Northern Agency Tronox Mines

DRAFT FINAL
Appendix J
Drainage Investigation Report

Response, Assessment, and Evaluation Services (RAES)

Contract No. EP-S9-17-03

Task Order 0001

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Submitted to

U.S. Environmental Protection Agency

Submitted by

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ACRONYMS AND ABBREVIATIONS

µg/L	Micrograms per liter
ABA	Acid-base accounting
ADWR	Arizona Department of Water Resources
amsl	Above mean sea level
ANSI	American National Standard Institute
AUM	Abandoned uranium mine
bgs	Below ground surface
BSA	Background study area
BSA-3	Background study area 3
BSA-4	Background study area 4
BSA-34	Background study area 34
BSA-35	Background study area 35
BTV	Background threshold value
COPC	Contaminant of potential concern
cpm	Counts per minute
CSM	Conceptual site model
CWWA	Cove Wash Watershed Assessment
DEM	Digital elevation model
DQO	Data quality objective
EE/CA	Engineering evaluation/cost analysis
ERG	Environmental Restoration Group, Inc.
GPS	Global positioning system
HDOP	Horizontal dilution of precision
HPIC	High pressure ionization chamber
HUC	Hydrologic unit code
Jml	Jurassic Lower Morrison Formation
Jms	Salt Wash Member of the Morrison Formation
Js	Summerville Formation
Jse	Jurassic Summerville and Entrada Sandstone
Kerr-McGee	Kerr-McGee Oil Industries, Inc.
MARLAP	*Multi-Agency Radiation Laboratory Analytical Protocols Manual*
MARSSIM	*Multi-Agency Radiation Survey and Site Investigation Manual*
MCL	Maximum contaminant level
mg/kg	Milligrams per kilogram

ACRONYMNS AND ABBREVIATIONS (CONTINUED)

NaI	Sodium iodide
NAUM	Navajo Area Uranium Mines
Neptune	Neptune and Company, Inc.
NNEPA	Navajo Nation Environmental Protection Agency
NNSWQS	Navajo Nation Surface Water Quality Standard
NORM	Naturally occurring radioactive material
NRC	U.S. Nuclear Regulatory Commission
pCi/g	Picocuries per gram
pCi/L	Picocuries per liter
ppt $CaCO_3$	Tons of calcium carbonate equivalent per 1,000 tons of material
Qa	Quaternary alluvium
QA/QC	Quality assurance/quality control
RAES	Response, Assessment and Evaluation Services
RPM	Remedial Project Manager
RPP	Radiation protection program
RSE	Removal site evaluation
RSE Report	Northern Agency Tronox Mines Removal Site Evaluation Report
SAP/QAPP	Sampling and Analysis Plan/Quality Assurance Project Plan
SOP	Standard operating procedure
SPLP	Synthetic precipitation leaching procedure
SSRSE	Site-specific removal site evaluation
TCLP	Toxicity characteristic leaching procedure
TENORM	Technologically enhanced naturally occurring radioactive material
Tetra Tech	Tetra Tech, Inc.
Trw	Tertiary Wingate Sandstone
TSG	TerraSpectra Geomatics
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
USL 95	95 percent upper simultaneous limit
UTL 95-95	95 percent upper tolerance limit
Weston	Weston Solutions, Inc.
XRF	X-ray fluorescence

EXECUTIVE SUMMARY

This Drainage Investigation Report is Appendix J to the Removal Site Evaluation (RSE) report for the Northern Agency Tronox Mines. The purpose of this report is to document the data quality objectives (DQO), sampling and analytical methodology, and results of the drainage investigation conducted as part of the large-scale RSE investigation undertaken by Tetra Tech, Inc. (Tetra Tech), in support of the U.S. Environmental Protection Agency (USEPA) Region 9, between March 2018 and October 2018. The project involved the characterization of over 39 abandoned uranium mines (AUM), 37 Target sites, 22 miles of drainages, 9.8 miles of access roads and footpaths, and 32 background study areas (BSA).

This drainage field investigation was performed along 21 drainages to (1) determine whether contaminants are being transported from AUMs via surface water pathways; (2) evaluate drainages that may have been impacted from historic mining operations; and (3) determine whether contaminants of potential concern (COPC) in sediment and surface water samples exceed background levels for local drainages.

The drainage investigation involved collection of 176,210 gamma radiation measurements, 305 sediment samples within drainages, and 8 surface water samples (including two duplicates) in the vicinity of the Tronox mines. Gamma radiation measurements were made in June 2018 and sediment samples were collected in June, August, and September 2018. Surface water samples were collected from drainages containing surface water in September 2018. All sediment and surface water samples were analyzed for metals and radionuclides. Additional analyses were conducted to document potential leachability of metals and radionuclides from sediment, and to evaluate general water quality parameters in surface water.

An evaluation of gamma survey and sediment sampling results indicate that the majority of AUMs appear to contribute to elevated concentrations of mine-related contaminants. For each drainage, gamma measurements and the concentrations of primary analytes relative to applied background threshold values (BTV) were considered, as well as the concentrations of analytes at each sampling location relative to upgradient and downgradient samples. Table J-ES-1 identifies drainages with primary analytes and/or gamma radiation exceeding two times the applied BTV, which may be indicative of mining-related contamination that requires removal action or source control at individual AUMs. Table J-ES-1 also identifies mines that have waste piles that are within or adjacent to, or directly eroding into the drainage.

The conclusions from the drainage investigation are:

- Drainages are impacted from mining-related activities conducted within the Cove Valley Region and Lukachukai Mountains Region.
- The Tse Tah West drainage and Knife Edge drainage appear to be minimally impacted by mining-related activities in the drainage reaches where surveys and sampling were conducted.
- Offsite migration via the surface water pathway is occurring from multiple AUMs in a majority of the drainages. The most likely sources of contamination migrating into

drainages are waste piles eroding off cliffs into drainages, or from onsite waste piles that have local drainages passing through or along the base of the waste piles.

- Linear extents of radiological contamination within the drainages were well documented through gamma radiation surveys, and the full longitudinal extent of radiological contamination above the applied BTV levels has been delineated except for areas where there was a poor GPS signal or areas that were inaccessible because of waterfalls or other hazardous terrain.
- Each primary analytes exceeded background concentrations in sediment in at least one drainage. Concentrations of arsenic, lead, and thorium infrequently exceeded BTVs within the drainages.
- Radium-226, uranium, and vanadium, all strong indicators of mine waste, are present at elevated levels in sediment in the majority of the drainages.
- Surface water in the Middle 3 and Middle 3E drainages exceeded maximum background concentrations (Weston Solutions, Inc. [Weston] 2018) of molybdenum in all samples, and radium-226 at one of six sample locations, but did not exceed background concentrations of other primary analytes. Sufficient flow was not observed in other drainages in September 2018.
- Mine-related analyte concentrations identified during the Tetra Tech 2018 low-flow surface water sampling are generally similar to the Weston Cove Wash watershed study concentrations in 2015, 2016, and 2017 during both low and high flow regimes, with few exceptions (Weston 2018).

In general, the RSE investigation was successful at fulfilling most of the DQOs, and few data gaps remain for the drainages. The remaining data gaps will require further investigation in areas with poor GPS signal (portions of Cove Wash North, Middle 1, Middle 2, Middle 3, and Middle 3E drainages) to better understand the linear extent of contamination in these areas; however, advanced GPS-enabled equipment is necessary to complete the investigation in these areas, which was not available during the RSE investigation. The drainage east of the Knife Edge drainage was identified as containing a waste pile associated with Target T33 (KE-01), which has dropped over a cliff to a lower bench. Potential migration of the waste to the drainage several hundred feet below is not known. The drainage on the south side of Knife Edge mesa, where Target T33 (KE-01) is located, was not sampled; therefore, evaluation of primary analytes in sediment and gamma radiation levels remain a data gap for this site.

