tables

TABLE 1
CADMIUM CONCENTRATIONS AND SEDIMENT TEXTURE IN SELECTED SAMPLES
WILLETTS CREEK
DZUS FASTENERS SITE (#1-52-033)

Sample ID	**Cadmium (mg/kg)**	**Notes**	**Texture**
SED-CR29	11	main creek channel	medium sand with silt
SED-CR20	12	main creek channel	silty muck
SED-CR19	14	main creek channel	medium fine sand with some silt
SED-CR20A	18	wetland	loam
OUTFALL-7	27	outfall	medium and coarse sand
SED-CR31	50	main creek channel	organic muck
SED-CR23B	59	wetland	silt loam
SED-CR23A	61	wetland	organic muck
SED-CR34A	63	wetland	organic muck
SED-CR28B	82	wetland	peat
SED-CR24B	93	wetland	organic muck
SED-CR17A	94	wetland	organic muck and silt
SED-CR24A	120	wetland	organic muck
SED-CR16	130	main creek channel	organic muck
SED-CR18	150	main creek channel	organic muck
SED-CR10	190	main creek channel	organic muck
SED-CR14	200	main creek channel	organic muck
OUTFALL-13	210	outfall buried in muck	organic muck
SED-CR04A	220	wetland	silt and organic material
SED-CR11	240	main creek channel	organic muck
SED-CR15	250	main creek channel	organic muck
SED-CR17	250	main creek channel	organic muck
SED-CR20B	310	NW of wetland	silt
SED-CR12	370	main creek channel	organic muck
SED-CR09	460	main creek channel	organic muck
SED-CR07A	1,600	wetland	organic muck

Notes:
Table includes all Willetts Creek sediment samples with cadmium concentrations above the 9 mg/kg cleanup criterion.
Samples collected in April 2013.
Wetland samples are highlighted in green.
Red type indicates organic muck texture.

TABLE 2
DZUS FASTENERS SITE (1-52-003)
SUMMARY OF WILLETTS CREEK SEDIMENT SAMPLE RESULTS FOR CADMIUM

Lab Sample ID	Field Sample ID	Location		Depth (ft)	Results (mg/kg)
AC76776-002	UP-1A	Upstream	UP-1	0.5-0.8	ND
AC76776-001	UP-1	Upstream	UP-1	0-0.5	ND
AC71997-001	SED-CR-01	Transect 01	Channel	0-1	1.4
AC71997-002	SED-CR02	Transect 02	Channel	0-1	ND
AC71997-003	SED-CR03	Transect 03	Channel	0-1	1.7
AC71997-004	SED-CR04	Transect 04	Channel	0-1	ND
AC71997-005	SED-CR04A	Transect 04	Channel	0-1	220
AC71997-063	OUTFALL 4	Outfalls	OUTFALL-4	0-1	ND
AC75648-081	CR5-W1S	Transect 05	W1	0-1	3.2
AC75648-077	CR5-W1D	Transect 05	W1	1-2	ND
AC75648-090	CR5-W2S	Transect 05	W2	0-1	11
AC75648-087	CR5-W3S	Transect 05	W3	0-1	47
AC75648-088	CR5-W3D	Transect 05	W3	1-2	6
AC75648-083	CR5-W4	Transect 05	W4	0-1	370
AC75783-001	CR5-W42FT	Transect 05	W4	2-3	14
AC75648-079	CR5-W5S	Transect 05	W5	0-1	110
AC71997-006	SED-CR05	Transect 05	Channel	0-1	ND
AC75648-078	CR5-CS1FT	Transect 05	Channel	1-2	ND
AC75648-082	CR5-CD2FT	Transect 05	Channel	2-3	ND
AC75648-086	CR5-E3S	Transect 05	E3	0-1	ND
AC75648-089	CR5-E31FT	Transect 05	E3	1-2	2.1
AC75648-080	CR5-E32FT	Transect 05	E3	2-3	ND
AC75648-085	CR5-E2	Transect 05	E2	0-1	4.4
AC75648-084	CR5-E1S	Transect 05	E1	0-1	3.8
AC75783-002	CR5-E1A	Transect 05	E1	1-2	5.2
AC75648-049	CR6-W1S	Transect 06	W1	0-1	3.2
AC75648-054	CR6-W1D	Transect 06	W1	1-2	ND
AC75648-059	CR6-W2S	Transect 06	W2	0-1	5.8
AC75648-050	CR6-W3S	Transect 06	W3	0-1	3.8
AC75648-055	CR6-W4S	Transect 06	W4	0-1	15
AC75648-053	CR6-W4D	Transect 06	W4	1-2	ND
AC75648-056	CR6-W5S	Transect 06	W5	0-1	20
AC75648-052	CR6-W6S	Transect 06	W6	0-1	47
AC75648-058	CR6-W7S	Transect 06	W7	0-1	230
AC75648-060	CR6-W7D	Transect 06	W7	1-2	4.9
AC71997-007	SED-CR06	Transect 06	Channel	0-1	ND
AC75648-047	CR6-Channel	Transect 06	Channel	1-2	11
AC75648-057	CR6-E1S	Transect 06	E1	0-1	6.2
AC75648-154	CR XZ (DUP)	Transect 06	E1	0-1	6.4
AC75648-048	CR6-E1D	Transect 06	E1	1-2	ND

ND	Not Detected
	<0.6 (LEL)
	0.6 - 9
	9 - 90
	91 - 900
	>900

Cleanup criterion is 9 mg/kg

TABLE 2
DZUS FASTENERS SITE (1-52-003)
SUMMARY OF WILLETTS CREEK SEDIMENT SAMPLE RESULTS FOR CADMIUM

Lab Sample ID	Field Sample ID	Location		Depth (ft)	Results (mg/kg)
AC81271-008	CR7C Surf	Transect 06/7	C	0-1	2.7
AC81271-009	CR7C 1ft	Transect 06/7	C	1-2	ND
AC81271-015	CR7 B Surf	Transect 06/7	B	0-1	1.3
AC81271-013	CR7 B 1ft	Transect 06/7	B	1-2	ND
AC75648-040	CR7-W1S	Transect 07	W1	0-1	1.2
AC75648-041	CR7-W1D	Transect 07	W1	1-2	ND
AC75648-034	CR7-W2S	Transect 07	W2	0-1	1.8
AC75648-036	CR7-W4S	Transect 07	W4	0-1	2.9
AC75648-037	CR7-W41FT	Transect 07	W4	1-2	ND
AC75648-042	CR7-W42FT	Transect 07	W4	2-3	ND
AC71997-009	SED-CR07A	Transect 07	CR7A	0-1	1,600
AC75648-039	CR7-W5S	Transect 07	W5	0-1	2.8
AC71997-064	OUTFALL 7	Outfalls	OUTFALL-7	0-1	27
AC75648-035	CR7-W6S	Transect 07	W6	0-1	12
AC75648-061	CR7-W6D	Transect 07	W6	1-2	ND
AC75648-051	CR7-W6AS	Transect 07	W6A	0-1	85
AC75648-038	CR7-W7S	Transect 07	W7	0-1	86
AC71997-008	SED-CR07	Transect 07	Channel	0-1	1.2
AC75648-043	CR7-C1FT	Transect 07	Channel	1-2	ND
AC75648-044	CR7-C2FT	Transect 07	Channel	2-3	ND
AC75648-046	CR7-E1S	Transect 07	E1	0-1	5.5
AC75648-045	CR7-E1D	Transect 07	E1	1-2	ND
AC81271-014	CR7/8 Surf	Transect 07/8		0-1	4,000
AC81271-016	CR7/8 1ft	Transect 07/8		1-2	280
AC81271-002	CR-8-4	Transect 08	W4	0-1	12
AC75648-022	CR8-W1S	Transect 08	W1	0-1	960
AC75648-021	CR8-W1D	Transect 08	W1	1-2	3.4
AC75648-023	CR8-W2S	Transect 08	W2	0-1	8,200
AC75648-024	CR8-W3S	Transect 08	W3	0-1	1,200
AC75648-025	CR8-W3D	Transect 08	W3	1-2	2,700
AC81271-019	CR8 2ft	Transect 08	W3	2-3	250
AC81271-020	CR8W 3ft	Transect 08	W3	3-4	81
AC71997-010	SED-CR08	Transect 08	Channel	0-1	3.4
AC75648-033	CR8-C1FT	Transect 08	Channel	1-2	ND
AC75648-029	CR8-E5S	Transect 08	E5	0-1	9.5
AC75648-028	CR8-E4S	Transect 08	E4	0-1	3.9
AC75648-026	CR8-E3S	Transect 08	E3	0-1	1,200
AC75648-027	CR8-E3D	Transect 08	E3	1-2	ND
AC75648-030	CR8-E2S	Transect 08	E2	0-1	1.9
AC75648-032	CR8-E1S	Transect 08	E1	0-1	3.7
AC75648-031	CR8-E1D	Transect 08	E1	1-2	ND

ND	Not Detected
	<0.6 (LEL)
	0.6 - 9
	9 - 90
	91 - 900
	>900

Cleanup criterion is 9 mg/kg

TABLE 2
DZUS FASTENERS SITE (1-52-003)
SUMMARY OF WILLETTS CREEK SEDIMENT SAMPLE RESULTS FOR CADMIUM

Lab Sample ID	Field Sample ID	Location		Depth (ft)	Results (mg/kg)
AC81271-021	CR 8/9 Surf	Transect 08/9	CR8/9	0-1	1,000
AC81271-022	CR 8/9 1ft	Transect 08/9	CR8/9	1-2	13
AC75648-106	CR9-W1S	Transect 09	W1	0-1	340
AC75648-010	CR XX (DUP)	Transect 09	W1	0-1	460
AC75648-102	CR9-W1D	Transect 09	W1	1-2	56
AC75648-020	SED -CRXY (DUP)	Transect 09	W1	1-2	26
AC71997-011	SED-CR09	Transect 09	CR9	0-1	460
AC75648-101	CR9-C1FT	Transect 09	CR9	1-2	1.3
AC75783-003	CR9-2F.CHAN	Transect 09	CR9	2-3	0.71
AC75648-104	CR9-E1S	Transect 09	E1	0-1	76
AC75648-105	CR9-E1D	Transect 09	E1	1-2	ND
AC75648-066	CR10-W1S	Transect 10	W1	0-1	2,600
AC75648-064	CR10-W1D	Transect 10	W1	1-2	120
AC71997-012	SED-CR10	Transect 10	CR10	0-1	190
AC75648-063	CR10-C1FT	Transect 10	CR10	1-2	24
AC75648-065	CR10-C2FT	Transect 10	CR10	2-3	6.6
AC75648-067	CR10-E1S	Transect 10	E1	0-1	270
AC75648-062	CR10-E1D	Transect 10	E1	1-2	160
AC75648-097	CR11-W1S	Transect 11	W1	0-1	400
AC75648-111	CR X V (DUP)	Transect 11	W1	0-1	780
AC75648-094	CR11-W1D	Transect 11	W1	1-2	22
AC71997-013	SED-CR11	Transect 11	CR11	0-1	240
AC75648-093	CR11-Channel	Transect 11	CR11	1-2	39
AC75648-092	CR11-E1S	Transect 11	E1	0-1	170
AC75648-091	CR XW (DUP)	Transect 11	E1	0-1	140
AC75648-098	CR11-E1D	Transect 11	E1	1-2	14
AC75648-074	CR12-W1S	Transect 12	W1	0-1	220
AC75648-005	CR12-W1D	Transect 12	W1	1-2	10
AC71997-014	SED-CR12	Transect 12	CR12	0-1	370
AC75648-075	CR12-C1FT	Transect 12	CR12	1-2	ND
AC75648-076	CR12-C2FT	Transect 12	CR12	2-3	0.61
AC75648-006	CR12-E1S	Transect 12	E1	0-1	3.2
AC75648-004	CR12-E1D	Transect 12	E1	1-2	ND
AC75648-073	CR12/13-W1S	Transect 12/13	CR1213-W1	0-1	340
AC75648-070	CR12/13-W1D	Transect 12/13	CR1213-W1	1-2	11
AC75648-071	CR12/13-CS	Transect 12/13	CR1213	0-1	390
AC75648-072	CR12/13-CD1FT	Transect 12/13	CR1213	1-2	12
AC75648-069	CR12/13-E1S	Transect 12/13	CR1213-E1	0-1	100
AC75648-068	CR12/13-E1D	Transect 12/13	CR1213-E1	1-2	3.9
AC71997-065	OUTFALL 13	Outfalls	OUTFALL-13	0-1	210

ND	Not Detected
	<0.6 (LEL)
	0.6 - 9
	9 - 90
	91 - 900
	>900

Cleanup criterion is 9 mg/kg

TABLE 2
DZUS FASTENERS SITE (1-52-003)
SUMMARY OF WILLETTS CREEK SEDIMENT SAMPLE RESULTS FOR CADMIUM

Lab Sample ID	Field Sample ID	Location		Depth (ft)	Results (mg/kg)
AC75648-114	CR13-W1S	Transect 13	W1	0-1	350
AC75648-113	CR13-W1D	Transect 13	W1	1-2	90
AC71997-015	SED-CR13	Transect 13	CR13	0-1	5.5
AC75648-116	CR13-Channel	Transect 13	CR13	1-2	0.65
AC75648-112	CR13-E1S	Transect 13	E1	0-1	120
AC75648-115	CR13-E1D	Transect 13	E1	1-2	7.1
AC75648-117	CR14-W1S	Transect 14	W1	0-1	240
AC75648-118	CR14-W1D	Transect 14	W1	1-2	28
AC71997-016	SED-CR14	Transect 14	CR14	0-1	200
AC75648-120	CR14- Channel	Transect 14	CR14	1-2	470
AC75648-119	CR14-E1S	Transect 14	E1	0-1	110
AC75648-121	CR14- E1D	Transect 14	E1	1-2	1.3
AC75648-124	CR15-W1S	Transect 15	W1	0-1	180
AC75648-125	CR15-W1D	Transect 15	W1	1-2	7.4
AC71997-017	SED-CR15	Transect 15	CR15	0-1	250
AC75648-126	CR15-Channel	Transect 15	CR15	1-2	190
AC75648-123	CR15-E1S	Transect 15	E1	0-1	210
AC75648-122	CR15-E1D	Transect 15	E1	1-2	28
AC75648-002	CR16-W1S	Transect 16	W1	0-1	57
AC75648-003	CR16-W1D	Transect 16	W1	1-2	1.4
AC71997-018	SED-CR16	Transect 16	CR16	0-1	130
AC75648-001	CR16-CH	Transect 16	CR16	1-2	18
AC75648-009	CR17-W1S	Transect 17	W1	0-1	180
AC75648-141	CR17-W1D	Transect 17	W1	1-2	0.71
AC71997-019	SED-CR17	Transect 17	CR17	0-1	250
AC75648-139	CR17-Channel	Transect 17	CR17	1-2	2.3
AC75648-008	CR17-E2S	Transect 17	E2	0-1	160
AC75648-140	CR17-E1S	Transect 17	E1	0-1	10
AC75648-007	CR17-E1D	Transect 17	E1	1-2	210
AC71997-020	SED-CR17A	Transect 17	CR17A	0-1	94
AC75648-131	CR18-W1S	Transect 18	W1	0-1	150
AC75648-130	CR18-W1D	Transect 18	W1	1-2	27
AC75648-128	CR18-W2	Transect 18	W2	0-1	440
AC71997-021	SED-CR18	Transect 18	CR18	0-1	150
AC75648-127	CR18-Channel	Transect 18	CR18	1-2	1.6
AC75648-129	CR18-E2	Transect 18	E2	0-1	320
AC75648-133	CR18-E1S	Transect 18	E1	0-1	56
AC75648-132	CR18-E1D	Transect 18	E1	1-2	48
AC71997-066	OUTFALL 19	Outfalls	OUTFALL-19	0-1	0.95

ND	Not Detected
	<0.6 (LEL)
	0.6 - 9
	9 - 90
	91 - 900
	>900

Cleanup criterion is 9 mg/kg

TABLE 2
DZUS FASTENERS SITE (1-52-003)
SUMMARY OF WILLETTS CREEK SEDIMENT SAMPLE RESULTS FOR CADMIUM

Lab Sample ID	Field Sample ID	Location		Depth (ft)	Results (mg/kg)
AC75648-149	CR-19W1S	Transect 19	W1	0-1	22
AC75648-150	CR19-W1D	Transect 19	W1	1-2	31
AC75648-136	CR19-W2	Transect 19	W2	0-1	650
AC71997-022	SED-CR19	Transect 19	CR19	0-1	14
AC75648-134	CR19-Channel	Transect 19	CR19	1-2	ND
AC75648-135	CR19-E2	Transect 19	E2	0-1	31
AC75648-138	CR19-E1S	Transect 19	E1	0-1	27
AC75648-137	CR19-E1D	Transect 19	E1	1-2	8.3
AC75648-148	CR20-W1S	Transect 20	W1	0-1	56
AC75648-147	CR20-W1D	Transect 20	W1	1-2	8.1
AC71997-025	SED-CR20B	Transect 20	CR20B	0-1	310
AC75648-144	CR20-W2	Transect 20	W2	0-1	130
AC71997-023	SED-CR20	Transect 20	CR20	0-1	12
AC75648-142	CR20-Channel	Transect 20	CR20	1-2	ND
AC71997-024	SED-CR20A	Transect 20	CR20A	0-1	18
AC75648-145	CR20-E1S	Transect 20	E1	0-1	2.7
AC75648-146	CR20-E1D	Transect 20	E1	1-2	2.8
AC75648-143	CR20-E2	Transect 20	E2	0-1	25
AC71997-026	SED-CR21	Transect 21	CR21	0-1	1.5
AC71997-027	SED-CR22	Transect 22	CR22	0-1	ND
AC71997-028	SED-CR23	Transect 23	CR23	0-1	1.8
AC71997-029	SED-CR23A	Transect 23	CR23A	0-1	61
AC71997-030	SED-CR-23B	Transect 23	CR23B	0-1	59
AC71997-109	SED-CR-24	Transect 24	CR24	0-1	ND
AC71997-112	SED-CR-24A	Transect 24	CR24A	0-1	120
AC71997-110	SED-CR-24B	Transect 24	CR24B	0-1	93
AC71997-031	SED-CR-25	Transect 25	CR25	0-1	1.3
AC71997-113	SED-CR-25A	Transect 25	CR25A	0-1	ND
AC71997-032	SED-CR-26	Transect 26	CR26	0-1	4
AC71997-033	SED-CR-27	Transect 27	CR27	0-1	5.1
AC71997-034	SED-CR-28	Transect 28	CR28	0-1	2.9
AC71997-035	SED-CR-28A	Transect 28	CR28A	0-1	ND
AC71997-114	SED-CR28B	Transect 28	CR28B	0-1	82
AC71997-036	SED-CR-29	Transect 29	CR29	0-1	11
AC71997-038	SED-CR-30	Transect 30	CR30	0-1	0.96
AC71997-040	SED-CR-31	Transect 31	CR31	0-1	50
AC71997-041	SED-CR-32	Transect 32	CR32	0-1	0.89
AC71997-044	SED-CR-133	Transect 33	CR33	0-1	0.73
AC71997-043	SED-CR-33	Transect 33	CR33	0-1	0.77
AC71997-045	SED-CR-34	Transect 34	CR34	0-1	ND
AC71997-046	SED-CR-34A	Transect 34	CR34A	0-1	63
AC71997-047	SED-CR-35	Transect 35	CR35	0-1	1.4
AC71997-049	SED-CR-136	Transect 36	CR36	0-1	ND
AC71997-048	SED-CR-36	Transect 36	CR36	0-1	ND
AC71997-051	SED-CR-37	Transect 37	CR37	0-1	ND