Table J-ES-1. Summary of Sediment Sampling and Gamma Survey Results Indicating Potential Impacts from Mine Waste Within and Adjacent to Drainages

Drainage ID[1]	Drainage Name	Mines with Mine Waste Within and Adjacent to Drainage [2, 3]	Soil Sampling Results Indicate Potential Impacts?	Gamma Survey Results Indicate Potential Impacts?
DM1	Tse Tah West	Brodie 1 (M1)	No (<2x BTV)	No (median <BTV)
DCWN	Cove Wash North	Mesa VI Mine (M13) Frank Jr. Mine (M14)	Yes (>2x BTV)	Yes, downgradient of Frank Jr. Mine (median <BTV, maximum value >2x BTV)
DC1	Middle 1	Mesa IV West Mine (M23)	Yes (>2x BTV)	Yes, in multiple areas downgradient of Middle 1D confluence (maximum value >2x BTV)
DC1A	Middle 1A	Mesa V Adit (M16) Mesa V-103 (M17)	Yes (>2x BTV)	Yes (maximum value >2x BTV)
DC1B	Middle 1B	Mesa V - 508 Mine (M18) Mesa IV 1/2 Mine and Simpson 181 (M19)	Yes (>2x BTV)	Yes (maximum value >2x BTV)
DC1G	Middle 1G	None	Yes (>2x BTV)	No (maximum value >2x BTV, median <BTV)
DT9	Cove Wash Middle	None	Yes (>2x BTV)	Yes (maximum value >2x BTV)
DC2, M21	Middle 2	None	Yes (>2x BTV)	Yes (maximum value >2x BTV)
DC2A	Middle 2A	None	Yes (>2x BTV)	No (median <BTV)
DC2B, M32	Middle 2B	Mesa II 1/2 Mine (M30) Mesa II 1/2 Mine 4 (M31) Mesa III Mine (M32)	Yes (>2x BTV)	Yes (maximum value >2x BTV)
DC3	Middle 3	None	Yes (>2x BTV)	Yes (maximum value >2x BTV)
DC3A	Middle 3A	None	Yes (>2x BTV)	Yes (maximum value >2x BTV)
DC3B, M28	Middle 3B	Mesa II Mine No. 1 and No. 2 and P-21 (M27) Mesa II Mine No. 1, P-150 (M28)	Yes (>2x BTV)	Yes (maximum value >2x BTV)

Table J-ES-1. Summary of Sediment Sampling and Gamma Survey Results Indicating Potential Impacts from Mine Waste within and Adjacent to Drainages (Continued)

Drainage ID[1]	Drainage Name	Mines with Mine Waste Within and Adjacent to Drainage [2, 3]	Soil Sampling Results Indicate Potential Impacts?	Gamma Survey Results Indicate Potential Impacts?
DC3C, M25	Middle 3C	Mesa I 3/4 Incline (M25)	Yes (>2x BTV)	Yes (maximum value >2x BTV)
DC3D	Middle 3D	Mesa I 1/2, West Mine (M12)	Yes (>2x BTV)	Yes (maximum value >2x BTV)
DC3E, M5, M7, M10	Middle 3E	Mesa I Mine 12 (M5) Target T16 (M1-04) Target T36 (M1-06) Mesa I 1/2 Mine (M10)	Yes (>2x BTV)	No (median <BTV)
DC3F, M6	Middle 3F	Mesa I Mine 10 (M3) Mesa I Mine 13 (M6) Mesa I Mine 15 (M8)	Yes (>2x BTV)	Yes (maximum value >2x BTV)
DC3G	Middle 3G	None	No (<2x BTV)	Yes (maximum value >2x BTV)
DM33	Knife Edge	None	Yes (>2x BTV)	No (maximum value <BTV)
DM35	Black Mesa	Black No.1 Mine (M34) Black No.2 Mine (M35)	Yes (>2x BTV)	No (maximum value <2xBTV)
DM39	Tommy James	None	Yes (>2x BTV)	No (maximum value <BTV)

Notes:

[1] Drainage IDs beginning with "M" indicate that an opportunistic sediment sample was collected downgradient of a waste pile associated with the mine with that Tetra Tech-assigned ID.

[2] Mines with unreclaimed waste piles within 500 feet of a field-mapped drainage where primary analyte concentrations or gamma activity showed increases in downgradient samples or measurements.

[3] M numbers in parentheses are Tetra Tech mine IDs.

BTV Background threshold value

1.0 INTRODUCTION

This Drainage Investigation Report is included as Appendix J of the Northern Agency Tronox Mines Removal Site Evaluation Report (RSE Report). This Drainage Investigation Report presents and documents the objectives, methodology, and results of the drainage investigation performed within drainages originating on mesas containing Northern Agency Tronox Mines, by Tetra Tech, Inc. (Tetra Tech), in support of the U.S. Environmental Protection Agency (USEPA) under Task Order 0001 of the Response, Assessment, and Evaluation Services (RAES) contract (EP-S9-17-03). The data generated during this investigation will be used to assist in developing and evaluating cleanup options in the engineering evaluation/cost analysis (EE/CA).

Under Task Order 0001, Tetra Tech conducted removal site evaluation (RSE) field investigations at 39 abandoned uranium mine (AUM) sites and 37 Target sites previously operated by, or likely associated with, Kerr-McGee Oil Industries, Inc. (Kerr-McGee), or its successor, Tronox (both Kerr-McGee and Tronox referred to herein collectively as "Tronox") at the Northern Agency Tronox Mines. "Targets" include lands potentially contaminated from mine-related waste resulting from Tronox operations that are (1) related to AUM sites ("AUM-related sites") or (2) identified by USEPA as requiring additional characterization ("non-AUM targets"). In addition, Tetra Tech evaluated potential migration pathways including drainages and mine roads that may have been impacted from historic mining operations. Appendix H presents site-specific removal site evaluation (SSRSE) reports for each AUM site, Appendix I presents the Target sites evaluation report, and Appendix K presents the access road investigation report. This appendix presents the results of the drainage investigation, which includes evaluation of gamma radiation survey data, sediment samples, and surface water samples collected within 21 drainages.

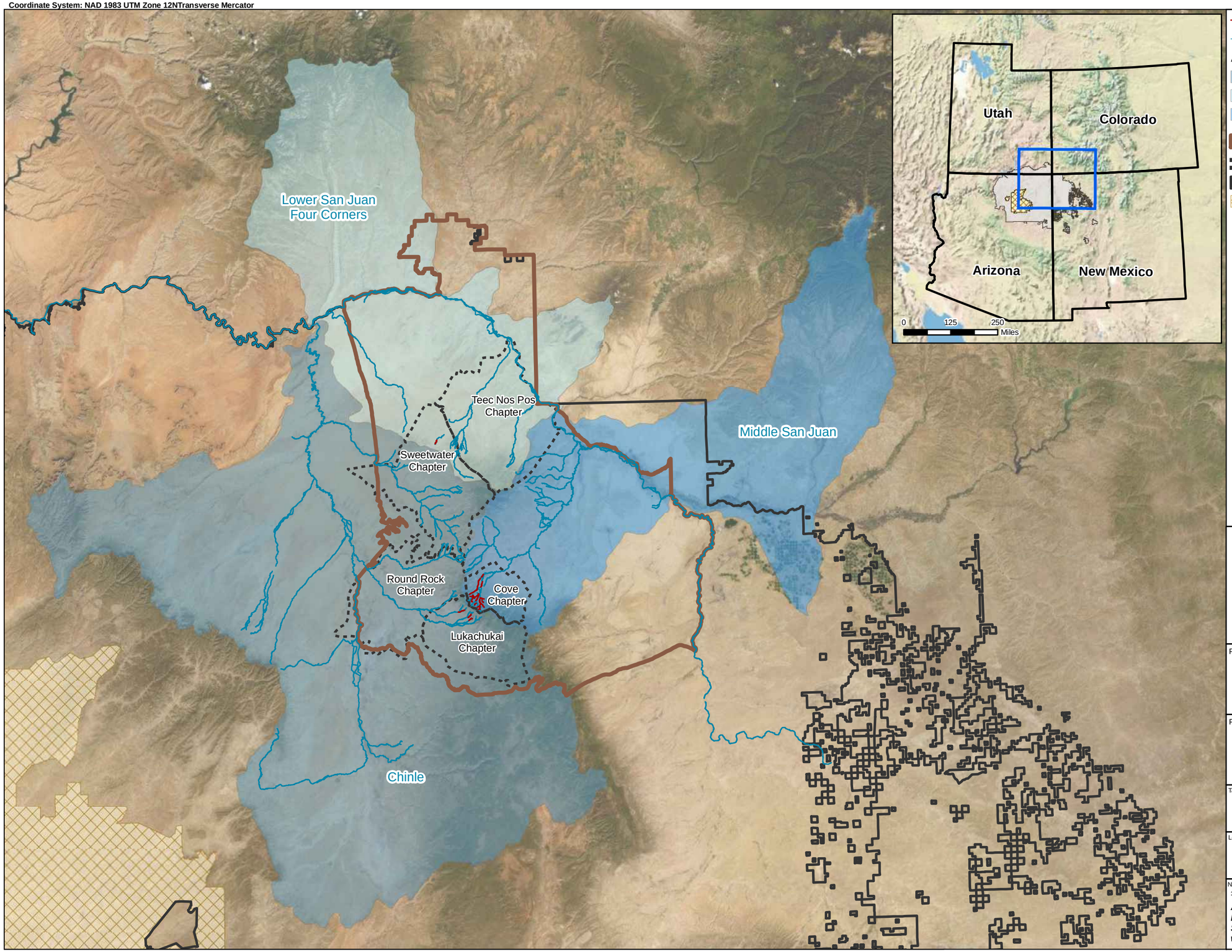
The AUM sites and Targets within the Northern Agency have the potential for containing mine-related contamination. The mine-related contamination may consist of radionuclide and heavy metal soil and sediment concentrations above background and human health and or ecological risk levels. These mine-related contaminants have the potential to be carried offsite via surface water pathways. Assessing and sampling migration pathways for surface water is necessary to identify sources contributing to contamination from AUM sites and Targets within drainages in the Tse Tah Region, Cove Valley Region, and the Lukachukai Mountains Region.