ND	Not Detected
	<0.6 (LEL)
	0.6 - 9
	9 - 90
	91 - 900
	>900

Cleanup criterion is 9 mg/kg

TABLE 2
DZUS FASTENERS SITE (1-52-003)
SUMMARY OF WILLETTS CREEK SEDIMENT SAMPLE RESULTS FOR CADMIUM

Lab Sample ID	Field Sample ID	Location		Depth (ft)	Results (mg/kg)
AC71997-052	SED-CR-38	Transect 38	CR38	0-1	ND
AC71997-053	SED-CR-39	Transect 39	CR39	0-1	ND
AC71997-055	SED-CR-40	Transect 40	CR40	0-1	ND
AC71997-056	SED-CR-41	Transect 41	CR41	0-1	ND
AC71997-057	SED-CR-42	Transect 42	CR42	0-1	ND
AC71997-058	SED-CR43	Transect 43	CR43	0-1	ND
AC71997-067	OUTFALL 22	Outfalls	OUTFALL-22	0-1	ND
AC71997-111	OUTFALL 24	Outfalls	OUTFALL-24	0-1	ND
AC71997-037	OUTFALL-29	Outfalls	OUTFALL-29	0-1	4.2
AC71997-039	OUTFALL-30	Outfalls	OUTFALL-30	0-1	1.1
AC71997-042	OUTFALL 32	Outfalls	OUTFALL-32	0-1	2
AC71997-050	OUTFALL 36	Outfalls	OUTFALL-36	0-1	ND
AC71997-054	OUTFALL 39	Outfalls	OUTFALL-39	0-1	ND
AC71997-061	OUTFALL 43	Outfalls	OUTFALL-43	0-1	1.1
AC71997-062	OUTFALL 143 (DUP	Outfalls	OUTFALL-43	0-1	1.6
AC81271-004	AF-8	HS Athletic Field	AF8	0-1	4.1
AC81271-018	SL1	HS Athletic Field	SL1	0-1	ND
AC81271-025	SL1-1ft	HS Athletic Field	SL1	1-2	31
AC81271-007	TXI-D (DUP)	HS Athletic Field	SL1	0-1	42
AC81271-017	SL2 1ft	HS Athletic Field	SL-2	1-2	3.1
AC81271-001	AF 8S	HS Athletic Field	AF8S	0-1	1.8
AC81271-012	AF-9	HS Athletic Field	AF9	0-1	0.99
AC81271-010	AF-10	HS Athletic Field	AF10	0-1	ND
AC81271-003	AF-12	HS Athletic Field	AF12	0-1	0.42
AC81271-011	AF-14	HS Athletic Field	AF14	0-1	2.7
AC81271-006	AF-16	HS Athletic Field	AF16	0-1	9.8
AC81271-005	AF-18	HS Athletic Field	AF18	0-1	ND

Legend	
ND	Not Detected
	<0.6 (LEL)
	0.6 - 9
	9 - 90
	91 - 900
	>900

Cleanup criterion is 9 mg/kg

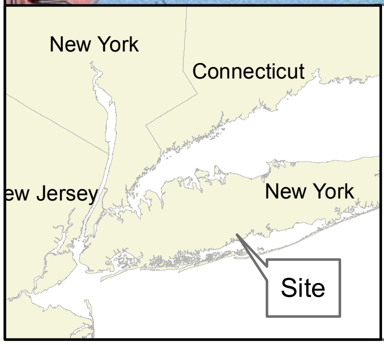
TABLE 3
DZUS FASTENERS SITE (1-52-003)
SUMMARY OF RA-2 CAPPING ALTERNATIVE

Description	Quantity	Unit of Measure	Unit Cost	Extended Cost
Mobilization/Demobilization				**$925,559**
Mob/Demob, Labor, Miscellaneous equipment and facilities	1	EA	$796,137.00	$796,137.00
Submittals/Implementation Plans/Bonds	1	EA	$41,331.00	$41,331.00
Closeout Reporting	1	EA	$22,211.00	$22,211.00
Project Manager	170	HR	$150.00	$18,720.00
Project Scientist	212	HR	$100.00	$15,600.00
Project Engineer	212	HR	$110.00	$17,160.00
Field Technician	460	HR	$80.00	$14,400.00
Site Work				**$351,974.33**
Clearing & Grubbing	3	AC	$7,125.00	$19,971.59
Stream Diversion Pipe	3200	FT	$49.45	$158,240.00
Stream Diversion Pipe Inlet Sandbags	160	EA	$4.51	$721.60
Stream Diversion Outlet Rip Rap	173	SY	$75.75	$13,113.17
Stream Diversion Outlet Geotextile Fabric	173	SY	$2.36	$408.54
Stream Diversion Outlet Crushed Stone	7	CY	$42.00	$302.94
Stream Diversion Pump	1	EA	$65,124.80	$65,124.80
Erosion and Sediment Controls	3200	LF	$7.47	$23,891.68
Foot Bridge Removal	400	SF	$21.50	$8,600.00
Foot Bridge Replacement	400	SF	$154.00	$61,600.00
Excavation				**$3,678,792.32**
Excavator	20336	CY	$2.34	$47,586.24
12 CY Waste Disposal Transport (Truck)	13463	CY	$12.60	$169,637.33
Soil Stabilization, portland cement	813	SY	$19.75	$16,065.44
Confirmatory Sampling (Cadmium)	100	EA	$60.00	$6,000.00
Waste Characterization Sampling	41	EA	$466.00	$19,106.00
Hazardous Transport and Disposal Facility Fee	9,845	TON	$284.05	$2,796,594.78
Non-Hazardous Disposal Facility Fee	15595	TON	$40.00	$623,802.53
Capping				**$1,083,434.00**
Geotextile Woven Fabric	13567	SY	$2.36	$32,017.33
Crushed Stone	565	CY	$42.00	$23,741.67
Riprap	13567	SY	$75.75	$1,027,675.00
Restoration				**$461,901.86**
Wetland Restoration	0.9	AC	$106,199.73	$95,813.81
Tree Restoration	434	EA	$736.65	$319,707.60
Grading and Seeding	9200	SY	$5.04	$46,380.45
Design (15% Capital)				**$981,381.23**
Contingency (30% Capital)				**$1,962,762.45**
Total Capital for Excavation with Off-site Disposal				**$9,486,685.18**
Present Value OM&M Costs				**$0.00**
Total Capital and Present Value Costs for Excavation with Off-site Disposal				**$9,486,685.18**
Total Costs for all elements				**$9,486,685.18**

TABLE 4
DZUS FASTENERS SITE (1-52-003)
SUMMARY OF EXCAVATION ALTERNATIVES

	RA-3A >9 mg/kg Excavation Alternative				RA-3B >90 mg/kg Excavation Alternative				RA-3C >900 mg/kg Excavation Alternative			
Description	**Quantity**	**Unit of Measure**	**Unit Cost**	**Extended Cost**	**Quantity**	**Unit of Measure**	**Unit Cost**	**Extended Cost**	**Quantity**	**Unit of Measure**	**Unit Cost**	**Extended Cost**
Mobilization/De-Mobilization				**$961,779.00**				**$929,659.00**				**$907,759.00**
Mob/Demob Labor, Miscellaneous equipment and facilities	1	EA	$796,137.00	$796,137.00	1	EA	$796,137.00	$796,137.00	1	EA	$796,137.00	$796,137.00
Submittals/Implementation Plans/Bonds	1	EA	$41,331.00	$41,331.00	1	EA	$41,331.00	$41,331.00	1	EA	$41,331.00	$41,331.00
Closeout Reporting	1	EA	$22,211.00	$22,211.00	1	EA	$22,211.00	$22,211.00	1	EA	$22,211.00	$22,211.00
Project Manager	168	HR	$150.00	$25,200.00	133	HR	$150.00	$19,920.00	109	HR	$150.00	$16,320.00
Project Scientist	210	HR	$100.00	$21,000.00	166	HR	$100.00	$16,600.00	136	HR	$100.00	$13,600.00
Project Engineer	210	HR	$110.00	$23,100.00	166	HR	$110.00	$18,260.00	136	HR	$110.00	$14,960.00
Field Technician	410	HR	$80.00	$32,800.00	190	HR	$80.00	$15,200.00	40	HR	$80.00	$3,200.00
Site Work				**$351,974.33**				**$288,834.00**				**$112,954.10**
Clearing & Grubbing	2.80	AC	$7,125.00	$19,971.59	1.53	AC	$7,125.00	$10,901.61	0.3	AC	$7,125.00	$1,979.17
Stream Diversion Pipe	3200	FT	$49.45	$158,240.00	2250	FT	$49.45	$111,262.50	550	LF	$7.47	$4,106.38
Stream Diversion Pipe Inlet Sandbags	160	EA	$4.51	$721.60	160	EA	$4.51	$721.60	550	FT	$49.45	$27,197.50
Stream Diversion Outlet Rip Rap	173.11	SY	$75.75	$13,113.17	173.11	SY	$75.75	$13,113.17	160	EA	$4.51	$721.60
Stream Diversion Outlet Geotextile Fabric	173.11	SY	$2.36	$408.54	173.11	SY	$2.36	$408.54	173.11	SY	$75.75	$13,113.17
Stream Diversion Outlet Crushed Stone	7.2	CY	$42.00	$302.94	7.21	CY	$42.00	$302.94	173.11	SY	$2.36	$408.54
Stream Diversion Pump	1	EA	$65,124.80	$65,124.80	1	EA	$65,124.80	$65,124.80	7.21	CY	$42.00	$302.94
Erosion and Sediment Controls	3200	LF	$7.47	$23,891.68	2250	LF	$7.47	$16,798.84	1	EA	$65,124.80	$65,124.80
Foot Bridge Removal	400	SF	$21.50	$8,600.00	400	SF	$21.50	$8,600.00	NA	NA	NA	NA
Foot Bridge Replacement	400	SF	$154.00	$61,600.00	400	SF	$154.00	$61,600.00	NA	NA	NA	NA
Excavation and Backfilling				**$7,295,826.52**				**$4,969,994.87**				**$1,396,611.25**
Excavator	27360	CY	$2.34	$64,022.40	12250	CY	$2.34	$28,665.00	2120	CY	$2.34	$4,960.80
12 CY Waste Disposal Transport (Truck)	14029	CY	$12.60	$176,767.92	NA	NA	NA	NA	NA	NA	NA	NA
Soil Stabilization, portland cement	1094	SY	$19.75	$21,614.40	490	SY	19.75	$9,677.50	85	SY	19.75	$1,674.80
Backfill (delivery and placement)	27360	CY	$44.24	$1,210,406.40	12250	CY	$44.24	$541,940.00	2120	CY	44.24	$93,788.80
Confirmatory Sampling (Cadmium)	100	EA	$60.00	$6,000.00	84	EA	$60.00	$5,040.00	84	EA	$60.00	$5,040.00
Waste Characterization Sampling	55	EA	$466.00	$25,630.00	25	EA	$466.00	$11,650.00	5	EA	$466.00	$2,330.00
Backfill Characterization Sampling	35	EA	$1,000.00	$35,000.00	20	EA	$1,000.00	$20,000.00	10	EA	$1,000.00	$10,000.00
Hazardous Transporation and Disposal Fee	17977	TON	$284.05	$5,106,361.75	15325	TON	$284.05	$4,353,022.37	4502	TON	$284.05	$1,278,816.85
Non Hazardous Disposal Facility Fee	16251	TON	$40.00	$650,023.65	NA	NA	NA	NA	NA	NA	NA	NA
Restoration				**$461,901.86**				**$254,451.98**				**$46,153.14**
Wetland Restoration	0.9	AC	$106,199.73	$95,813.81	0.52	AC	$106,199.73	$55,218.50	0.09	AC	$106,199.73	$9,995.84
Tree Restoration	434	EA	$736.65	$319,707.60	237	EA	$736.65	$174,586.87	43	EA	$736.65	$31,676.10
Grading and Seeding	9,200	SY	$5.04	$46,380.45	4889	SY	$5.04	$24,646.62	889	SY	$5.04	$4,481.20
Design (15% Capital)				**$1,360,722.26**				**$966,440.98**				**$369,521.62**
Contingency (30% Capital)				**$2,721,444.51**				**$1,932,881.96**				**$739,043.25**
Total Capital for Excavation with Off-site Disposal				**$13,153,648.48**				**$9,342,262.79**				**$3,572,042.37**
Present Value OM&M Costs				**$0.00**				**$0.00**				**$0.00**
Total Capital and Present Value Costs for Excavation with Off-site Disposal				**$13,153,648.48**				**$9,342,262.79**				**$3,572,042.37**
Total Costs for all elements				**$13,153,648.48**				**$9,342,262.79**				**$3,572,042.37**

Figures



USGS NY Bay Shore West Quadrangle

U.S.G.S. 1:24 000 SCALE TOPOGRAPHIC MAP

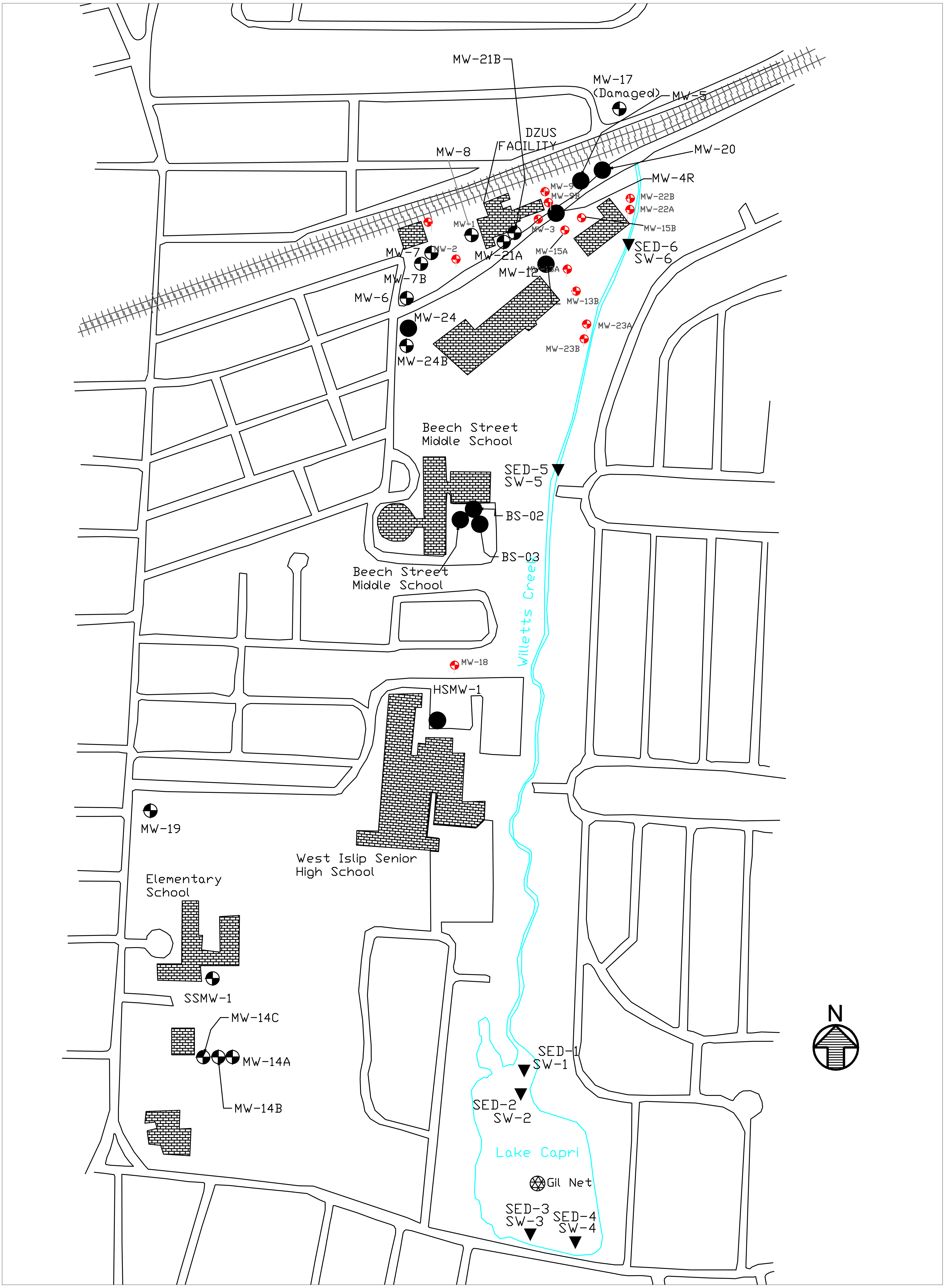
Prepared by: AECOM

Prepared for: NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Multi Site G
Operation, Maintenance & Monitoring

Site Location
Dzus Fasteners Site

Date:	Scale:	Figure No. :
January 2013	1 inch = 2,500 feet	1



LEGEND:

EXISTING MONITORING WELLS

EXISTING WELLS INCLUDED IN LONG TERM MONITORING
(MW-1 was damaged in December 2007.)