All work performed as part of the drainage investigation study was conducted in accordance with the Sampling and Analysis Plan/Quality Assurance Project Plan (SAP/QAPP) included as Appendix C of the RSE Work Plan submitted May 14, 2018 (Tetra Tech 2018). Deviations to the RSE Work Plan are discussed in the main text of the RSE report. The drainages that underwent investigation by gamma radiation survey and sediment and surface water sampling described in this report are located within the Northern AUM Region, one of six AUM regions identified in the Navajo Nation. Figure J-1 highlights the Northern AUM Region area of interest where this drainage investigation took place, and shows the drainages within the RSE study area. Other AUM regions are identified in the RSE report. This Drainage Investigation Report presents the methods, results, and evaluation of the gamma radiation surveys and sediment and surface water sampling efforts performed by the Tetra Tech team. The gamma survey and sediment sampling occurred between June 2018 and September 2018 within the Sweetwater, Cove, and Lukachukai Chapters of the Navajo Nation, all of which are shown on Figure J-1. Surface water sampling took place in August and September 2018 within two sections of a single drainage (Middle 3 and

Middle 3E) in the Cove Chapter. Figure J-2 and Figure J-3 present the sediment and surface water sample locations within the Northern Agency Tronox Mine Region. The drainage investigation evaluates each individual drainage reach separately, which are indicated in Table J-1. Because of the large area addressed by the RSE investigation, Tetra Tech organized the investigation areas into three primary regions in the RSE Work Plan (Tetra Tech 2018). The three regions were developed with geospatial and geopolitical considerations and include (1) Tse Tah Region; (2) Cove Valley Region; and (3) Lukachukai Mountains. The regions corresponding to each drainage reach are indicated on Table J-1.

The drainage located near Block K Mine was determined to not be hydrologically connected to the mine. The field-mapped drainage is an old road that forms a channel leading to the main access road, which is between 2.5 to 3 feet below the surrounding surface. The drainage is on the opposite side of the road and surface water runoff from the Block K Mine would not flow to the drainage. Tetra Tech recommended that the drainage the drainage not be evaluated, and the USEPA onsite Remedial Project Manager (RPM) agreed. Therefore, there are no sampled drainages associated with Block K Mine.

Coordinate System: NAD 1983 UTM Zone 12NTransverse Mercator



- Drainage Included in RSE Investigation
- Other Drainage[1]

Affected Watersheds - *Hydrologic Unit Code 8*[1]

- Chinle
- Lower San Juan-Four Corners
- Middle San Juan
- Navajo Nation Northern Abandoned Uranium Mine Region
- Affected Chapter Boundary
- Navajo Nation
- Hopi Reservation

1 in = 16 mi

1:992,232

N W E S

16 8 0 16 Miles

REGIONAL OVERVIEW AND WATERSHED BOUNDARIES

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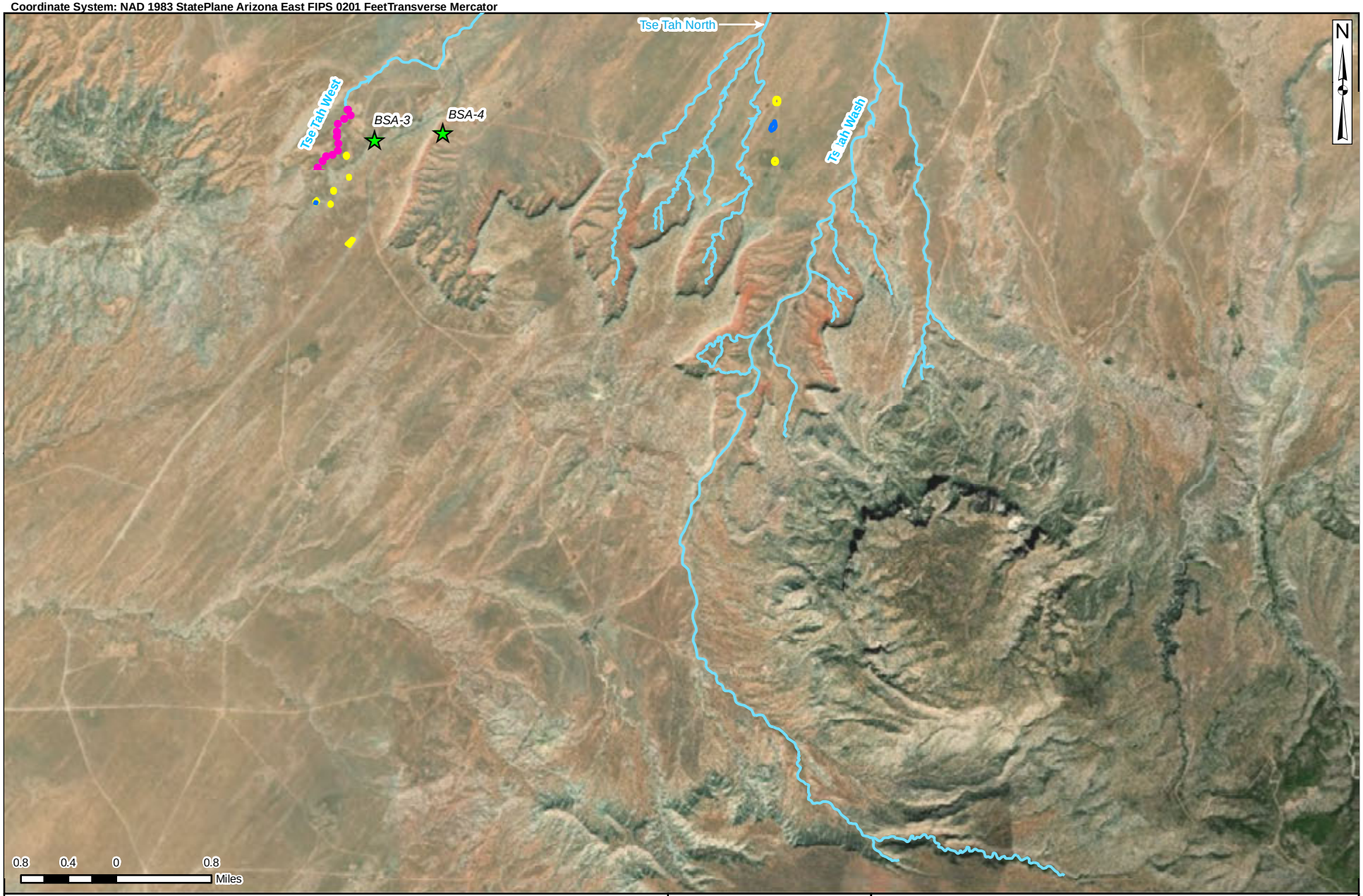
Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location:	**Date:**
NAVAJO NATION	7/23/2019

Notes:

[1]**U.S. Environmental Protection Agency. *Abandoned Uranium Mines and the Navajo Nation: Navajo Nation AUM Screening Assessment Report and Atlas with Geospatial Data.* 2007**

Figure No.: J-1

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



Sediment Sample Location
Drainage Background Location[1]
AUM Site Boundary
Non-AUM Target Site Boundary
Affected Chapter Boundary
Drainage[2]

[1] BSA-3 and BSA-4 were selected as the final background study area for Brodie 1
[2] U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp*. July, 2007.