MISSING MONITORING WELLS

SURFACE WATER AND SEDIMENT SAMPLE LOCATION

RAILROAD TRACKS

GRAPHIC SCALE

400 200 0 400

Scale in Feet

Prepared by :

AECOM

SUBMITTED BY : PK	MULTI SITE G - Dzus Fasteners SITE NO. 1-52-033
DRAWN BY : SC	SITE PLAN
APPROVED BY : PK	DATE : JUNE 2010 — SCALE : AS SHOWN — DRAWING NO. : 2

0 100 200 400 600 800

Feet

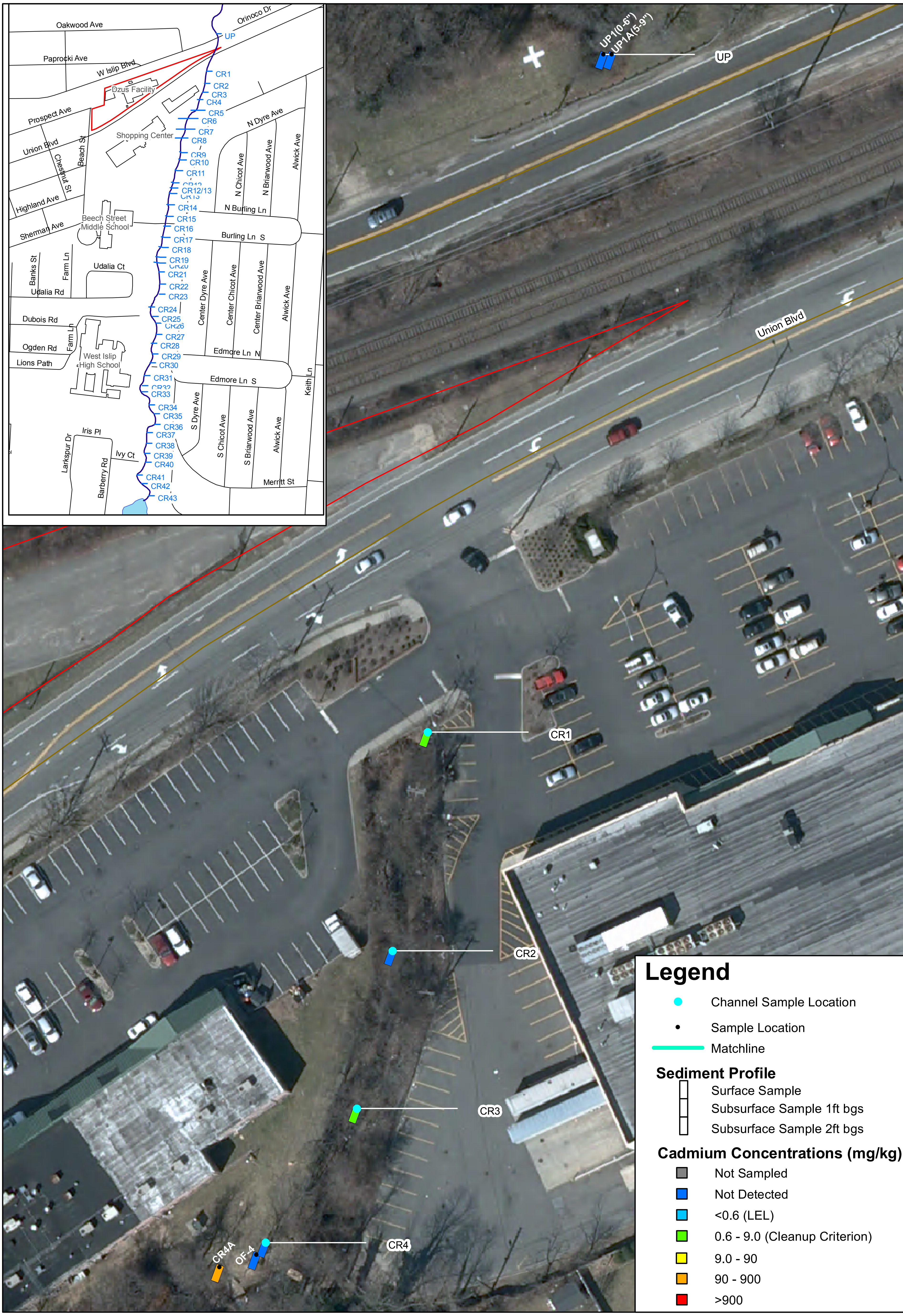
Prepared by: AECOM

Prepared for: NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Multi Site G
Operation, Maintenance & Monitoring

Aerial Map
Dzus Fasteners Site

Date:	Scale:	Figure No. :
February 2013	As Shown	3



0 25 50 100 150 200 Feet

Sources:
1. Sediment Locations, Handheld GPS Unit
2. Aerials, 2010 Half Foot 4 Band Long Island Zone
New York Statewide Digital Orthoimagery Program

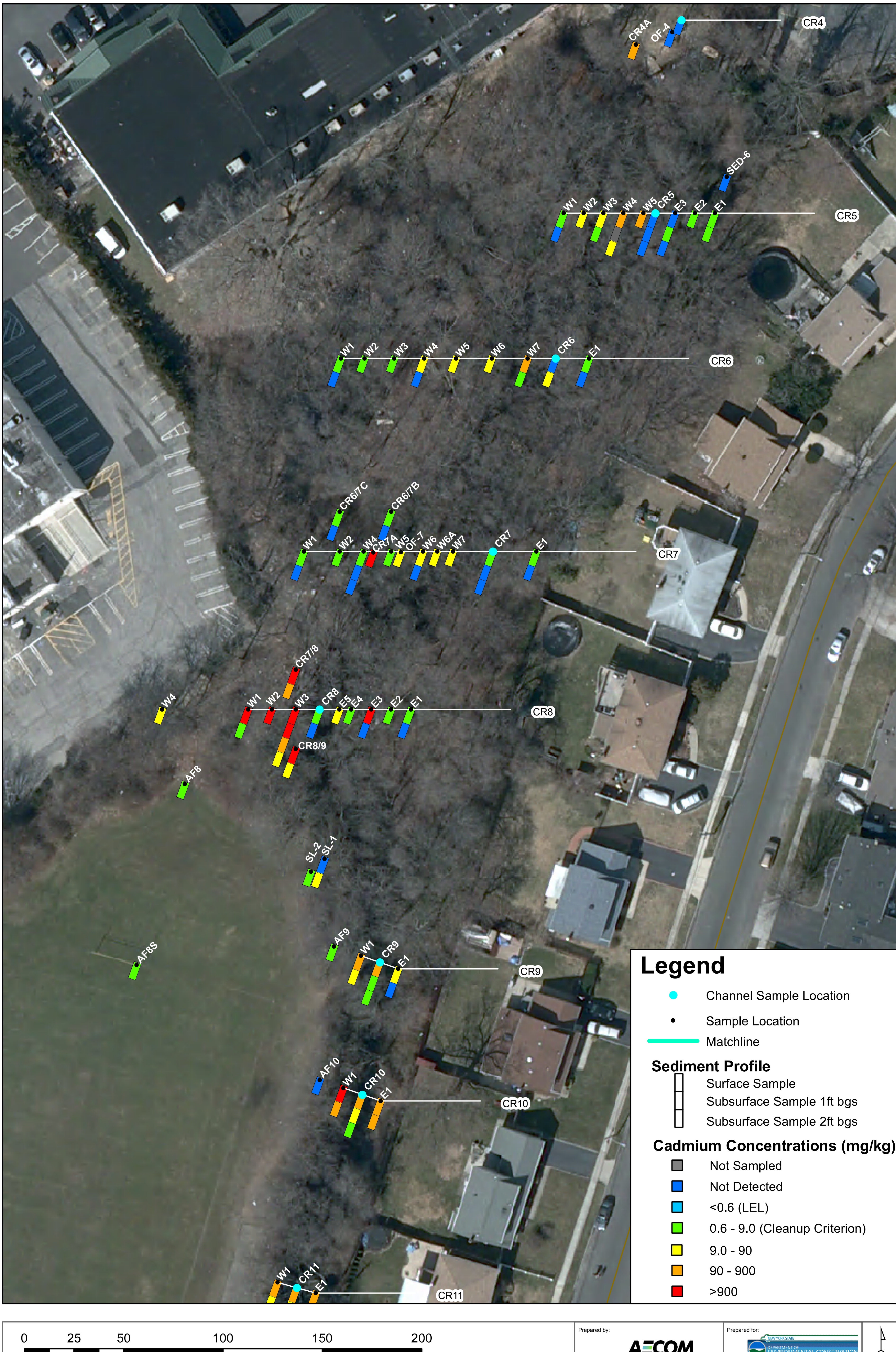
Prepared by: AECOM

Prepared for: NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Multi Site G
Operation, Maintenance & Monitoring

Willetts Creek Sediment Transects
Dzus Fasteners Site

Date:	Page:	Figure No. :
January 2015	Page 1 of 5	4



Sources:
1. Sediment Locations, Handheld GPS Unit
2. Aerials, 2010 Half Foot 4 Band Long Island Zone
New York Statewide Digital Orthoimagery Program

Prepared by: AECOM

Prepared for: New York State Department of Environmental Conservation

Multi Site G
Operation, Maintenance & Monitoring

Willetts Creek Sediment Transects
Dzus Fasteners Site

Date:	Page:	Figure No. :
January 2015	2 of 5	4

0 25 50 100 150 200 Feet

Sources:
1. Sediment Locations, Handheld GPS Unit
2. Aerials, 2010 Half Foot 4 Band Long Island Zone
New York Statewide Digital Orthoimagery Program

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Multi Site G
Operation, Maintenance & Monitoring

Willetts Creek Sediment Transects
Dzus Fasteners Site

Date:	Page:	Figure No. :
January 2015	3 of 5	4

0 25 50 100 150 200 Feet

Sources:
1. Sediment Locations, Handheld GPS Unit
2. Aerials, 2010 Half Foot 4 Band Long Island Zone
New York Statewide Digital Orthoimagery Program

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Multi Site G
Operation, Maintenance & Monitoring

Willetts Creek Sediment Transects
Dzus Fasteners Site

Date:	Page:	Figure No. :
January 2015	Page 4 of 5	4

0 50 100 200 300 400
Feet

Sources:
1. Sediment Locations, Handheld GPS Unit
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New York Statewide Digital Orthoimagery Program

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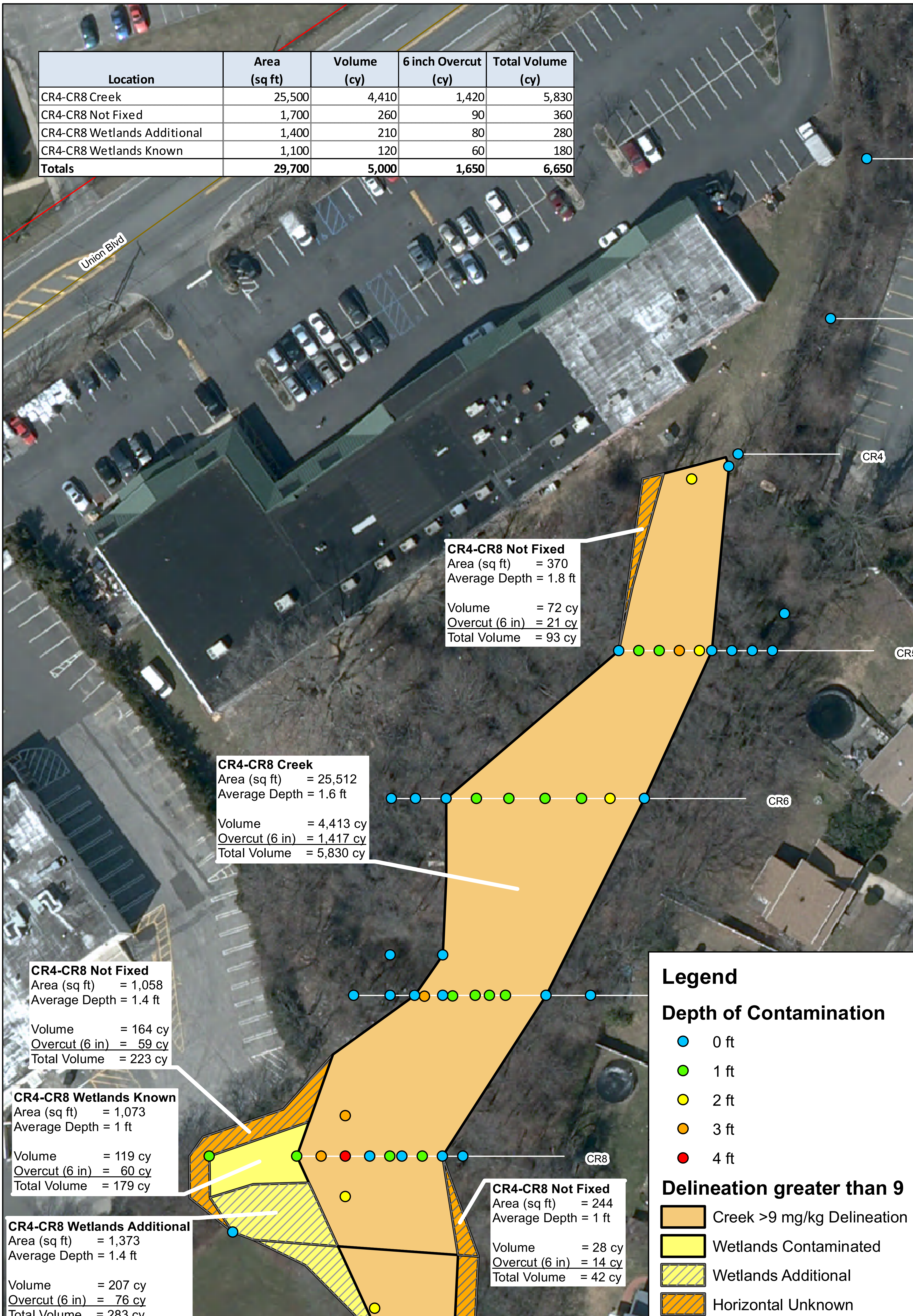
Multi Site G
Operation, Maintenance & Monitoring

Willetts Creek Sediment Transects
Dzus Fasteners Site

Date:	Page:	Figure No. :
January 2015	Page 5 of 5	4

Location	Area (sq ft)	Volume (cy)	6 inch Overcut (cy)	Total Volume (cy)
CR4-CR8 Creek	25,500	4,410	1,420	5,830
CR4-CR8 Not Fixed	1,700	260	90	360
CR4-CR8 Wetlands Additional	1,400	210	80	280
CR4-CR8 Wetlands Known	1,100	120	60	180
Totals	**29,700**	**5,000**	**1,650**	**6,650**



0 25 50 100 150 200 Feet

Sources:
1. Sediment Locations, Handheld GPS Unit
2. Aerials, 2010 Half Foot 4 Band Long Island Zone
New York Statewide Digital Orthoimagery Program

Prepared by: AECOM

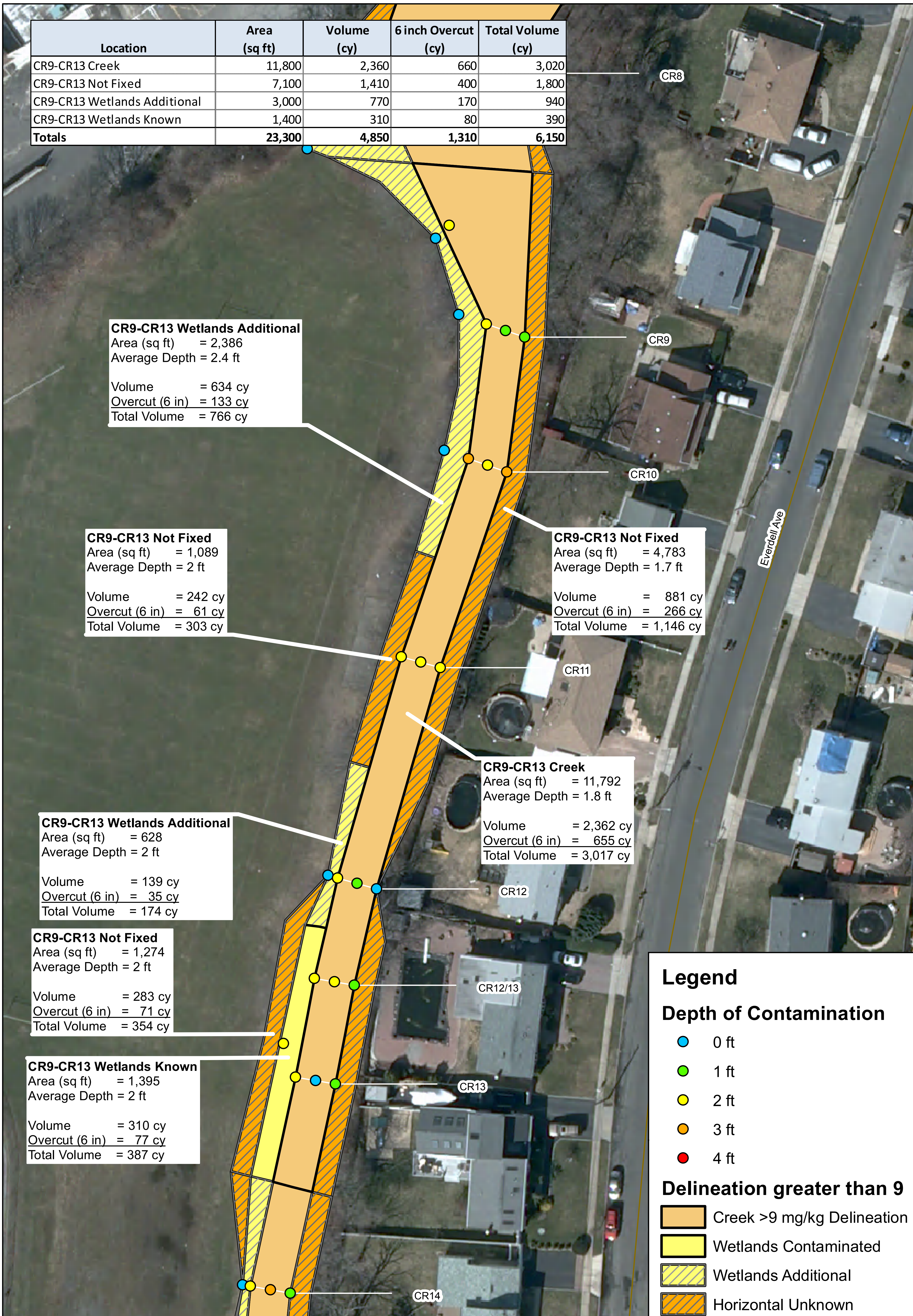
Prepared for: New York State Department of Environmental Conservation