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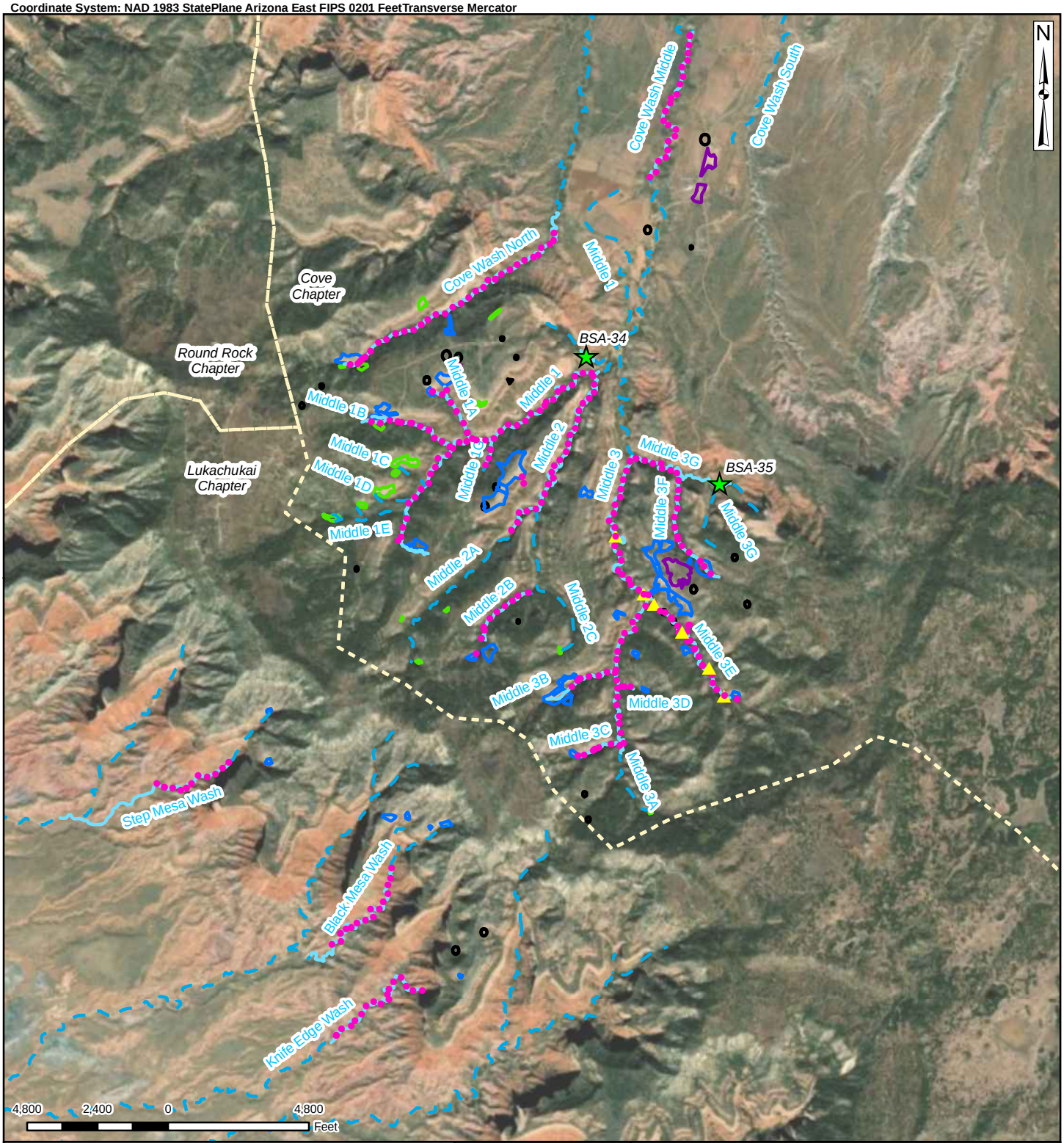
TSE TAH REGION SEDIMENT SAMPLE LOCATION MAP AND BACKGROUND STUDY AREA

Task Order No.:	Contract No.:	Figure No.:
TO0001	EP-S9-17-03	J-2
Location: NAVAJO NATION	Date: 7/8/2019	

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



- Sediment Sample Location
- Water Sample Location
- Drainage Background Location
- AUM Site Boundary
- Non-AUM Target Site Boundary
- AUM Related Site Boundary
- Non-Tronox AUM Site
- Affected Chapter Boundary
- Drainage*
- Drainage - Field Mapped

*U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navajo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Prepared for: U.S. EPA Region 9

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COVE VALLEY REGION AND LUKACHUKAI MOUNTAINS REGION SEDIMENT AND SURFACE WATER SAMPLE LOCATION MAP

Task Order No.:	Contract No.:	Figure No.:
TO0001	EP-S9-17-03	J-3
Location: COVE CHAPTER NAVAJO NATION	Date: 7/23/2019	

Table J-1. List of Drainages and Potentially Contributing Mines

No.	Drainage Name	Drainage ID[1]	Region	Potentially Contributing Mines or Non-AUM Targets	Drainage length (feet)
1	Tse Tah West	DM1	Tse Tah	Brodie 1 (M1)	5,716
2	Cove Wash North	DCWN	Lukachukai Mountains	Mesa VI Mine (M13) Frank Jr. Mine (M14)	11,247
3	Middle 1	DC1	Lukachukai Mountains	Mesa IV West Mine (M23)	12,068
4	Middle 1A	DC1A	Lukachukai Mountains	Mesa V Incline (M15) Mesa V Adit (M16) Mesa V-103 (M17)	2,852
5	Middle 1B	DC1B	Lukachukai Mountains	Mesa V - 508 Mine (M18) Mesa IV 1/2 Mine and Simpson 181 (M19)	4,316
6	Middle 1G	DC1G	Lukachukai Mountains	Mesa IV Mine No. 1 (M20) Mesa IV Mine No. 2 (M21) Mesa IV Mine No. 3 (M22)	930
7	Cove Wash Middle	DT9	Cove Valley	Cove Transfer Station 1 (T9) Cove Transfer Station South (T37) Cove Transfer Station 2 (T38)	6,367
8	Middle 2	DC2, M21	Lukachukai Mountains	Mesa IV Mine No. 1 (M20) Mesa IV Mine No. 2 (M21) Mesa IV Mine No. 3 (M22) Mesa II Pit (M24)	9,253
9	Middle 2A	DC2A	Lukachukai Mountains	Mesa IV Mine No.1 (M20)	1,624
10	Middle 2B	DC2B, M32	Lukachukai Mountains	Mesa II 1/2 Mine (M30) Mesa II 1/2 Mine 4 (M31) Mesa III Mine (M32)	4,164
11	Middle 3	DC3	Lukachukai Mountains	Mesa I Mine 11 (M4) Mesa I Mine 12 (M5) Mesa II Pit (M24)	5,740
12	Middle 3A	DC3A	Lukachukai Mountains	Henry Phillips Mine (M11) Mesa I 1/2, West Mine (M12) Mesa I 3/4 Incline (M25)	5,826
13	Middle 3B	DC3B, M28	Lukachukai Mountains	Mesa I 3/4 Mine No. 2, P150 (M26) Mesa II Mine No. 1 and No. 2 and P-21 (M27) Mesa II Mine No. 1, P-150 (M28)	3,648
14	Middle 3C	DC3C, M25	Lukachukai Mountains	Mesa I 3/4 Incline (M25)	1,657
15	Middle 3D	DC3D	Lukachukai Mountains	Mesa I 1/2, West Mine (M12)	564

Table J-1. List of Drainages and Potentially Contributing Mines (Continued)

No.	Drainage Name	Drainage ID[1]	Region	Potentially Contributing Mines or Non-AUM Targets	Drainage length (feet)
16	Middle 3E	DC3E, M5, M7, M10	Lukachukai Mountains	Mesa I Mine 12 (M5) Mesa I Mine 14 (M7) Mesa I 1/4 Mine (M9) Mesa I 1/2 Mine (M10) M1-04 (T16) M1-05 (T35) M1-06 (T36)	7,939
17	Middle 3F	DC3F, M6	Lukachukai Mountains	Mesa I Mine 10 (M3) Mesa I Mine 13 (M6) Mesa I Mine 15 (M8)	4,893
18	Middle 3G	DC3G	Lukachukai Mountains	None	4,086
19	Knife Edge	DM33	Lukachukai Mountains	Knife Edge Mesa Mine (M33) KE-02 (T34) KE-01 (T33)	6,105
20	Black Mesa	DM35	Lukachukai Mountains	Black No.1 Mine (M34) Black No.2 Mine (M35) Black No.2 Mine (West) (M36) Flag No.1 Mine (M37)	6,808
21	Tommy James	DM39	Lukachukai Mountains	Step Mesa Mine (M38) Tommy James Mine (M39)[1]	7,510

Note:

[1] Drainage IDs beginning with "M" indicate that an opportunistic sediment sample was collected downgradient of a waste pile associated with the mine with that Tetra Tech-assigned ID.

AUM Abandoned uranium mine

1.1 PURPOSE

In 2018, Tetra Tech conducted a data gap analysis as part of a historical site assessment for the 39 Tronox mines and associated drainages. Based on the results of that data gap analysis, Tetra Tech concluded there was not sufficient data for USEPA to make risk management or cleanup decisions at the AUMs or in the drainages; the historical site assessment identified erosion of waste rock and soil from mine features into drainages as a key migration pathway. Therefore, Tetra Tech (2018) developed several data quality objectives (DQO) as part of the RSE Work Plan. Survey design and planning processes that were integrated into the RSE investigations performed at the drainages associated with the Northern Agency Tronox Mines. The results of the data gap analysis are provided in Appendix A of the RSE Work Plan and a detailed list of DQOs are presented in the SAP/QAPP in Appendix C (Tetra Tech 2018). The objectives of the RSE investigation for the drainages were as follows:

- Determine whether contaminants have migrated into drainages from AUMs via surface water pathways.
- Evaluate potential migration pathways, including drainages, that may have been impacted from historic mining operations.
- Determine whether contaminants of potential concern (COPC) in sediment and surface water samples exceed established background levels for drainages.
- Determine whether gamma radiation levels exceed background levels for drainages.
- Assess whether drainages are impacted from mine contaminants.

The following section presents the DQO study questions established for the drainages and explains how each of the DQOs were addressed as part of this RSE investigation.