Multi Site G
Operation, Maintenance & Monitoring

Delineations of Sediments
Cadmium Concentrations >9 mg/kg
Dzus Fasteners Site

Date:	Page:	Figure No. :
January 2015	1 of 5	5

Location	Area (sq ft)	Volume (cy)	6 inch Overcut (cy)	Total Volume (cy)
CR9-CR13 Creek	11,800	2,360	660	3,020
CR9-CR13 Not Fixed	7,100	1,410	400	1,800
CR9-CR13 Wetlands Additional	3,000	770	170	940
CR9-CR13 Wetlands Known	1,400	310	80	390
Totals	**23,300**	**4,850**	**1,310**	**6,150**



0 25 50 100 150 200 Feet

Sources:
1. Sediment Locations, Handheld GPS Unit
2. Aerials, 2010 Half Foot 4 Band Long Island Zone
New York Statewide Digital Orthoimagery Program
3. DOC - Depth of Contamination

Prepared by: AECOM

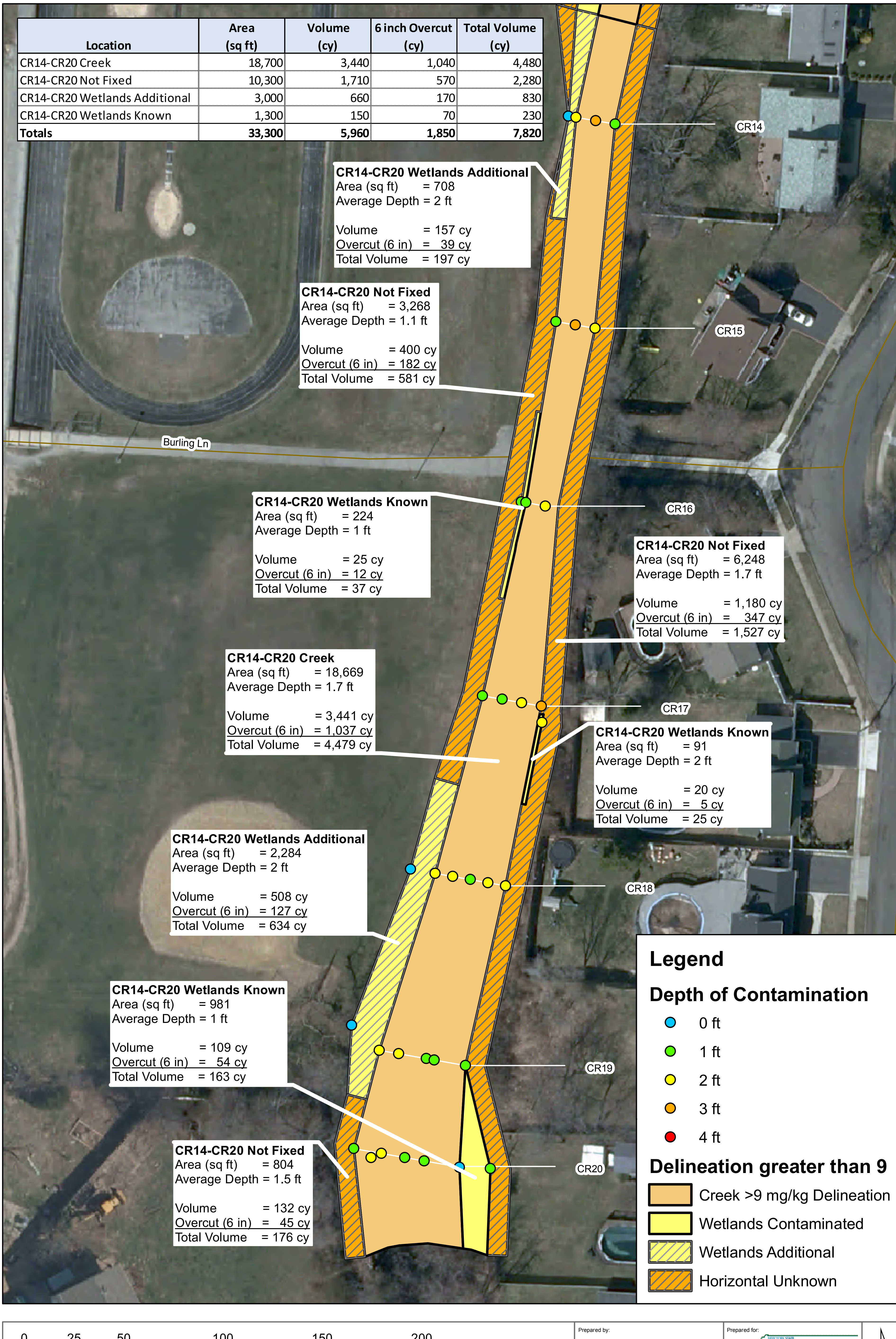
Prepared for: New York State Department of Environmental Conservation

Multi Site G
Operation, Maintenance & Monitoring

Delineations of Sediments
Cadmium Concentrations >9 mg/kg
Dzus Fasteners Site

Date: January 2015 | Page: 2 of 5 | Figure No. : 5

Location	Area (sq ft)	Volume (cy)	6 inch Overcut (cy)	Total Volume (cy)
CR14-CR20 Creek	18,700	3,440	1,040	4,480
CR14-CR20 Not Fixed	10,300	1,710	570	2,280
CR14-CR20 Wetlands Additional	3,000	660	170	830
CR14-CR20 Wetlands Known	1,300	150	70	230
Totals	**33,300**	**5,960**	**1,850**	**7,820**



Sources:
1. Sediment Locations, Handheld GPS Unit
2. Aerials, 2010 Half Foot 4 Band Long Island Zone
New York Statewide Digital Orthoimagery Program

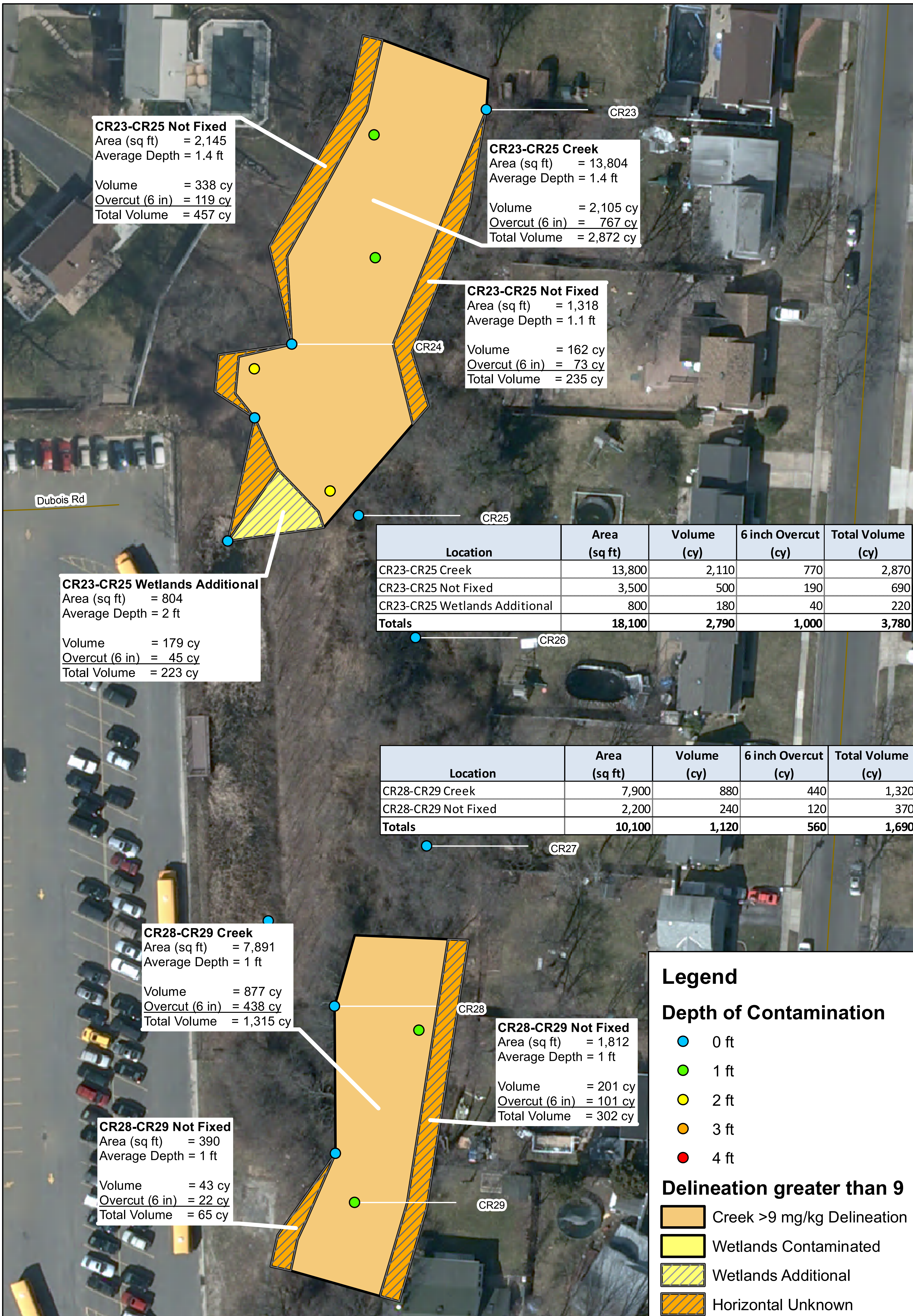
Prepared by: AECOM

Prepared for: New York State Department of Environmental Conservation

Multi Site G
Operation, Maintenance & Monitoring

Delineations of Sediments
Cadmium Concentrations >9 mg/kg
Dzus Fasteners Site

Date:	Page:	Figure No. :
January 2015	3 of 5	5



Location	Area (sq ft)	Volume (cy)	6 inch Overcut (cy)	Total Volume (cy)
CR23-CR25 Creek	13,800	2,110	770	2,870
CR23-CR25 Not Fixed	3,500	500	190	690
CR23-CR25 Wetlands Additional	800	180	40	220
Totals	**18,100**	**2,790**	**1,000**	**3,780**

Location	Area (sq ft)	Volume (cy)	6 inch Overcut (cy)	Total Volume (cy)
CR28-CR29 Creek	7,900	880	440	1,320
CR28-CR29 Not Fixed	2,200	240	120	370
Totals	**10,100**	**1,120**	**560**	**1,690**

0 25 50 100 150 200 Feet

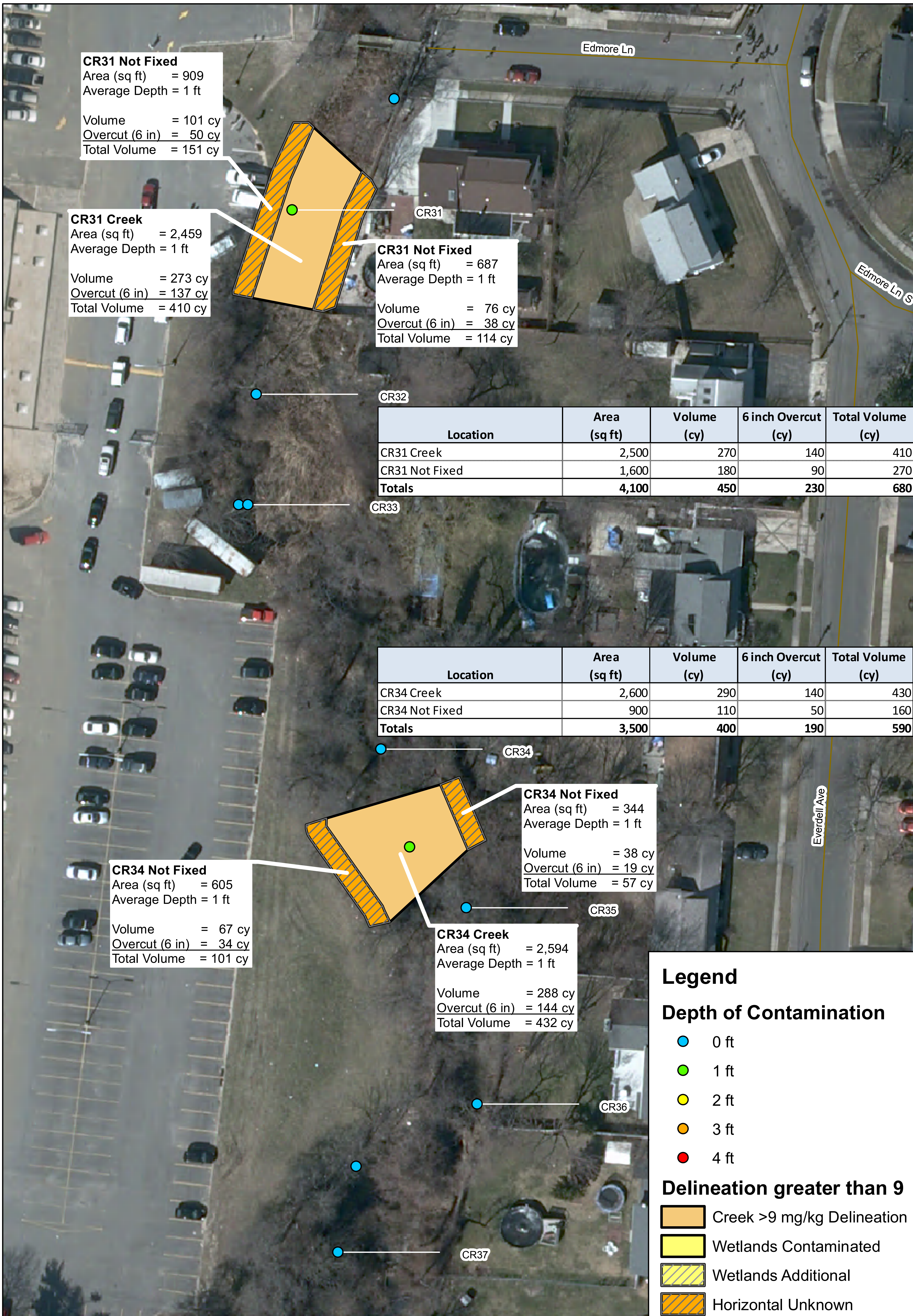
Sources:
1. Sediment Locations, Handheld GPS Unit
2. Aerials, 2010 Half Foot 4 Band Long Island Zone
New York Statewide Digital Orthoimagery Program

Prepared by: AECOM
Prepared for: New York State Department of Environmental Conservation

Multi Site G
Operation, Maintenance & Monitoring

Delineations of Sediments
Cadmium Concentrations >9 mg/kg
Dzus Fasteners Site

Date:	Page:	Figure No. :
January 2015	Page 4 of 5	5



Location	Area (sq ft)	Volume (cy)	6 inch Overcut (cy)	Total Volume (cy)
CR31 Creek	2,500	270	140	410
CR31 Not Fixed	1,600	180	90	270
Totals	**4,100**	**450**	**230**	**680**

Location	Area (sq ft)	Volume (cy)	6 inch Overcut (cy)	Total Volume (cy)
CR34 Creek	2,600	290	140	430
CR34 Not Fixed	900	110	50	160
Totals	**3,500**	**400**	**190**	**590**

0 25 50 100 150 200 Feet

Sources:
1. Sediment Locations, Handheld GPS Unit
2. Aerials, 2010 Half Foot 4 Band Long Island Zone
New York Statewide Digital Orthoimagery Program

Prepared by: AECOM

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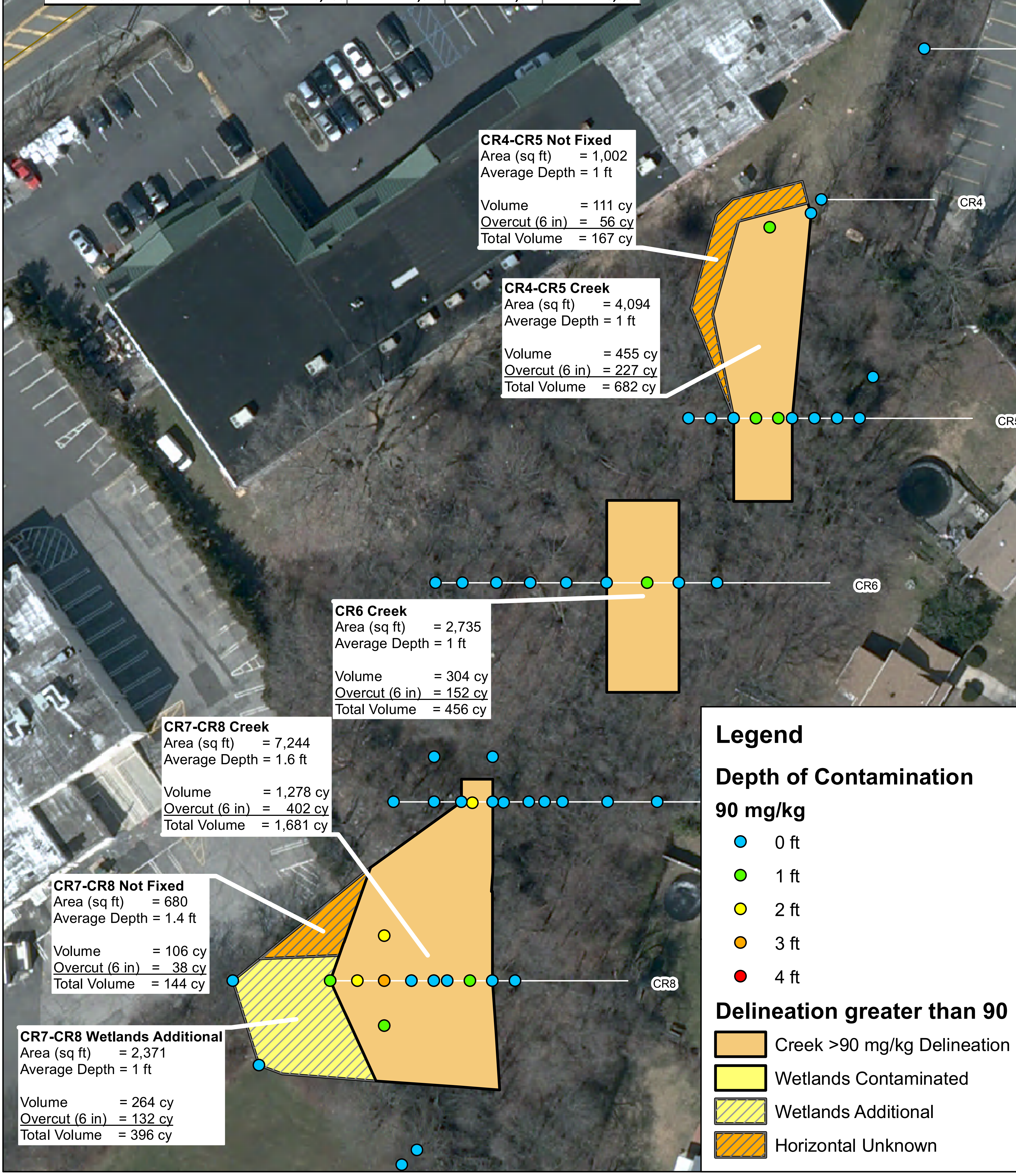
Multi Site G
Operation, Maintenance & Monitoring

Delineations of Sediments
Cadmium Concentrations >9 mg/kg
Dzus Fasteners Site

Date: January 2015 | Page: 5 of 5 | Figure No. : 5

Location	Area (sq ft)	Volume (cy)	6 inch Overcut (cy)	Total Volume (cy)
CR4-CR5 Creek	4,100	450	230	680
CR4-CR5 Not Fixed	1,000	110	60	170
CR4-CR5 Totals	**5,100**	**560**	**290**	**850**
CR6 Creek Totals	**2,700**	**300**	**150**	**460**
CR7-CR8 Creek	7,200	1,280	400	1,680
CR7-CR8 Not Fixed	700	110	40	140
CR7-CR8 Wetlands Additional	2,400	260	130	400
CR7-CR8 Totals	**10,300**	**1,650**	**570**	**2,220**
CR4-CR8 Totals	**18,100**	**2,510**	**1,010**	**3,530**



Sources:
1. Sediment Locations, Handheld GPS Unit
2. Aerials, 2010 Half Foot 4 Band Long Island Zone
New York Statewide Digital Orthoimagery Program

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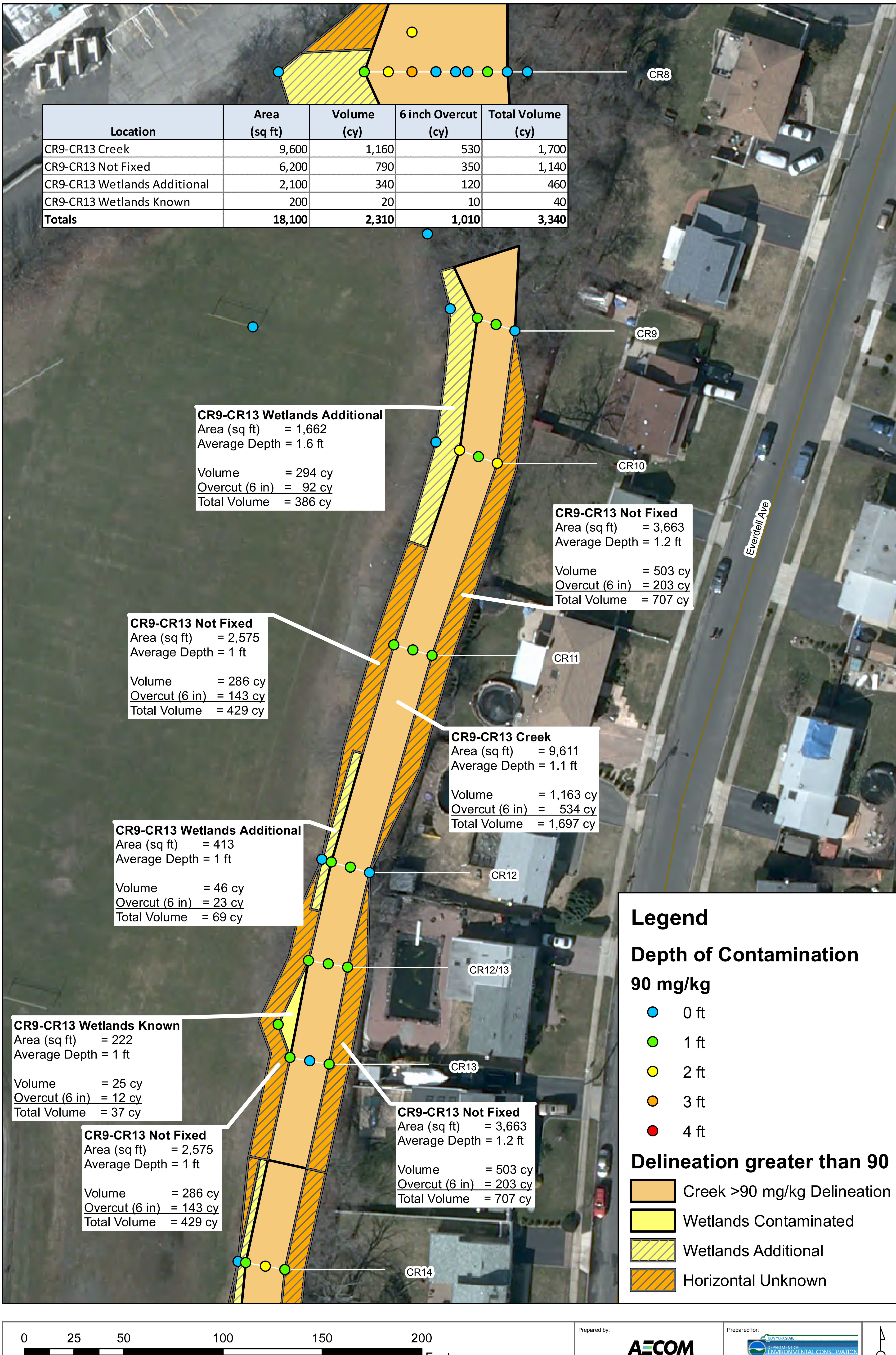
Multi Site G
Operation, Maintenance & Monitoring

Delineations of Sediments
Cadmium Concentrations >90 mg/kg
Dzus Fasteners Site

Date:	Page:	Figure No. :
January 2015	1 of 4	6

Location	Area (sq ft)	Volume (cy)	6 inch Overcut (cy)	Total Volume (cy)
CR9-CR13 Creek	9,600	1,160	530	1,700
CR9-CR13 Not Fixed	6,200	790	350	1,140
CR9-CR13 Wetlands Additional	2,100	340	120	460
CR9-CR13 Wetlands Known	200	20	10	40
Totals	**18,100**	**2,310**	**1,010**	**3,340**



Sources:
1. Sediment Locations, Handheld GPS Unit
2. Aerials, 2010 Half Foot 4 Band Long Island Zone New York Statewide Digital Orthoimagery Program
3. DOC - Depth of Contamination

Prepared by: AECOM

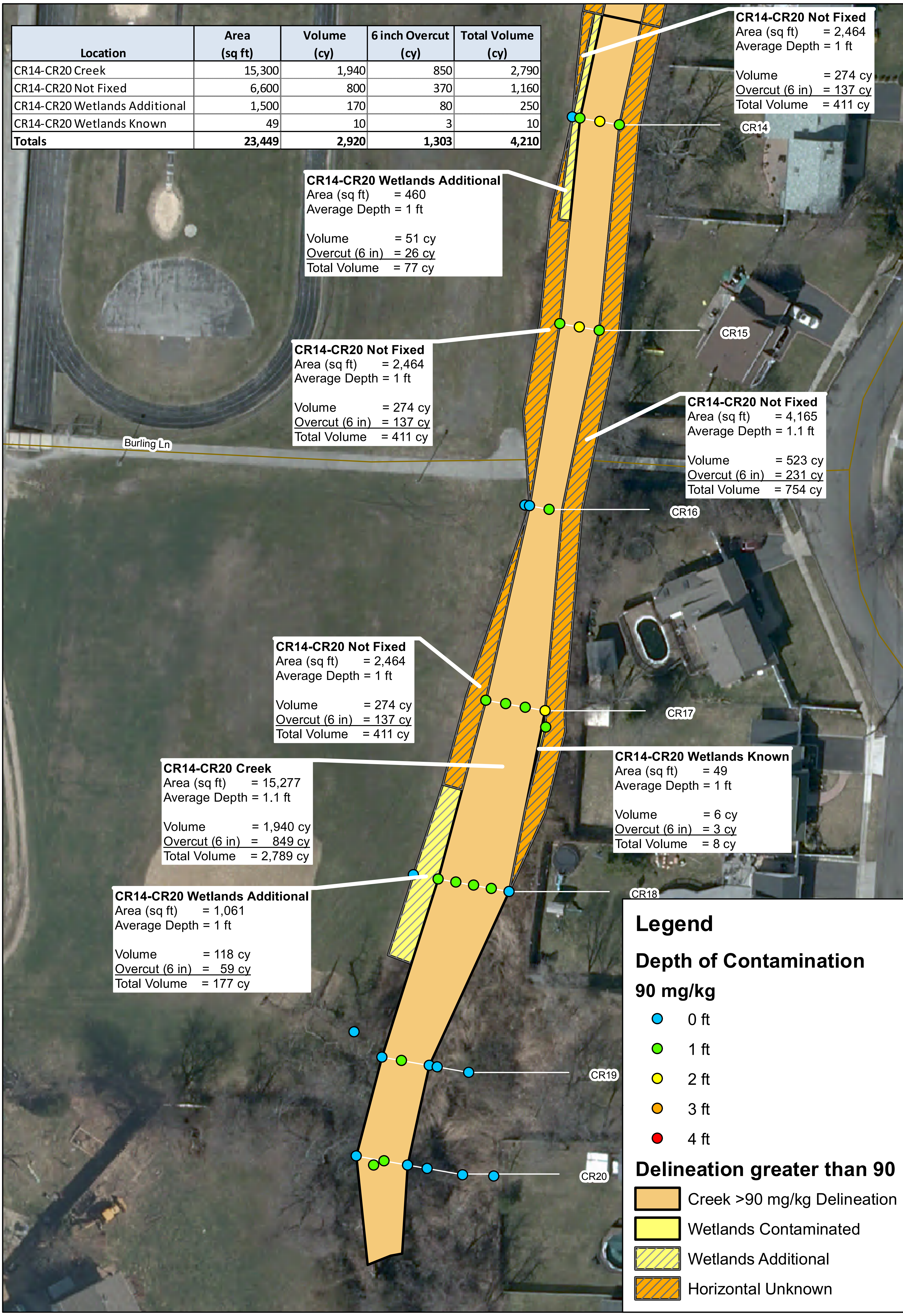
Prepared for: New York State Department of Environmental Conservation

Multi Site G
Operation, Maintenance & Monitoring

Delineations of Sediments
Cadmium Concentrations >90 mg/kg
Dzus Fasteners Site

Date:	Page:	Figure No. :
January 2015	2 of 4	6

Location	Area (sq ft)	Volume (cy)	6 inch Overcut (cy)	Total Volume (cy)
CR14-CR20 Creek	15,300	1,940	850	2,790
CR14-CR20 Not Fixed	6,600	800	370	1,160
CR14-CR20 Wetlands Additional	1,500	170	80	250
CR14-CR20 Wetlands Known	49	10	3	10
Totals	**23,449**	**2,920**	**1,303**	**4,210**



0 25 50 100 150 200 Feet

Sources:
1. Sediment Locations, Handheld GPS Unit
2. Aerials, 2010 Half Foot 4 Band Long Island Zone
New York Statewide Digital Orthoimagery Program

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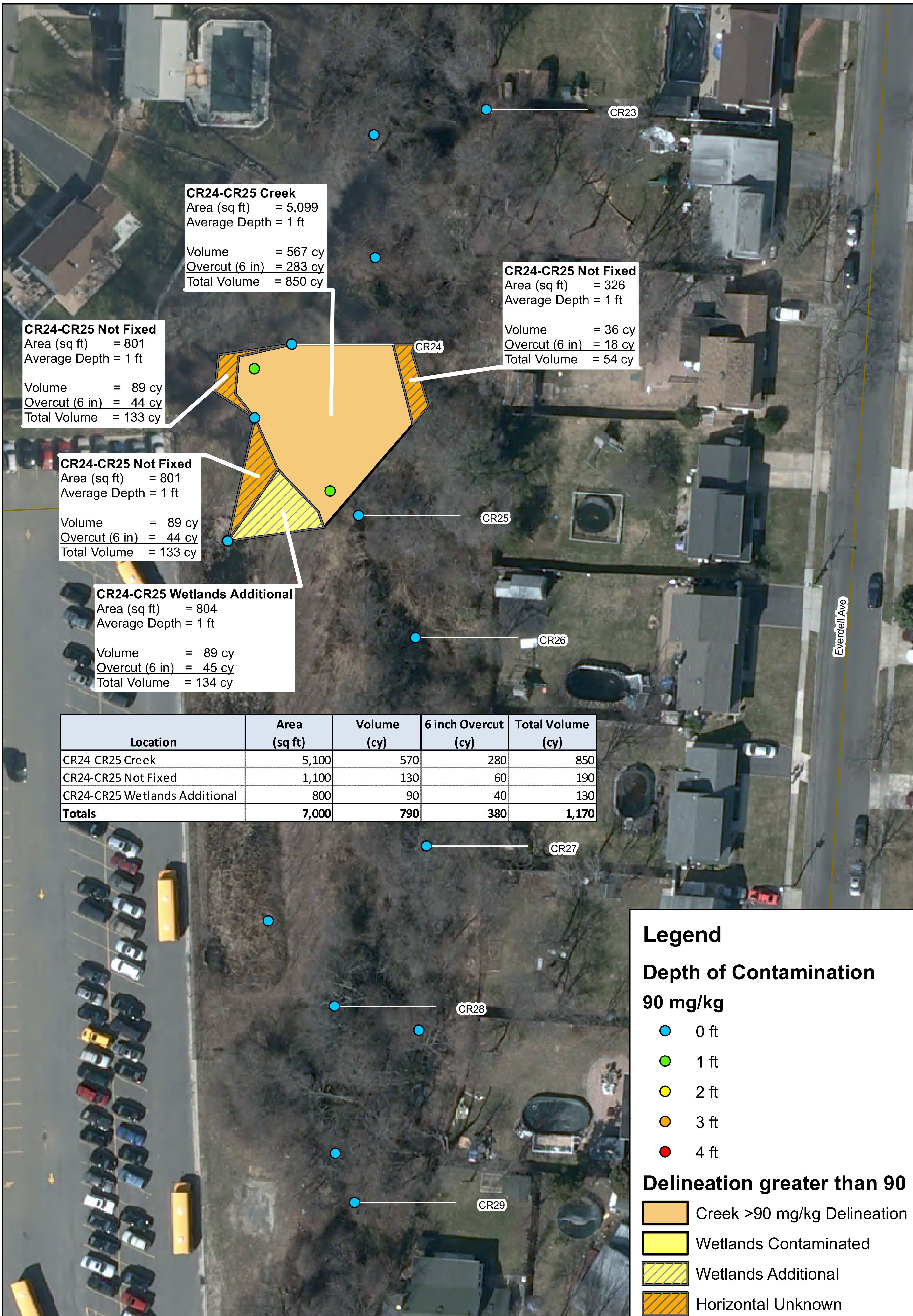
Multi Site G
Operation, Maintenance & Monitoring

Delineations of Sediments
Cadmium Concentrations >90 mg/kg
Dzus Fasteners Site

Date:	Page:	Figure No. :
January 2015	3 of 4	6



Location	Area (sq ft)	Volume (cy)	6 inch Overcut (cy)	Total Volume (cy)
CR24-CR25 Creek	5,100	570	280	850
CR24-CR25 Not Fixed	1,100	130	60	190
CR24-CR25 Wetlands Additional	800	90	40	130
Totals	**7,000**	**790**	**380**	**1,170**

0 25 50 100 150 200 Feet

Sources:
1. Sediment Locations, Handheld GPS Unit
2. Aerials, 2010 Half Foot 4 Band Long Island Zone
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Multi Site G
Operation, Maintenance & Monitoring