1.2 DATA QUALITY OBJECTIVES

A primary objective of the RSE investigation is to address the DQOs established for both the Baseline Study and Site Characterization Study. The DQOs for the project are presented in Appendix C of the RSE Work Plan (Tetra Tech 2018). DQOs for the drainages are intrinsically connected to the DQOs for the AUMs, however only a subset of the study questions are specifically applicable to sediment and surface water in drainages. A roadmap for how the Baseline Study DQOs and the Site Characterization Study DQOs are addressed in this SSRSE Report are presented in Table J-2 and Table J-3, respectively.

Results for the gamma survey, sediment samples, and surface water samples in each drainage also inform the mine-specific investigation results presented in the SSRSE reports (Appendix H of the RSE Report). For instance, the opportunistic sediment samples described in Note 1 of Table J-3 assisted in characterization of direct impacts from the AUM waste piles. The results from this drainage investigation report, with regard to the potential for offsite migration of mine waste, are presented within each SSRSE in Appendix H of the RSE Report.

Table J-2. Baseline Study Data Quality Objective Roadmap

Phase of the RSE	Question No.	Principal Study Question	Activity Performed to Address DQO	Section of Drainage Investigation Report
Baseline Study	1	What are the background levels of gamma radiation, radionuclides, and metals in soils and sediment that are representative of conditions at each site?	Background sampling	Section 3.0
	2	What is the lateral extent of mine-related surficial contamination at each site?	Site Mapping	Section 4.1
			Gamma Radiation Survey	Section 5.0
			Sediment Samples	Section 5.0
	3	Is there potential for contaminants to migrate offsite via surface water pathways at each site?	Site Mapping	Section 4.1
			Sediment Samples	Section 5.0
	4	Is there potential for contaminants to migrate offsite via the groundwater pathway?	NA	Main RSE Report
	5	What is the spatial extent, locations, and types of NORM and TENORM at the site?	Site Mapping	Section 4.1
	6	Have the Tronox NAUM risk prioritization factors been evaluated adequately (such as site accessibility, reclamation status, land use, and waste material characteristics)?[1]	NA	Main RSE Report

Notes:

[1] Tronox NAUM risk prioritization factors are being developed by stakeholders to prioritize cleanup at Northern Agency Tronox Mines.

DQO Data quality objective
NA Not applicable
NAUM Navajo Area Uranium Mines
NORM Naturally occurring radioactive material
RSE Removal site evaluation
SSRSE Site-specific removal site evaluation
TENORM Technologically enhanced naturally occurring radioactive material

Table J-3. Site Characterization Study Data Quality Objective Roadmap

Phase of the RSE	Question No.	Principal Study Question	Activity Performed to Address DQO	Section of SSRSE Report
Site Characterization Study	1	Did the Baseline Study adequately identify the lateral extent of surficial contamination at the site, downwind areas, and drainages?	Site Mapping[1]	Section 4.1
			Gamma Radiation Survey[1]	Section 5.0
			Sediment Samples[1]	Section 5.0
	2	Has the lateral extent of mine-related radionuclides and metals in surface soil, waste, or sediment been adequately defined?	Sediment Samples[2]	Section 5.0
	3	What are the lateral and vertical extents of mine-related subsurface radionuclides and metals in soils and waste at each site?	NA	Subsurface samples were not collected within drainages
	4	Are mine-related radionuclides and metals in surface soils, waste, and drainage sediments potentially leaching to surface water or groundwater?	Geochemical Sampling	Section 5.0
			Surface Water Sampling	Section 5.0
	5	Has groundwater been impacted by historical mining activities? [1]	NA	Main RSE Report
	6	What is the distribution of concentrations of radon gas present at accessible mine openings, waste piles, and drainages, and is radon gas being emitted from buried waste cells?	NA	Main RSE Report
	7	Have the physical characteristics of mine waste been adequately evaluated to support modeling, remedy evaluation, and evaluation of the Tronox NAUM risk prioritization factors?[3]	NA	No geotechnical samples collected within drainages

Notes:

[1] In general, drainages were visited once during the RSE field investigation. Drainages that were not accessible during the Baseline Study were sampled during the Site Characterization Study. In addition, opportunistic sediment samples were collected below or within waste piles directly spilling into a drainage, and judgmental samples were collected in areas of high gamma readings or within waste piles directly within a drainage.

[2] Sediment was characterized from 0 to 6 inches below ground surface within drainages.

DQO Data quality objective
NA Not applicable
NAUM Navajo Area Uranium Mines
RSE Removal site evaluation
SSRSE Site-specific removal site evaluation

1.3 REPORT ORGANIZATION

This Drainage Investigation Report is organized as follows:

- Section 1.0 presents relevant background information, purpose and objectives, and DQOs of the drainage investigation.
- Section 2.0 presents a description of the drainages, discusses the organization of the investigation areas by drainage reach, provides an overview of the hydrology and hydrogeology in the area, and presents information on previous investigations.
- Section 3.0 presents a summary of established background threshold levels for the drainages included in this drainage investigation study.
- Section 4.0 presents the sampling field methodology including drainage mapping, gamma radiation surveys, sediment sampling, surface water sampling, and cultural resources surveys.
- Section 5.0 presents field sampling results of the gamma radiation survey, sediment sampling, and surface water sampling, discussed by drainage, as well as a summary and mapping of the geospatial extent of primary analytes.
- Section 6.0 presents an evaluation of offsite migration pathways.
- Section 7.0 presents conclusions and identifies data gaps and recommendations.
- Section 8.0 presents the references for works cited in this report.

Attachments to this report provide important supporting information and data tables. The summary of attachments are as follows:

- Attachment J1 presents sediment and surface water sample laboratory result tables.
- Attachment J2 presents a table and two figures supporting the combination of two of the background areas selected for drainages.
- Attachment J3 presents a set of figures for each drainage showing gamma and sediment sample results.
- Attachment J4 presents the field documentation completed during sediment and surface water sampling.
- Attachment J5 presents the photographic log of the RSE field investigation activities and important site features.

2.0 SITE SETTING

This section describes the physical setting, geology, hydrology and migration pathways, and previous investigations for the drainages.

2.1 PHYSICAL SETTING

The drainage investigation study included several drainages within the Northern AUM region of the Navajo Nation; Figure J-1 presents the watershed boundaries for these drainages. The majority of the drainages (Cove Wash North, Cove Wash Middle, Middle 1, Middle 2, and Middle 3 and tributaries) flow northeast into the Middle San Juan watershed of Apache County, Arizona. The Tse Tah West drainage flows northeast into the Lower San Juan Four Corners watershed, while the Knife Edge, Black Mesa, and Tommy James drainages flow southeast into the Chinle watershed. The drainages primarily consist of ephemeral channels that drain the AUMs and Targets and potentially transport and deposit mine-related contaminants into downstream areas. Previous investigations, particularly the Weston Solutions, Inc. (Weston) Cove Wash Watershed Assessment (Weston 2018) and Navajo Nation Environmental Protection Agency (NNEPA) surface water quality assessment (NNEPA 2014) have shown that, from a human health standpoint, some of these drainages may have been impaired by historical mining operations. Tetra Tech evaluated the drainage network in and around the Tronox AUMs and Targets to evaluate the potential link between mine-related contaminants and drainage sediment. During the RSE investigation, surface water was sampled where it was observed (the Middle 3 and Middle 3E drainages).