Delineations of Sediments
Cadmium Concentrations >90 mg/kg
Dzus Fasteners Site

Date:	Page:	Figure No. :
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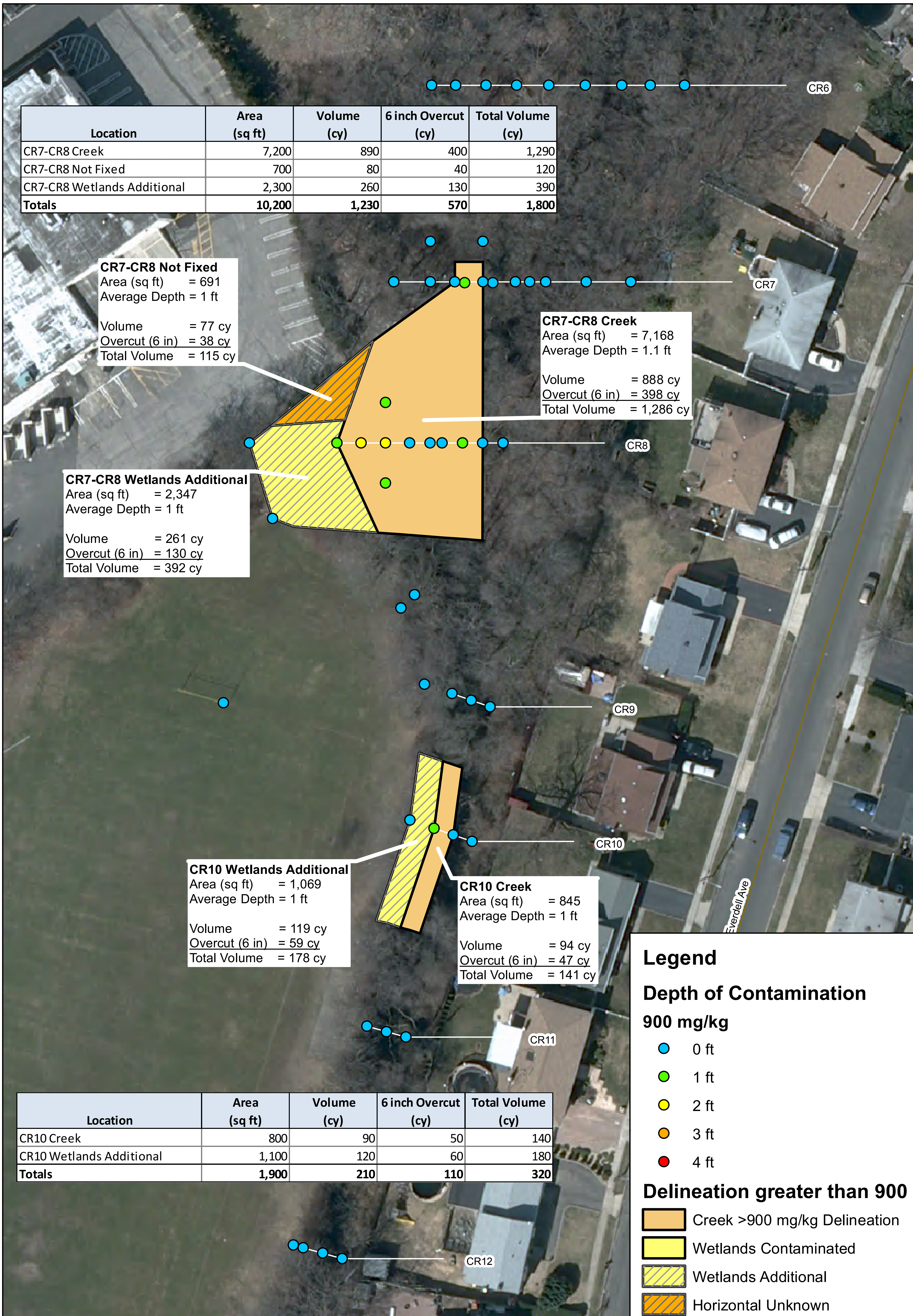

Location	Area (sq ft)	Volume (cy)	6 inch Overcut (cy)	Total Volume (cy)
CR7-CR8 Creek	7,200	890	400	1,290
CR7-CR8 Not Fixed	700	80	40	120
CR7-CR8 Wetlands Additional	2,300	260	130	390
Totals	**10,200**	**1,230**	**570**	**1,800**

Location	Area (sq ft)	Volume (cy)	6 inch Overcut (cy)	Total Volume (cy)
CR10 Creek	800	90	50	140
CR10 Wetlands Additional	1,100	120	60	180
Totals	**1,900**	**210**	**110**	**320**

0 25 50 100 150 200 Feet

Sources:
1. Sediment Locations, Handheld GPS Unit
2. Aerials, 2010 Half Foot 4 Band Long Island Zone
New York Statewide Digital Orthoimagery Program

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Multi Site G
Operation, Maintenance & Monitoring

Delineations of Sediments
Cadmium Concentrations >900 mg/kg
Dzus Fasteners Site

Date:	Page:	Figure No. :
January 2015	1 of 1	7

Appendix A

Excavation Cost Sheets

APPENDIX A, TABLE 1
DZUS FASTENERS SITE (1-52-003)
SUMMARY OF RA-2 CAPPING ALTERNATIVE

Description	Quantity	Unit of Measure	Unit Cost	Extended Cost
Mobilization/Demobilization				**$966,439**
Mob/Demob Labor, Miscellaneous equipment and facilities	1	EA	$796,137.00	$796,137.00
Submittals/Implementation Plans/Bonds	1	EA	$41,331.00	$41,331.00
Closeout Reporting	1	EA	$22,211.00	$22,211.00
Project Manager	170	HR	$150.00	$25,440.00
Project Scientist	212	HR	$100.00	$21,200.00
Project Engineer	212	HR	$110.00	$23,320.00
Field Technician	460	HR	$80.00	$36,800.00
Site Work				**$351,974.33**
Clearing & Grubbing	2.80	AC	$7,125.00	$19,971.59
Stream Diversion Pipe	3,200.00	FT	$49.45	$158,240.00
Stream Diversion Pipe Inlet Sandbags	160.00	EA	$4.51	$721.60
Stream Diversion Outlet Rip Rap	173.11	SY	$75.75	$13,113.17
Stream Diversion Outlet Geotextile Fabric	173.11	SY	$2.36	$408.54
Stream Diversion Outlet Crushed Stone	7.21	CY	$42.00	$302.94
Stream Diversion Pump	1.00	EA	$65,124.80	$65,124.80
Erosion and Sediment Controls	3,200.00	LF	$7.47	$23,891.68
Foot Bridge Removal	400.00	SF	$21.50	$8,600.00
Foot Bridge Replacement	400.00	SF	$154.00	$61,600.00
Excavation				**$3,678,792.32**
Excavator	20,336	CY	$2.34	$47,586.24
12 CY Disposal Transport (Truck)	13,463	CY	$12.60	$169,637.33
Soil Stabilization, portland cement	813	SY	$19.75	$16,065.44
Confirmatory Sampling (Cadmium)	100	EA	$60.00	$6,000.00
Waste Characterization Sampling	41	EA	$466.00	$19,106.00
Hazardous Transport and Disposal Facility Fee	9,845	TON	$284.05	$2,796,594.78
Non-Hazardous Disposal Facility Fee	15,595	TON	$40.00	$623,802.53
Capping				**$1,083,434.00**
Geotextile Woven Fabric	13,567	SY	$2.36	$32,017.33
Crushed Stone	565	CY	$42.00	$23,741.67
Riprap	13,567	SY	$75.75	$1,027,675.00
Restoration				**$461,901.86**
Wetland Restoration	0.90	AC	$106,199.73	$95,813.81
Tree Restoration	434.00	EA	$736.65	$319,707.60
Grading and Seeding	9,200.00	SY	$5.04	$46,380.45
Design (15% Capital)				**$981,381.23**
Contingency (30% Capital)				**$1,962,762.45**
Total Capital for Excavation with Off-site Disposal				**$9,486,685.18**
Present Value OM&M Costs				**$0.00**
Total Capital and Present Value Costs for Excavation with Off-site Disposal				**$9,486,685.18**
Total Costs for all elements				**$9,486,685.18**

Capping Alternative Assumptions

Clearing & Grubbing	$19,971.59	$, Source: RS Means 2013 estimate, clear & grub brush including stumps
Wetland Restoration	$106,199.73	ACRE, Source: Bloody Brook Appendix J Cost Estimate Summary Remedial Alternative 2
Tree Restoration	$736.65	EA, Source: Bloody Brook Appendix J Cost Estimate Summary Remedial Alternative 3
Tree Restoration Quantity	434	EA, Source: Engineering judgement, estimate number of trees within a 4225 ft^2 area within the excavation area foot print and multiplied the sum of the planned excavation area foot print (e.g. creek, wetlands additional, wetlands contaminated, and wetlands unknown).
Grading and Seeding	$5.04	SY, Source: Bloody Brook Appendix J Cost Estimate Summary Remedial Alternative 4
Grading and Seeding Quantity	9200	SY, Source: Engineering judgement, assumed seeded areas to be within the creek delineation area.
Foot Bridge Removal	$21.50	SF, Source: RS Means 2013 estimate: Bridge demolition, bridges, pedestrial, precast, 60' to 150' long.
Foot Bridge Replacement	$154.00	SF, Source: RS Means 2013 estimate: Bridges, pedestrian, spans over streams, roadways, etc., including erection, not including foundations, Pre cast concrete, complete in place 8' wide, 60' span.
Foot Bridge Quantity	400	SF, Source: Engineering judgement, estimated foot bridge length and width to be 50 ft by 8 ft, respectively, in google earth.
Max Rainfall Event	12	in, Source: August 2014 storm.
Stream Diversion Pipe Length	3200	FT, Source: engineering estimate, google earth and Alternative Analysis Report Excavation delineation Figure 5
Stream Diversion Pipe Unit Cost	$49.45	LF, Source: RS Means 2013 estimate: HDPE Type S Corrugated Piping 36" diameter. Includes bell & spigot connection. Excludes elbows, excavation and backfill.
Stream Diversion Sandbags to capture headwaters	$4.51	EA, Source: Granview Block & Gravel, assumed 50 pound sand bags
Stream Diversion Sandbags to capture headwaters Quantity	160	EA, Source: Engineering judgement, assumed stream width 40 feet at headwaters. Assumed sandbag length to be 2 feet long; assumed bag wall on each side of pipe inlet to be 3 bag rows high and 2 columns thick.
Stream Diversion Outlet Riprap Apron Quantity	1558	SF, Source: Bloody Brook Discharge pipe design/NYSDEC standards and specifications for E&S control figure 5B.12
Riprap	$75.75	SY, Source: Engineering judgement, RS Means 2013 18" minimum thickness, not grouted.
Geotextile Woven Fabric	$2.36	SY, Source: Engineering judgement, RS Means 2013 Geotextile fabric, woven, heavy duty, 600 lb. tensile strength
Crushed Stone	$42.00	CY, Source: Engineering judgement to protect geotextile fabric; RS Means 2013 spread, with 200 H.P. dozer, no compaction, 2 mi. RT haul, crushed stone (1.40 tons per CY), 1.5" size stone
Crushed Stone Quantity	7.2	CY, Source: Engineering judgement, assume 1.5 inch depth (1 layer of stone) with surface area equal to the rip rap apron above
Storm Diversion Pump	$65,124.80	EA, Source: Engineering judgement/ Godwin Pumps. Assumed CD250M diesel pump, on skid, capable of flow rates to 3720 gpm. Assumed purchase of pump, excludes pipe installation costs.
Erosion and Sediment Controls	$7.47	LF, Source: Bloody Brook Appendix J Cost Estimate Summary Remedial Alternative 2. Assumed E&S controls
Erosion and Sediment Control Quantity	3200	LF, Source: Engineering judgement, assumed distance between points in the excavation boundary that were furtherest apart.
Mobilze/Demobilize Labor, Miscellaneous equipment and facilities	$796,137.00	EA, Source: Bloody Brook Appendix J Cost Estimate Summary Remedial Alternative 2
Submittals/Implementation Plans/Bonds	$41,331.00	EA, Source: Bloody Brook Appendix J Cost Estimate Summary Remedial Alternative 2
Closeout Reporting	$22,211.00	EA, Source: Bloody Brook Appendix J Cost Estimate Summary Remedial Alternative 2
Project Schedule	106	DAY, Source: Engineering judgement: assume 2 months for planning and design, 42 days for excavation, 1 month for project close out. Assume capping installation will occur in completed areas following approval of confirmation samples with DER-10. Assume additional 4 days of capping for last area excavated.
Work Hours per day	10	Hr/day, Source: engineering judgement
Work Days per Week	5	Day/Wk, Source: engineering judgement
Creek Delineation Excavation Area	82,800	sf
Wetlands Contaminated Excavation Area	3,800	sf
Wetlands Additional Area	8,200	sf
Wetlands Unknown Area	27,300	sf 122,100
Total Excavation Area	2.80	ACRE
Excavation Depth	0.54	YD, Source: engineering judgement, assumed excavation depth equivalent to rip rap thickness (18") and crushed stone thickness (1.5") from RS Means 2013; geotextile fabric negligeble .
Creek Delineation Excavation Volume (in top 18 inches)	13787	CY
Wetlands Contaminated Excavation Volume in top 18 inches	627	CY
Wetlands Additional Volume in top 18 inches	1364	CY
Wetlands Unknown Volume in top 18 inches	4558	CY
Volume>=90 mg/kg in Top 18 inches	7870	CY, Source: GIS calculations, AECOM
Hazardous Waste Volume	7870	CY, Source: GIS calculations, AECOM

Capping Alternative Assumptions (Continued)

Hazardous Waste Volume with soil stabilization [enter]	8500	CY, Source: Assumed addition of cement from soil stabilization
Non Haz Waste to be disposed off with soil stabilization	13463	CY, assumed with soil stabilization
Excavation Rate	673	CY/Day, RS Means estimate 3CY excavator -15% of loading
Excavation Duration	42	DAY, Soure: engineering judgement with additional days for redundancy
12 CY Waste Disposal Transport (Truck)	12.6	$/CY, Source: RS Means 2013, 12 C.Y. truck 35 mph ave, cycle 20 miles
Excavator	2.34	$/CY, Source: RS Means 2013 Excavator , Hydraulic, Crawler, 3 CY Capacity=300 CY/Hr for wet excavation
Drive Time to/from landfill	0.83	Hr, Source: engineering judgement, assume Smith Town Landfill as disposal site
Soil Stabilization, portland cement addition rate	8%	CY, Source: Portland cement addition rate assumed from New Jersey Case Study discussed in "Solidification/Stabilization Treatment and Examples of Use at Port Facilities by Charles M. Wilk, LEHP, QEP
Soil Stabilization, Portland cement	$19.75	SY, Source: engineering judgement; RS Means 2013 Cement Soil Stabilization, Cement, 9% by mix, 12" deep. Includes scarifying and compaction
Confirmatory Sampling (Cadmium)	$60.00	EA, Source: Phoenix Environmental, US EPA Method 6010 analytical cost for standard TAT sample
Confirmatory Samples	100	EA, Source: Engineering judgement, assumed the number of sediment samples taken within the wetlands contaminated and creek (>9 mg/kg) boundary illustrated in the AAR Figure 5.
Waste Characterization Sampling	$466.00	EA, Source: Phoenix Environmental, analytical cost for standard TAT sample: GRO/DRO, VOCs, SVOCs, PCBs, Metals (including cadmium), Cyanide, Sulfur, and BTU ASTM D240-87.
Waste Characterization Sample	41	EA, Source: Engineering judgement, assume one grab sample per 500 CY; analytes assumed to be those required by ESMI: GRO/DRO, VOCs, SVOCs, PCBs, Metals (including cadmium), Cyanide, Sulfur, and BTU ASTM D240-87.
Soil Density	1.375	g/cc, Source: Engineering judgement, took average of bulk density estimated from NRCS websoil survey conducted at the site.
Ton="Short ton", 1 short ton= 907185 grams		Source: Engineering judgement, engineer's toolbox http://www.engineeringtoolbox.com/unit-converter-d_185.html#Mass
1 cubic yard= 764239.4 cubic centimeters		Source: Engineering judgement, engineer's toolbox http://www.engineeringtoolbox.com/unit-converter-d_185.html#Mass
1 square yard= 9 square feet		Source: Engineering judgement, engineer's toolbox http://www.engineeringtoolbox.com/unit-converter-d_185.html#Mass
Non Hazardous Disposal Facility Fee	$40.00	Ton, Source: STM
Hazardous Soil Transportation and Disposal Fee	$284.05	Ton, Source: SAU, assume 2008 Michigan disposal fee of $105, plus $142 transportation fee and 15% appreciation to 2015 cost.
Project Manager Rate	$150.00	HR, Source: Midtown Feasibility Study Cost Estimate, App B costs Alternative S2A.
Project Manager Quantity	169.6	HR, Source: engineering judgement/STM. Assume 8 hours of work per week over entire project schedule.
Project Scientist Rate	$100.00	HR, Source: Midtown Feasibility Study Cost Estimate, App B costs Alternative S2A.
Project Scientist Quantity	212	HR, Source: engineering judgement/STM. Assume 10 hours of work per week during entire project.
Project Engineer Rate	$110.00	HR, Source: Midtown Feasibility Study Cost Estimate, App B costs Alternative S2A.
Project Engineer Quantity	212	HR, Source: engineering judgement/STM. Assume 10 hours of work per week during entire project.
Field Technician Rate	$80.00	HR, Source: Midtown Feasibility Study Cost Estimate, App B costs Alternative S2A.
Field Technician Quantity	460	HR, Source: Engineering judgement; assume 10-hours of work per day for excavation and capping with 4 days redundacy to complete capping.
Contingency (30%)		EA, Source: Engineering judgement, includes all excavation and backfilling items except waste disposal fees; 30% sourced from Midtown Feasibility Study Cost Estimate, App B costs Alternative S2A.
Riprap	$75.75	SY, Source: Engineering judgement, RS Means 2013 18" minimum thickness, not grouted.
Geotextile Woven Fabric	$2.36	SY, Source: Engineering judgement, RS Means 2013 Geotextile fabric, woven, heavy duty, 600 lb. tensile strength
Crushed Stone	$42.00	CY, Source: Engineering judgement to protect geotextile fabric; RS Means 2013 spread, with 200 H.P. dozer, no compaction, 2 mi. RT haul, crushed stone (1.40 tons per CY), 1.5" size stone