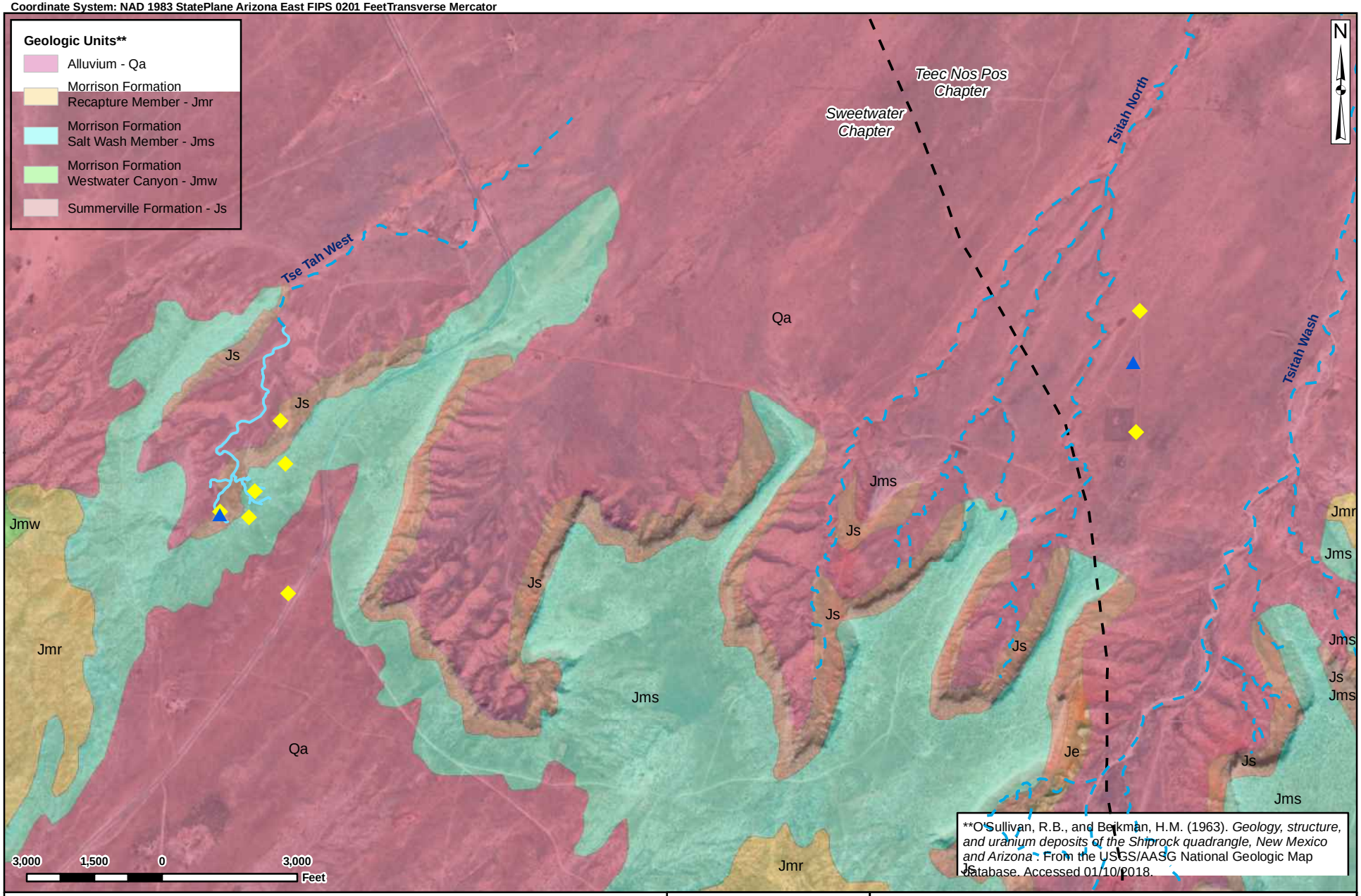
2.2 GEOLOGY

Surface and subsurface geology are described in detail in Appendix A of the RSE Report; the report describes physiographic, lithologic, fluvial, and erosional conditions within the Northern Agency Tronox Mine region. The following discussion focuses on surface geology within the Tse Tah Region, Cove Valley Region, and Lukachukai Mountains Region.

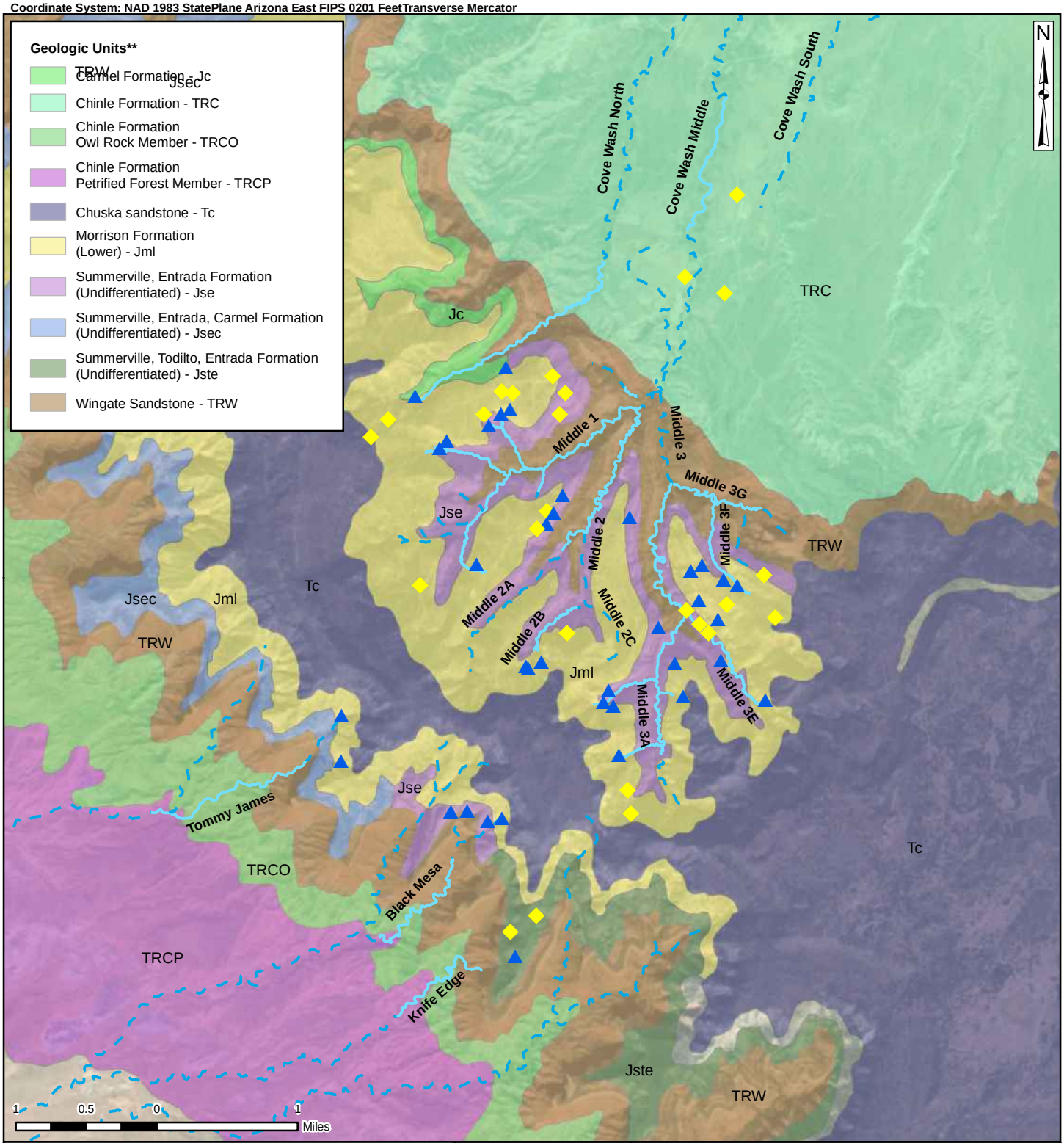
Surface geology within the Tse Tah Region is made up of three primary surface geological formations: Quaternary alluvium (Qa), Salt Wash Member of the Morrison Formation (Jms), and Summerville Formation (Js). Quaternary alluvium occurs primarily in surficial deposits of valley fill and consists mainly of stream-deposited silt, sand, and gravel, aeolian (wind-blown) sand and silt, and colluvial material (O'Sullivan and Beikman 1963). A map showing the regional geological formations for the Tse Tah Region is provided on Figure J-4. A map showing the soil types of the Tse Tah Region is provided on Figure J-6.

Surface geology within the vicinity of the Cove Valley Region is marked by the occurrence of the Chinle Formation (Trc), a fluvial and lacustrine formation exposed in the broad valleys around the mountains. In contrast to the Tse Tah and Cove Valley which lie primarily in valleys, the Lukachukai Mountains are characterized by broad flat mesas with steep canyons. Finger-like mesas and deep, steep-walled canyons combine to form very rugged topography. The prominent mesas on the north side of the mountains are numbered I through VI arching toward the northwest. The south side mesas are descriptively named as Knife Edge, Flag, and Step.

Mesa tops, flanks, and drainages are characterized primarily by members of the Jml. Occurrence of Jml geology and predominance of the Salt Wash Member of the Morrison Formation coincide with prevalence of AUM sites and Target sites in the Cove Region. Uranium ore in the region was mined at the exposed ground surface primarily at mesa tops, rims, and upper canyon walls. Uranium ore bodies are clustered, and typically found at heads of canyons or near back ends of mesas, 30 feet to 80 feet above the base of the Salt Wash Member. The drainages cut down through the Jml, the Jurassic Summerville and Entrada Sandstone (Jse), and the Tertiary Windgate Sandstone (Trw). A map showing the regional geological formations of the Cove Valley Region and Lukachukai Mountains Region is provided on Figure J-5. A map showing the soil types of the Cove Valley and Lukachukai Mountain Regions is provided on Figure J-7.


Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator
Geologic Units**
Alluvium - Qa
Morrison Formation Recapture Member - Jmr
Morrison Formation Salt Wash Member - Jms
Morrison Formation Westwater Canyon - Jmw
Summerville Formation - Js
Teec Nos Pos Chapter
Sweetwater Chapter
Tsitah North
Tsitah Wash
Tse Tah West
N
Qa
Js
Jmw
Jmr
Jms
Je
3,000 1,500 0 3,000 Feet
**O'Sullivan, R.B., and Beikman, H.M. (1963). Geology, structure, and uranium deposits of the Shiprock quadrangle, New Mexico and Arizona. From the USGS/AASG National Geologic Map database. Accessed 01/10/2018.
Drainage*
Drainage - Field Mapped
Abandoned Uranium Mine Site
Non-AUM Target Site
Navajo Nation Chapter Boundary
*U.S Environmental Protection Agency, Region 9, Superfund Program, Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp. July, 2007.
Prepared for:
Prepared By:
TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612
TSE TAH REGION SURFACE GEOLOGY MAP
Task Order No.: TO0001
Contract No.: EP-S9-17-03
Figure No.: J-4
Location: NAVAJO NATION
Date: 7/23/2019

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



Drainage*

Drainage - Field Mapped

Abandoned Uranium Mine Site

Non-AUM Target Site

Navajo Nation Chapter Boundary

*U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navajo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.
**O'Sullivan, R.B., and Beikman, H.M. (1963). *Geology, structure, and uranium deposits of the Shiprock quadrangle, New Mexico and Arizona* . From the USGS/AASG National Geologic Map Database. Accessed 01/10/2018.

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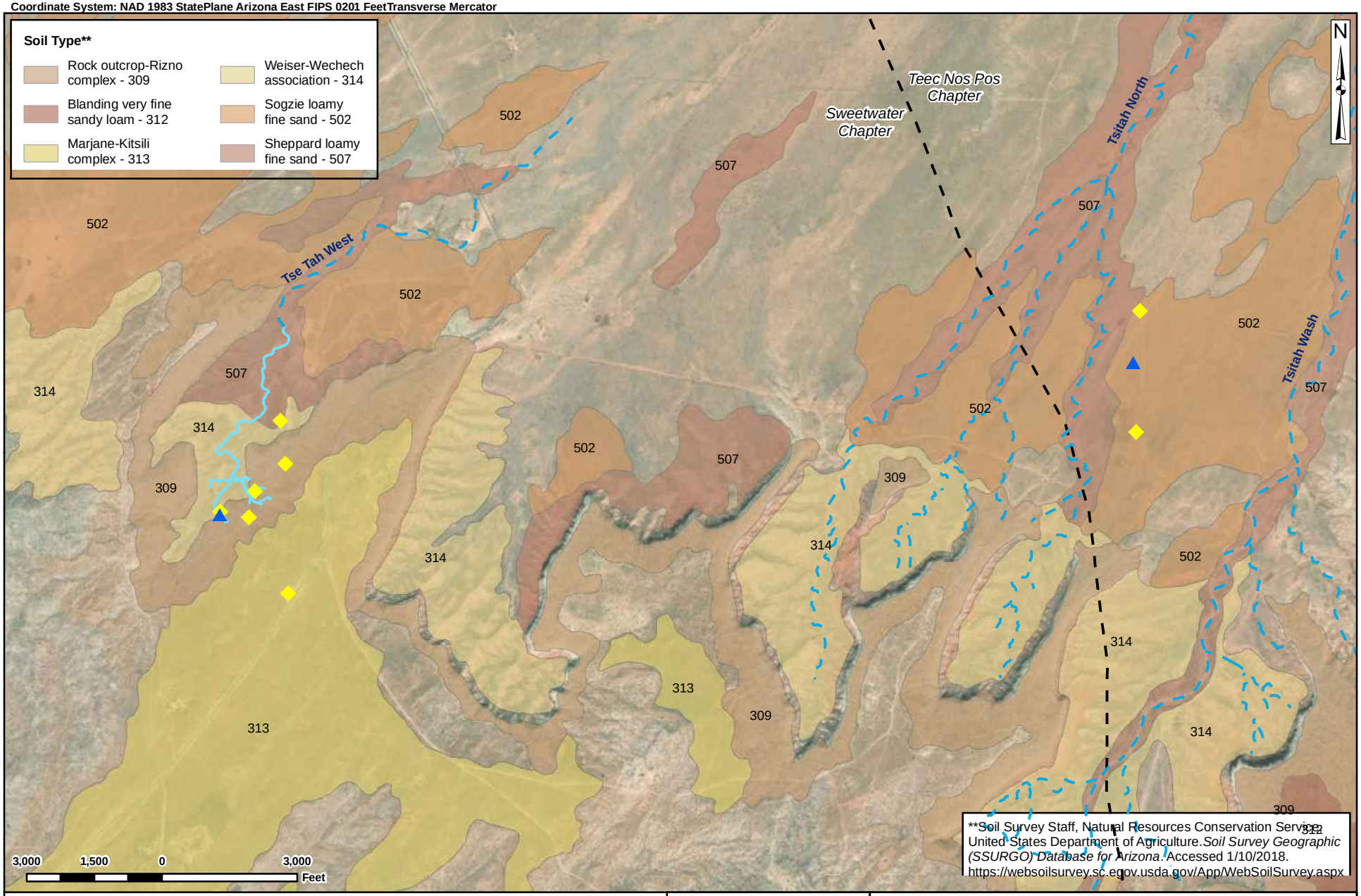
COVE VALLEY REGION AND LUKACHUKAI MOUNTAINS REGION SURFACE GEOLOGY MAP

Task Order No.:	Contract No.:	Figure No.:
TO 001	EP-S9-17-03	J-5
Location: COVE CHAPTER NAVAJO NATION	Date: 7/23/2019	



*U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp*. July, 2007.

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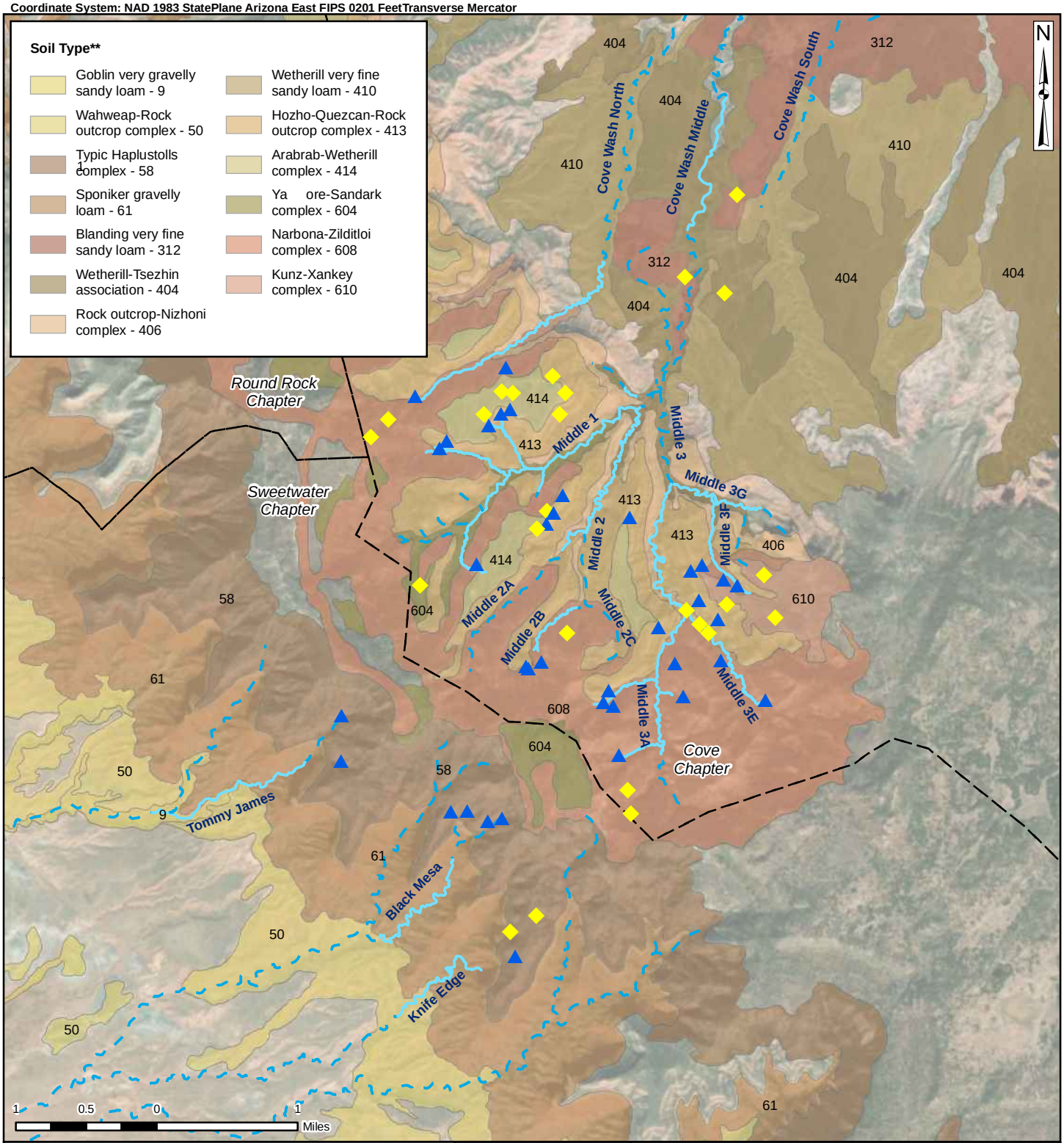
TSE TAH REGION SOILS MAP