APPENDIX A TABLE 2A
DZUS FASTENERS SITE (1-52-003)
SUMMARY OF RA-3A (>9 mg/kg) EXCAVATION ALTERNATIVE

Description	Quantity	Unit of Measure	Unit Cost	Extended Cost
Mobilization/De-Mobilization				**$961,779.00**
Mob/Demob Labor, Miscellaneous equipment and facilities	1	EA	$796,137.00	$796,137.00
Submittals/Implementation Plans/Bonds	1	EA	$41,331.00	$41,331.00
Closeout Reporting	1	EA	$22,211.00	$22,211.00
Project Manager	168	HR	$150.00	$25,200.00
Project Scientist	210	HR	$100.00	$21,000.00
Project Engineer	210	HR	$110.00	$23,100.00
Field Technician	410	HR	$80.00	$32,800.00
Site Work				**$351,974.33**
Clearing & Grubbing	2.80	AC	$7,125.00	$19,971.59
Stream Diversion Pipe	3,200.00	FT	$49.45	$158,240.00
Stream Diversion Pipe Inlet Sandbags	160.00	EA	$4.51	$721.60
Stream Diversion Outlet Rip Rap	173.11	SY	$75.75	$13,113.17
Stream Diversion Outlet Geotextile Fabric	173.11	SY	$2.36	$408.54
Stream Diversion Outlet Crushed Stone	7.21	CY	$42.00	$302.94
Stream Diversion Pump	1.00	EA	$65,124.80	$65,124.80
Erosion and Sediment Controls	3,200.00	LF	$7.47	$23,891.68
Foot Bridge Removal	400.00	SF	$21.50	$8,600.00
Foot Bridge Replacement	400.00	SF	$154.00	$61,600.00
Excavation and Backfilling				**$7,295,826.52**
Excavator	27,360	CY	$2.34	$64,022.40
12 CY Waste Disposal Transport (Truck)	14,029	CY	$12.60	$176,767.92
Soil Stabilization, portland cement	1,094	SY	$19.75	$21,614.40
Backfill (delivery and placement)	27,360	CY	$44.24	$1,210,406.40
Confirmatory Sampling (Cadmium)	100	EA	$60.00	$6,000.00
Waste Characterization Sampling	55	EA	$466.00	$25,630.00
Backfill Characterization Sampling	35	EA	$1,000.00	$35,000.00
Hazardous Transport and Disposal Facility Fee	17,977	TON	$284.05	$5,106,361.75
Non-Hazardous Disposal Facility Fee	16,251	TON	$40.00	$650,023.65
Restoration				**$461,901.86**
Wetland Restoration	0.90	AC	$106,199.73	$95,813.81
Tree Restoration	434.00	EA	$736.65	$319,707.60
Grading and Seeding	9,200.00	SY	$5.04	$46,380.45
Design (15% Capital)				**$1,360,722.26**
Contingency (30% Capital)				**$2,721,444.51**
Total Capital for Excavation with Off-site Disposal				**$13,153,648.48**
Present Value OM&M Costs				**$0.00**
Total Capital and Present Value Costs for Excavation with Off-site Disposal				**$13,153,648.48**
Total Costs for all elements				**$13,153,648.48**

Assumptions - greater than 9 mg/kg Excavation Alternative

Clearing & Grubbing	$19,971.59	$, Source: RS Means 2013 estimate, clear & grub brush including stumps
Wetland Restoration	$106,199.73	ACRE, Source: Bloody Brook Appendix J Cost Estimate Summary Remedial Alternative 2
Tree Restoration	$736.65	EA, Source: Bloody Brook Appendix J Cost Estimate Summary Remedial Alternative 3
Tree Restoration Quantity	434	EA, Source: Engineering judgement, estimate number of trees within a 4225 ft^2 area within the excavation area foot print and multiplied the sum of the planned excavation area foot print (e.g. creek, wetlands additional, wetlands contaminated, and wetlands unknown).
Grading and Seeding	$5.04	SY, Source: Bloody Brook Appendix J Cost Estimate Summary Remedial Alternative 4
Grading and Seeding Quantity	9200	SY, Source: Engineering judgement, assumed seeded areas to be within the creek delineation area.
Foot Bridge Removal	$21.50	SF, Source: RS Means 2013 estimate: Bridge demolition, bridges, pedestrial, precast, 60' to 150' long.
Foot Bridge Replacement	$154.00	SF, Source: RS Means 2013 estimate: Bridges, pedestrian, spans over streams, roadways, etc., including erection, not including foundations, Pre cast concrete, complete in place 8' wide, 60' span.
Foot Bridge Quantity	400	SF, Source: Engineering judgement, estimated foot bridge length and width to be 50 ft by 8 ft, respectively, in google earth.
Max Rainfall Event	12	in, Source: August 2014 storm.
Stream Diversion Pipe Length	3200	FT, Source: engineering estimate, google earth and Alternative Analysis Report Excavation delineation Figure 5
Stream Diversion Pipe Unit Cost	$49.45	LF, Source: RS Means 2013 estimate: HDPE Type S Corrugated Piping 36" diameter. Includes bell & spigot connection. Excludes elbows, excavation and backfill.
Stream Diversion Sandbags to capture headwaters	$4.51	EA, Source: Granview Block & Gravel, assumed 50 pound sand bags
Stream Diversion Sandbags to capture headwaters Quantity	160	EA, Source: Engineering judgement, assumed stream width 40 feet at headwaters. Assumed sandbag length to be 2 feet long; assumed bag wall on each side of pipe inlet to be 3 bag rows high and 2 columns thick.
Stream Diversion Outlet Riprap Apron Quantity	1558	SF, Source: Bloody Brook Discharge pipe design/NYSDEC standards and specifications for E&S control figure 5B.12
Riprap	$75.75	SY, Source: Engineering judgement, RS Means 2013 18" minimum thickness, not grouted.
Geotextile Woven Fabric	$2.36	SY, Source: Engineering judgement, RS Means 2013 Geotextile fabric, woven, heavy duty, 600 lb. tensile strength
Crushed Stone	$42.00	CY, Source: Engineering judgement to protect geotextile fabric; RS Means 2013 spread, with 200 H.P. dozer, no compaction, 2 mi. RT haul,
		crushed stone (1.40 tons per CY), 1.5" size stone
Crushed Stone Quantity	7.2	CY, Source: Engineering judgement, assume 1.5 inch depth (1 layer of stone) with surface area equal to the rip rap apron above
Storm Diversion Pump	$65,124.80	EA, Source: Engineering judgement/ Godwin Pumps. Assumed CD250M diesel pump, on skid, capable of flow rates to 3720 gpm. Assumed purchase of pump, excludes pipe installation costs.
Erosion and Sediment Controls	$7.47	LF, Source: Bloody Brook Appendix J Cost Estimate Summary Remedial Alternative 2. Assumed E&S controls
Erosion and Sediment Control Quantity	3200	LF, Source: Engineering judgement, assumed distance between points in the excavation boundary that were furtherest apart.
Mobilize/Demobilize Labor, Miscellaneous equipment and facilities	$796,137.00	EA, Source: Bloody Brook Appendix J Cost Estimate Summary Remedial Alternative 2
Submittals/Implementation Plans/Bonds	$41,331.00	EA, Source: Bloody Brook Appendix J Cost Estimate Summary Remedial Alternative 2
Closeout Reporting	$22,211.00	EA, Source: Bloody Brook Appendix J Cost Estimate Summary Remedial Alternative 2
Project Schedule	105	DAY, Source: Engineering judgement: assume 2 months for planning and design, 45 days for construction, 1 month for project close out. Total= 6 months
Work Hours per day	10	HR/day, Source: engineering judgement
Work Days per Week	5	Day/Wk, Source: engineering judgement
Creek (>9 mg/kg) Delineation Excavation Area	82,800	sf
Wetlands Contaminated Excavation Area	3,800	sf
Wetlands Additional Area	8,200	sf
Wetlands Unknown Area	27,300	sf
Total Excavation Area	2.80	ACRE
Excavation Depth Range	0.5-2	ft.
Creek (>9 mg/kg) Delineation Excavation Volume	18360	CY
Wetlands Contaminated Excavation Volume	800	CY
Wetlands Additional Volume	2270	CY
Wetlands Unknown Volume	5930	CY
Non Hazardous Soil (>9 mg/kg)	12990	CY
Non Hazardous Soil (>9 mg/kg) with soil stabilization	14029	CY
Hazardous Soil (>90 mg/kg)	12250	CY
Hazardous Soil (>90 mg/kg) with soil stabilization	13230	CY
Hazardous Soil (>900 mg/kg)	2120	CY
Hazardous Soil (>900 mg/kg) with soil stabilization	2290	CY

Assumptions - greater than 9 mg/kg Excavation Alternative

Excavation Rate	673	CY/Day, RS Means estimate 3CY excavator -15% of loading
Excavation Duration	41	DAY, Soure: engineering judgement
12 CY Waste Disposal Transport (Truck)	12.6	$/CY, Source: RS Means 2013, 12 C.Y. truck 35 mph ave, cycle 20 miles
Excavator	2.34	$/CY, Source: RS Means 2013 Excavator , Hydraulic, Crawler, 3 CY Capacity=300 CY/Hr for wet excavation

Assumptions - greater than 9 mg/kg Excavation Alternative

Drive Time to/from landfill	0.83	Hr, Source: engineering judgement, assume Smith Town Landfill as disposal site
Soil Stabilization, portland cement	8%	CY, Source: Portland cement addition rate assumed from New Jersey Case Study discussed in "Solidification/Stabilization Treatment and Examples of Use at Port Facilities by Charles M. Wilk, LEHP, QEP
Soil Stabilization, Portland cement	$19.75	SY, Source: engineering judgement; RS Means 2013 Cement Soil Stabilization, Cement, 9% by mix, 12" deep. Includes scarifying and compaction
Backfill (delivery and placement)	$44.24	CY, Source: Midtown Feasibility Study Cost Estimate, App B costs Alternative S2A.
Confirmatory Sampling (Cadmium)	$60.00	EA, Source: Phoenix Environmental, US EPA Method 6010 analytical cost for standard TAT sample
Confirmatory Samples	100	EA, Source: Engineering judgement, assumed the number of sediment samples taken within the excavation boundary (>90 mg/kg) boundary illustrated in the AAR Figure 5.
Waste Characterization Sampling	$466.00	EA, Source: Phoenix Environmental, analytical cost for standard TAT sample: GRO/DRO, VOCs, SVOCs, PCBs, Metals (including cadmium), Cyanide, Sulfur, and BTU ASTM D240-87.
Waste Characterization Sample	55	EA, Source: Engineering judgement, assume one grab sample per 500 CY; analytes assumed to be those required by ESMI: GRO/DRO, VOCs, SVOCs, PCBs, Metals (including cadmium), Cyanide, Sulfur, and BTU ASTM D240-87.
Backfill Characterization Sampling	$1,000.00	EA, Source: STM
Backfill Characterization Sampling Quantity	35	Source: DER-10, page 158 of 226, 3 (ii)(1): 7 discrete samples (VOCs), 2 (SVOCs, inorganics, &PCBs/pesticides), plus additional 2 VOC and 1 composite for each additional 1000 cubic yards. Assume 7 samples and 2 composites as seven sample suite, plus additional 2 VOCs and 1 composite as one suite. Thus, 7+(1*((27360CY/1000CY)*1)= 35
Soil Density	1.375	g/cc, Source: Engineering judgement, took average of bulk density estimated from NRCS websoil survey conducted at the site.
Ton="Short ton", 1 short ton= 907185 grams		Source: Engineering judgement, engineer's toolbox http://www.engineeringtoolbox.com/unit-converter-d_185.html#Mass
1 cubic yard= 764239.4 cubic centimeters		Source: Engineering judgement, engineer's toolbox http://www.engineeringtoolbox.com/unit-converter-d_185.html#Mass
Disposal Facility Fee	$40.00	Ton, Source: STM
Hazardous Soil Transportation and Disposal Fee	$284.05	Ton, Source: SAU, assume 2008 Michigan disposal fee of $105, plus $142 transportation fee and 15% appreciation to 2015 cost.
Project Manager Rate	$150.00	HR, Source: Midtown Feasibility Study Cost Estimate, App B costs Alternative S2A.
Project Manager Quantity	168	HR, Source: engineering judgement/STM. Assume 8 hours of work per week over entire project schedule.
Project Scientist Rate	$100.00	HR, Source: Midtown Feasibility Study Cost Estimate, App B costs Alternative S2A.
Project Scientist Quantity	210	HR, Source: engineering judgement/STM. Assume 10 hours of work per week during entire project.
Project Engineer Rate	$110.00	HR, Source: Midtown Feasibility Study Cost Estimate, App B costs Alternative S2A.
Project Engineer Quantity	210	HR, Source: engineering judgement/STM. Assume 10 hours of work per week during entire project.
Field Technician Rate	$80.00	HR, Source: Midtown Feasibility Study Cost Estimate, App B costs Alternative S2A.
Field Technician Quantity	410	HR, Source: Engineering judgement; assume 10-hours of work per day for excavation
Contingency (30%)		EA, Source: Engineering judgement, includes all excavation and backfilling items except waste disposal fees; 30% sourced from Midtown Feasibility Study Cost Estimate, App B costs Alternative S2A.

APPENDIX A TABLE 2B
DZUS FASTENERS SITE (1-52-003)
SUMMARY OF RA-3B (>90 mg/kg) EXCAVATION ALTERNATIVE

Description	Quantity	Unit of Measure	Unit Cost	Extended Cost
Mobilization/De-Mobilization				**$929,659.00**
Mob/Demob Labor, Miscellaneous equipment and facilities	1	EA	$796,137.00	$796,137.00
Submittals/Implementation Plans/Bonds	1	EA	$41,331.00	$41,331.00
Closeout Reporting	1	EA	$22,211.00	$22,211.00
Project Manager	133	HR	$150.00	$19,920.00
Project Scientist	166	HR	$100.00	$16,600.00
Project Engineer	166	HR	$110.00	$18,260.00
Field Technician	190	HR	$80.00	$15,200.00
Site Work				**$288,834.00**
Clearing & Grubbing	1.53	AC	$7,125.00	$10,901.61
Stream Diversion Pipe	2,250.00	FT	$49.45	$111,262.50
Stream Diversion Pipe Inlet Sandbags	160.00	EA	$4.51	$721.60
Stream Diversion Outlet Rip Rap	173.11	SY	$75.75	$13,113.17
Stream Diversion Outlet Geotextile Fabric	173.11	SY	$2.36	$408.54
Stream Diversion Outlet Crushed Stone	7.21	CY	$42.00	$302.94
Stream Diversion Pump	1.00	EA	$65,124.80	$65,124.80
Erosion and Sediment Controls	2,250.00	LF	$7.47	$16,798.84
Foot Bridge Removal	400.00	SF	$21.50	$8,600.00
Foot Bridge Replacement	400.00	SF	$154.00	$61,600.00
Excavation and Backfilling				**$4,969,994.87**
Excavator	12,250	CY	$2.34	$28,665.00
Soil Stabilization, portland cement	490	SY	$19.75	$9,677.50
Backfill (delivery and placement)	12,250	CY	$44.24	$541,940.00
Confirmatory Sampling (Cadmium)	84	EA	$60.00	$5,040.00
Waste Characterization Sampling	25	EA	$466.00	$11,650.00
Backfill Characterization Sampling	20	EA	$1,000.00	$20,000.00
Hazardous Disposal Transportation and Facilit	15,325	TON	$284.05	$4,353,022.37
Restoration				**$254,451.98**
Wetland Restoration	0.52	AC	$106,199.73	$55,218.50
Tree Restoration	237.00	EA	$736.65	$174,586.87
Grading and Seeding	4,888.89	SY	$5.04	$24,646.62
Design (15% Capital)				**$966,440.98**
Contingency (30% Capital)				**$1,932,881.96**
Total Capital for Excavation with Off-site Disposal				**$9,342,262.79**
Present Value OM&M Costs				**$0.00**
Total Capital and Present Value Costs for Excavation with Off-site Disposal				**$9,342,262.79**
Total Costs for all elements				**$9,342,262.79**

Assumptions - greater than 90 mg/kg Excavation Alternative

Clearing & Grubbing	$10,901.61	$, Source: RS Means 2013 estimate, clear & grub brush including stumps
Wetland Restoration	$106,199.73	ACRE, Source: Bloody Brook Appendix J Cost Estimate Summary Remedial Alternative 2
Tree Restoration	$736.65	EA, Source: Bloody Brook Appendix J Cost Estimate Summary Remedial Alternative 3
Tree Restoration Quantity	237	EA, Source: Engineering judgement, estimate number of trees within a 4225 ft^2 area within the excavation area foot print and multiplied the sum of the planned excavation area foot print (e.g. creek, wetlands additional, wetlands contaminated, and wetlands unknown).
Grading and Seeding	$5.04	SY, Source: Bloody Brook Appendix J Cost Estimate Summary Remedial Alternative 4
Grading and Seeding Quantity	4889	SY, Source: Engineering judgement, assumed seeded areas to be within the creek delineation area.
Foot Bridge Removal	$21.50	SF, Source: RS Means 2013 estimate: Bridge demolition, bridges, pedestrial, precast, 60' to 150' long.
Foot Bridge Replacement	$154.00	SF, Source: RS Means 2013 estimate: Bridges, pedestrian, spans over streams, roadways, etc., including erection, not including foundations, Pre cast concrete, complete in place 8' wide, 60' span.
Foot Bridge Quantity	400	SF, Source: Engineering judgement, estimated foot bridge length and width to be 50 ft by 8 ft, respectively, in google earth.
Max Rainfall Event	12	in, Source: Paul Kareth.
Stream Diversion Pipe Length	2250	FT, Source: engineering estimate, google earth and Alternative Analysis Report Excavation delineation Figure 5
Stream Diversion Pipe Unit Cost	$49.45	LF, Source: RS Means 2013 estimate: HDPE Type S Corrugated Piping 36" diameter. Includes bell & spigot connection. Excludes elbows, excavation and backfill.
Stream Diversion Sandbags to capture headwaters	$4.51	EA, Source: Granview Block & Gravel, assumed 50 pound sand bags
Stream Diversion Sandbags to capture headwaters Quantity	160	EA, Source: Engineering judgement, assumed stream width 40 feet at headwaters. Assumed sandbag length to be 2 feet long; assumed bag wall
		on each side of pipe inlet to be 3 bag rows high and 2 columns thick.
Stream Diversion Outlet Riprap Apron Quantity	1558	SF, Source: Bloody Brook Discharge pipe design/NYSDEC standards and specifications for E&S control figure 5B.12
Riprap	$75.75	SY, Source: Engineering judgement, RS Means 2013 18" minimum thickness, not grouted.
Geotextile Woven Fabric	$2.36	SY, Source: Engineering judgement, RS Means 2013 Geotextile fabric, woven, heavy duty, 600 lb. tensile strength
Crushed Stone	$42.00	CY, Source: Engineering judgement to protect geotextile fabric; RS Means 2013 spread, with 200 H.P. dozer, no compaction, 2 mi. RT haul, crushed stone (1.40 tons per CY), 1.5" size stone
Crushed Stone Quantity	7.2	CY, Source: Engineering judgement, assume 1.5 inch depth (1 layer of stone) with surface area equal to the rip rap apron above
Storm Diversion Pump	$65,124.80	EA, Source: Engineering judgement/ Godwin Pumps. Assumed CD250M diesel pump, on skid, capable of flow rates to 3720 gpm. Assumed purchase of pump, excludes pipe installation costs.
Erosion and Sediment Controls	$7.47	LF, Source: Bloody Brook Appendix J Cost Estimate Summary Remedial Alternative 2. Assumed E&S controls
Erosion and Sediment Control Quantity	2250	LF, Source: Engineering judgement, assumed distance between points in the excavation boundary that were furtherest apart.
Mobilize/Demobilize Labor, Miscellaneous equipment and facilities	$796,137.00	EA, Source: Bloody Brook Appendix J Cost Estimate Summary Remedial Alternative 2
Submittals/Implementation Plans/Bonds	$41,331.00	EA, Source: Bloody Brook Appendix J Cost Estimate Summary Remedial Alternative 2
Closeout Reporting	$22,211.00	EA, Source: Bloody Brook Appendix J Cost Estimate Summary Remedial Alternative 2
Project Schedule	83	DAY, Source: Engineering judgement: assume 2 months for planning and design, 45 days for construction, 1 month for project close out. Total= 6 months
Work Hours per day	10	HR/day, Source: engineering judgement
Work Days per Week	5	Day/Wk, Source: engineering judgement
Creek (>9 mg/kg) Delineation Excavation Area	44,000	sf
Wetlands Contaminated Excavation Area	249	sf
Wetlands Additional Area	6,800	sf
Wetlands Unknown Area	15,600	sf
Total Excavation Area	1.53	ACRE
Excavation Depth Range	0.5-2	ft.
Creek (>9 mg/kg) Delineation Excavation Volume	8160	CY
Wetlands Contaminated Excavation Volume	50	CY
Wetlands Additional Volume	1240	CY
Wetlands Unknown Volume	2800	CY
Total Hazardous Excavated Soil	12250	CY
Total Hazardous Excavated Soil with soil stabilization	13230	CY, assumed with soil stabilization
Excavation Rate	673	CY/Day, RS Means estimate 3CY excavator -15% of loading
Excavation Duration	19	DAY, Soure: engineering judgement

Assumptions - greater than 90 mg/kg Excavation Alternative

Excavator	2.34	$/CY, Source: RS Means 2013 Excavator , Hydraulic, Crawler, 3 CY Capacity=300 CY/Hr for wet excavation
Drive Time to/from landfill	0.83	Hr, Source: engineering judgement, assume Smith Town Landfill as disposal site
Soil Stabilization, portland cement	8%	CY, Source: Portland cement addition rate assumed from New Jersey Case Study discussed in "Solidification/Stabilization Treatment and Examples of Use at Port Facilities by Charles M. Wilk, LEHP, QEP
Soil Stabilization, Portland cement	$19.75	SY, Source: engineering judgement; RS Means 2013 Cement Soil Stabilization, Cement, 9% by mix, 12" deep. Includes scarifying and compaction
Backfill (delivery and placement)	$44.24	CY, Source: Midtown Feasibility Study Cost Estimate, App B costs Alternative S2A.
Confirmatory Sampling (Cadmium)	$60.00	EA, Source: Phoenix Environmental, US EPA Method 6010 analytical cost for standard TAT sample
Confirmatory Samples	84	EA, Source: Engineering judgement, assumed the number of sediment samples taken within the excavation boundary (>90 mg/kg) boundary illustrated in the AAR Figure 5.
Waste Characterization Sampling	$466.00	EA, Source: Phoenix Environmental, analytical cost for standard TAT sample: GRO/DRO, VOCs, SVOCs, PCBs, Metals (including cadmium), Cyanide, Sulfur, and BTU ASTM D240-87.
Waste Characterization Sample	25	EA, Source: Engineering judgement, assume one grab sample per 500 CY; analytes assumed to be those required by ESMI: GRO/DRO, VOCs, SVOCs, PCBs, Metals (including cadmium), Cyanide, Sulfur, and BTU ASTM D240-87.
Backfill Characterization Sampling	$1,000.00	EA, Source: STM
Backfill Characterization Sampling Quantity	20	Source: DER-10, page 161 of 226, Table 5.4(e)10: 7 discrete samples (VOCs), 2 (SVOCs, inorganics, &PCBs/pesticides), plus additional 2 VOC and 1 composite for each additional 1000 cubic yards. Assume 7 samples and 2 composites as seven sample suite, plus additional 2 VOCs and 1 composite as one suite. Thus, 7+(1*((12250 CY/1000 CY)*1)= 20
Soil Density	1.375	g/cc, Source: Engineering judgement, took average of bulk density estimated from NRCS websoil survey conducted at the site.
Ton="Short ton", 1 short ton= 907185 grams		Source: Engineering judgement, engineer's toolbox http://www.engineeringtoolbox.com/unit-converter-d_185.html#Mass
1 cubic yard= 764239.4 cubic centimeters		Source: Engineering judgement, engineer's toolbox http://www.engineeringtoolbox.com/unit-converter-d_185.html#Mass
Hazardous Transportation and Disposal Facility Fee	$284.05	Ton, Source: SAU, assume 2008 Michigan disposal fee of $105, plus $142 transportation fee and 15% appreciation to 2015 cost.
Project Manager Rate	$150.00	HR, Source: Midtown Feasibility Study Cost Estimate, App B costs Alternative S2A.
Project Manager Quantity	132.8	HR, Source: engineering judgement/STM. Assume 8 hours of work per week over entire project schedule.
Project Scientist Rate	$100.00	HR, Source: Midtown Feasibility Study Cost Estimate, App B costs Alternative S2A.
Project Scientist Quantity	166	HR, Source: engineering judgement/STM. Assume 10 hours of work per week during entire project.
Project Engineer Rate	$110.00	HR, Source: Midtown Feasibility Study Cost Estimate, App B costs Alternative S2A.
Project Engineer Quantity	166	HR, Source: engineering judgement/STM. Assume 10 hours of work per week during entire project.
Field Technician Rate	$80.00	HR, Source: Midtown Feasibility Study Cost Estimate, App B costs Alternative S2A.
Field Technician Quantity	190	HR, Source: Engineering judgement; assume 10-hours of work per day for excavation
Contingency (30%)		EA, Source: Engineering judgement, includes all excavation and backfilling items except waste disposal fees; 30% sourced from Midtown Feasibility Study Cost Estimate, App B costs Alternative S2A.

APPENDIX A TABLE 2C
DZUS FASTENERS SITE (1-52-003)
SUMMARY OF RA-3C (>900 mg/kg) EXCAVATION ALTERNATIVE

Description	Quantity	Unit of Measure	Unit Cost	Extended Cost
Mobilization/De-Mobilization				**$907,759.00**
Mob/Demob Labor, Miscellaneous equipment and facilities	1	EA	$796,137.00	$796,137.00
Submittals/Implementation Plans/Bonds	1	EA	$41,331.00	$41,331.00
Closeout Reporting	1	EA	$22,211.00	$22,211.00
Project Manager	109	HR	$150.00	$16,320.00
Project Scientist	136	HR	$100.00	$13,600.00
Project Engineer	136	HR	$110.00	$14,960.00
Field Technician	40	HR	$80.00	$3,200.00
Site Work				**$112,954.10**
Clearing & Grubbing	0.28	AC	$7,125.00	$1,979.17
Erosion and Sediment Controls	550.00	LF	$7.47	$4,106.38
Stream Diversion Pipe	550.00	FT	$49.45	$27,197.50
Stream Diversion Pipe Inlet Sandbags	160.00	EA	$4.51	$721.60
Stream Diversion Outlet Rip Rap	173.11	SY	$75.75	$13,113.17
Stream Diversion Outlet Geotextile Fabric	173.11	SY	$2.36	$408.54
Stream Diversion Outlet Crushed Stone	7.21	CY	$42.00	$302.94
Stream Diversion Pump	1.00	EA	$65,124.80	$65,124.80
Excavation and Backfilling				**$1,396,611.25**
Excavator	2,120	CY	$2.34	$4,960.80
Soil Stabilization, portland cement	85	SY	$19.75	$1,674.80
Backfill (delivery and placement)	2,120	CY	$44.24	$93,788.80
Confirmatory Sampling (Cadmium)	84	EA	$60.00	$5,040.00
Waste Characterization Sampling	5	EA	$466.00	$2,330.00
Backfill Characterization Sampling	10	EA	$1,000.00	$10,000.00
Hazardous Disposal and Transportation Facility F	4,502	TON	$284.05	$1,278,816.85
Restoration				**$46,153.14**
Wetland Restoration	0.09	AC	$106,199.73	$9,995.84
Tree Restoration	43.00	EA	$736.65	$31,676.10
Grading and Seeding	888.89	SY	$5.04	$4,481.20
Design (15% Capital)				**$369,521.62**
Contingency (30% Capital)				**$739,043.25**
Total Capital for Excavation with Off-site Disposal				**$3,572,042.37**
Present Value OM&M Costs				**$0.00**
Total Capital and Present Value Costs for Excavation with Off-site Disposal				**$3,572,042.37**
Total Costs for all elements				**$3,572,042.37**

Assumptions - greater than 900 mg/kg Excavation Alternative

Clearing & Grubbing	$1,979.17	$, Source: RS Means 2013 estimate, clear & grub brush including stumps
Wetland Restoration	$106,199.73	ACRE, Source: Bloody Brook Appendix J Cost Estimate Summary Remedial Alternative 2
Tree Restoration	$736.65	EA, Source: Bloody Brook Appendix J Cost Estimate Summary Remedial Alternative 3
Tree Restoration Quantity	43	EA, Source: Engineering judgement, estimate number of trees within a 4225 ft^2 area within the excavation area foot print and multiplied the sum of the planned excavation area foot print (e.g. creek, wetlands additional, wetlands contaminated, and wetlands unknown).
Grading and Seeding	$5.04	SY, Source: Bloody Brook Appendix J Cost Estimate Summary Remedial Alternative 4
Grading and Seeding Quantity	889	SY, Source: Engineering judgement, assumed seeded areas to be within the creek delineation area.
Max Rainfall Event	12	in, Source: August 2014 storm event that produced approximately 12-inches of rain in a 24-hour period.
Stream Diversion Pipe Length	550	FT, Source: engineering estimate, google earth and Alternative Analysis Report Excavation delineation Figure 5
Stream Diversion Pipe Unit Cost	$49.45	LF, Source: RS Means 2013 estimate: HDPE Type S Corrugated Piping 36" diameter. Includes bell & spigot connection. Excludes elbows, excavation and backfill.
Stream Diversion Sandbags to capture headwaters	$4.51	EA, Source: Granview Block & Gravel, assumed 50 pound sand bags
Stream Diversion Sandbags to capture headwaters Quantity	160	EA, Source: Engineering judgement, assumed stream width 40 feet at headwaters. Assumed sandbag length to be 2 feet long; assumed bag wall on each side of pipe inlet to be 3 bag rows high and 2 columns thick.
Stream Diversion Outlet Riprap Apron Quantity	1558	EA, Source: Engineering judgement, assumed stream width 40 feet at headwaters. Assumed sandbag length to be 2 feet long; assumed bag wall on each side of pipe inlet to be 3 bag rows high and 2 columns thick.
Riprap	$75.75	SY, Source: Engineering judgement, RS Means 2013 18" minimum thickness, not grouted.
Geotextile Woven Fabric	$2.36	SY, Source: Engineering judgement, RS Means 2013 Geotextile fabric, woven, heavy duty, 600 lb. tensile strength
Crushed Stone	$42.00	CY, Source: Engineering judgement to protect geotextile fabric; RS Means 2013 spread, with 200 H.P. dozer, no compaction, 2 mi. RT haul, crushed stone (1.40 tons per CY), 1.5" size stone
Crushed Stone Quantity	7.2	CY, Source: Engineering judgement, assume 1.5 inch depth (1 layer of stone) with surface area equal to the rip rap apron above
Storm Diversion Pump	$65,124.80	EA, Source: Engineering judgement/ Godwin Pumps. Assumed CD250M diesel pump, on skid, capable of flow rates to 3720 gpm. Assumed purchase of pump, excludes pipe installation costs.
Erosion and Sediment Controls	$7.47	LF, Source: Bloody Brook Appendix J Cost Estimate Summary Remedial Alternative 2. Assumed E&S controls
Erosion and Sediment Control Quantity	550	LF, Source: Engineering judgement, assumed distance between points in the excavation boundary that were furtherest apart.
Mobilize/Demobilize Labor, Miscellaneous equipment and facilities	$796,137.00	EA, Source: Bloody Brook Appendix J Cost Estimate Summary Remedial Alternative 2
Submittals/Implementation Plans/Bonds	$41,331.00	EA, Source: Bloody Brook Appendix J Cost Estimate Summary Remedial Alternative 2
Closeout Reporting	$22,211.00	EA, Source: Bloody Brook Appendix J Cost Estimate Summary Remedial Alternative 2
Project Schedule	68	DAY, Source: Engineering judgement: assume 2 months for planning and design, 45 days for construction, 1 month for project close out: Total= 6 months
Work Hours per day	10	HR/day, Source: engineering judgement
Work Days per Week	5	Day/Wk, Source: engineering judgement
Creek (>9 mg/kg) Delineation Excavation Area	8,000	sf
Wetlands Contaminated Excavation Area	0	sf
Wetlands Additional Area	3,400	sf
Wetlands Unknown Area	700	sf
Total Excavation Area	0.28	ACRE
Excavation Depth Range	0.5-2	ft.
Creek (>9 mg/kg) Delineation Excavation Volume	1430	CY
Wetlands Contaminated Excavation Volume	0	CY
Wetlands Additional Volume	570	CY
Wetlands Unknown Volume	120	CY
Total Hazardous Excavated Soil	2120	CY
Total Hazardous Excavated Soil with soil stabilization	3887	CY, assumed with soil stabilization
Excavation Rate	673	CY/Day, RS Means estimate 3CY excavator -15% of loading
Excavation Duration	4	DAY, Soure: engineering judgement
12 CY Waste Disposal Transport (Truck)	12.6	$/CY, Source: RS Means 2013, 12 C.Y. truck 35 mph ave, cycle 20 miles
Excavator	2.34	$/CY, Source: RS Means 2013 Excavator , Hydraulic, Crawler, 3 CY Capacity=300 CY/Hr for wet excavation
Drive Time to/from landfill	0.83	Hr, Source: engineering judgement, assume Smith Town Landfill as disposal site

Assumptions - greater than 900 mg/kg Excavation Alternative

Soil Stabilization, portland cement	8%	CY, Source: Portland cement addition rate assumed from New Jersey Case Study discussed in "Solidification/Stabilization Trewatment and Examples of Use at Port Facilities by Charles M. Wilk, LEHP, QEP
Soil Stabilization, Portland cement	$19.75	SY, Source: engineering judgement; RS Means 2013 Cement Soil Stabilization, Cement, 9% by mix, 12" deep. Includes scarifying and compaction
Backfill (delivery and placement)	$44.24	CY, Source: Midtown Feasibility Study Cost Estimate, App B costs Alternative S2A.
Confirmatory Sampling (Cadmium)	$60.00	EA, Source: Phoenix Environmental, US EPA Method 6010 analytical cost for standard TAT sample
Confirmatory Samples	84	EA, Source: Engineering judgement, assumed the number of sediment samples taken within the excavation boundary (>90 mg/kg) boundary illustrated in the AAR Figure 5.
Waste Characterization Sampling	$466.00	EA, Source: Engineering judgement, assumed the number of sediment samples taken within the excavation boundary (>90 mg/kg) boundary illustrated in the AAR Figure 5.
Waste Characterization Sample	5	EA, Source: Engineering judgement, assume one grab sample per 500 CY; analytes assumed to be those required by ESMI: GRO/DRO, VOCs, SVOCs, PCBs, Metals (including cadmium), Cyanide, Sulfur, and BTU ASTM D240-87.
Backfill Characterization Sampling	$1,000.00	EA, Source: STM
Backfill Characterization Sampling Quantity	10	Source: DER-10, page 161 of 226, Table 5.4(e)10: 7 discrete samples (VOCs), 2 (SVOCs, inorganics, &PCBs/pesticides), plus additional 2 VOC and 1 composite for each additional 1000 cubic yards. Assume 7 samples and 2 composites as seven sample suite, plus additional 2 VOCs and 1 composite as one suite. Thus, 7+(1*((2120 CY/1000 CY)*1)=10
Soil Density	1.375	g/cc, Source: Engineering judgement, took average of bulk density estimated from NRCS websoil survey conducted at the site.
Ton="Short ton", 1 short ton= 907185 grams		Source: Engineering judgement, engineer's toolbox http://www.engineeringtoolbox.com/unit-converter-d_185.html#Mass
1 cubic yard= 764239.4 cubic centimeters		Source: Engineering judgement, engineer's toolbox http://www.engineeringtoolbox.com/unit-converter-d_185.html#Mass
Disposal Facility Fee	$284.05	Ton, Source: SAU, assume 2008 Michigan disposal fee of $105, plus $142 transportation fee and 15% appreciation to 2015 cost.
Project Manager Rate	$150.00	HR, Source: Midtown Feasibility Study Cost Estimate, App B costs Alternative S2A.
Project Manager Quantity	108.8	HR, Source: engineering judgement/STM. Assume 8 hours of work per week over entire project schedule.
Project Scientist Rate	$100.00	HR, Source: Midtown Feasibility Study Cost Estimate, App B costs Alternative S2A.
Project Scientist Quantity	136	HR, Source: engineering judgement/STM. Assume 10 hours of work per week during entire project.
Project Engineer Rate	$110.00	HR, Source: Midtown Feasibility Study Cost Estimate, App B costs Alternative S2A.
Project Engineer Quantity	136	HR, Source: engineering judgement/STM. Assume 10 hours of work per week during entire project.
Field Technician Rate	$80.00	HR, Source: Midtown Feasibility Study Cost Estimate, App B costs Alternative S2A.
Field Technician Quantity	40	HR, Source: Engineering judgement; assume 10-hours of work per day for excavation
Contingency (30%)		EA, Source: Engineering judgement, includes all excavation and backfilling items except waste disposal fees; 30% sourced from Midtown Feasibility Study Cost Estimate, App B costs Alternative S2A.