Task Order No.:	Contract No.:	Figure No.:
TO0001	EP-S9-17-03	J-6
Location: NAVAJO NATION	Date: 7/23/2019	

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



Drainage*
Drainage - Field Mapped
Abandoned Uranium Mine Site
Non-AUM Target Site
Navajo Nation Chapter Boundary

*U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navajo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.
**Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture.*Soil Survey Geographic (SSURGO) Database for Arizona*. Accessed 1/10/2018. https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx

Prepared for: U.S. EPA Region 9

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COVE VALLEY REGION AND LUKACHUKAI MOUNTAINS REGION SOILS MAP

Task Order No.:	Contract No.:	Figure No.:
TO 001	EP-S9-17-03	J-7
Location: COVE CHAPTER NAVAJO NATION	Date: 7/23/2019	

2.3 HYDROLOGY AND MIGRATION PATHWAYS

2.3.1 Hydrology and Hydrogeology

The Cove Chapter is within the San Juan River Basin of the Upper Colorado River Basin (U.S. Geological Survey [USGS] hydrologic unit code [HUC] Region 14). Most of the Navajo Nation is drained by two principal tributaries, the San Juan River and the Little Colorado River. The Colorado and San Juan Rivers are perennial streams, but all other streams in the region are either ephemeral or intermittent (Cooley and others 1969; Neptune and Company, Inc. [Neptune] and TerraSpectra Geomatics [TSG] 2018). The Tse Tah Region AUM sites and Targets are within the Lower San Juan-Four Corners River Basin. Cove Chapter is within the upper reaches of the Middle San Juan River Basin that drains to the northeast from the Lukachukai Mountains. The drainages in the Lukachukai Chapter flow southeast into the Chinle Watershed. Figure J-1 presents the watershed boundaries within which the Northern Agency Tronox Mine drainages are located.

Surface water runoff from the majority of the drainages flows to the Cove Community from the Lukachukai Mountains, south to north. Surface water runoff from Tse Tah West drainage flows northeast. Figure J-8 presents the regional land surface elevation map. Drainages in canyons and arroyos in the region are mostly dry during a large part of the year and radiate from the mountains, ultimately joining the San Juan River, north of the area (Stokes 1951). Dams and channels divert water to holding ponds constructed of earthen berms in agricultural areas, and pipes carry water from the holding ponds to the fields for irrigation. Runoff is primarily ephemeral and intermittent, and controlled by interception, transmission losses, and storm type and pattern. Unconsolidated surficial deposits intercept and absorb much of the precipitation, overland, and channel flow. Much of the water intercepted is retained near the surface, evaporated, or transpired. Ephemeral streams flow down undefined channels during and following heavy rainfall events that are mostly localized, short-duration, high-intensity thunderstorms.

The majority of the drainages (Cove Wash North, Cove Wash Middle, Middle 1, Middle 2, and Middle 3 and tributaries) flow northeast into the Middle San Juan watershed of Apache County, Arizona. The Tse Tah West drainage flows northeast into the Lower San Juan Four Corners watershed, while the Knife Edge, Black Mesa, and Tommy James drainages flow southeast into the Chinle watershed.

Cove Wash is the only named waterbody within the Cove Wash watershed. Designated surface water uses are: Secondary Human Contact, Aquatic and Wildlife Habitat, Fish Consumption, and Livestock Watering (Neptune and TSG 2018). Based on a document review, it is not clear if residents currently use local surface water for drinking water. Although the Cove Wash watershed is not a known drinking water source, it may have been historically used by residents before drinking water was provided by a municipal source 20 years ago.

Many AUM sites and Targets within the RSE investigation area are located on the rims and cliffs of mesas separated by deeply incised canyons. Canyon drainages appear to be the primary environmental feature controlling migration of surficial mine wastes via contaminated water and sediments from the Lukachukai Mountains to the lower Cove Wash watershed, where the Cove

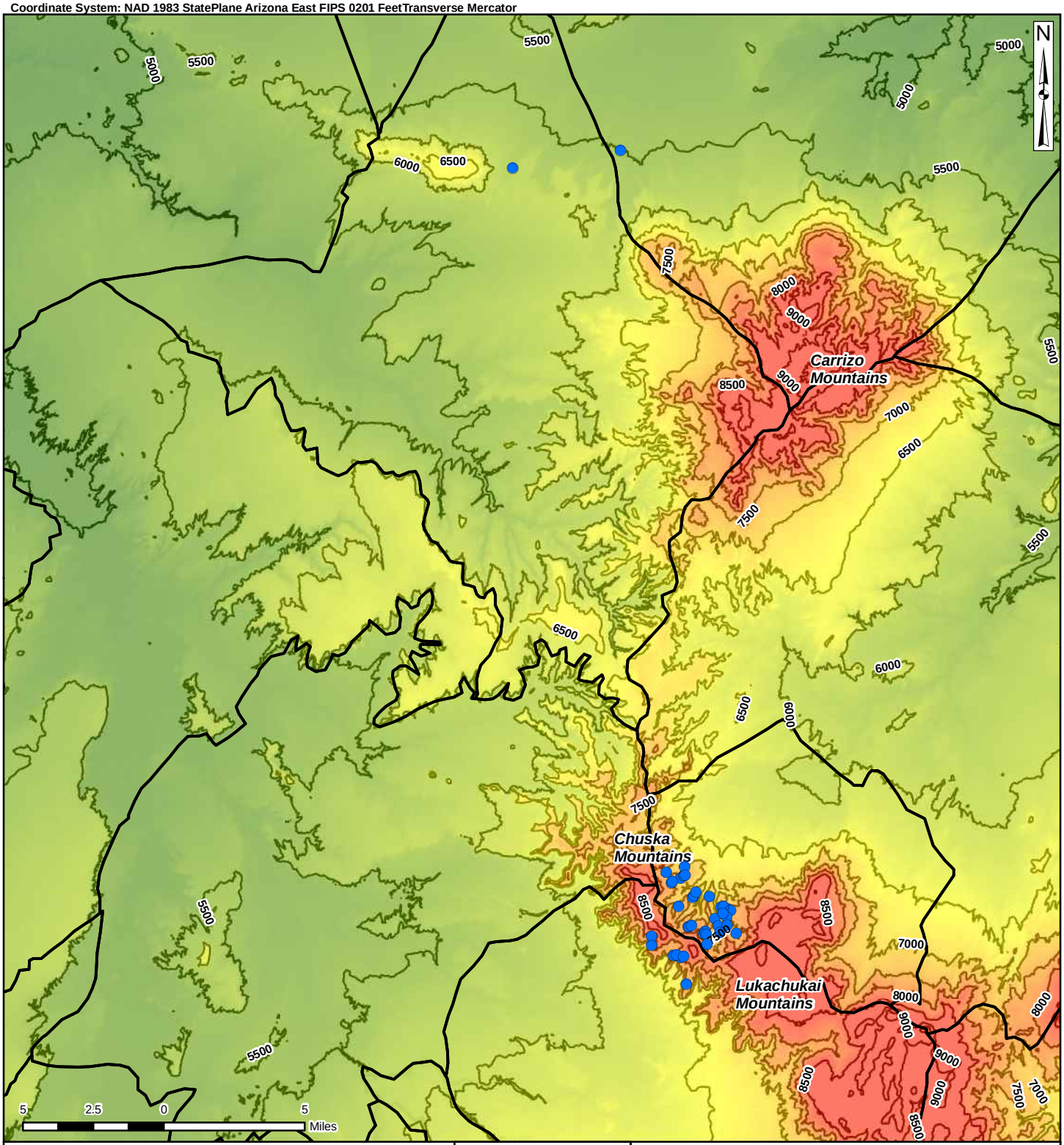
Community is located. Rock fractures and discharge to surface springs and seeps are the primary means for dissolved uranium to migrate from underground mines and regional groundwater to surface water.

Springs that occur on tops of mesas above the Morrison Formation were typically developed with a livestock trough. During site visits in 2013 and 2014, USEPA personnel observed that portions of the Cove Wash tributary network have perennial surface flows from spring sources (Neptune and TSG 2018). In addition to springs, seeps occur throughout the canyons between the mesas.

The project area is underlain by one groundwater basin, the Little Colorado River Plateau Groundwater Basin, composed of sedimentary and volcanic rocks (Arizona Department of Water Resources [ADWR] 2009). Regional generalized groundwater conditions within the Tse Tah Region, Cove Valley Region, and Lukachukai Mountains Region are discussed in Appendix B of the RSE Work Plan (Tetra Tech 2018). Regional groundwater movement is to the northwest within multiple aquifers that consist primarily of stacked sandstone and limestone units generally separated from one another by low-permeability shales and siltstones. The three largest regional aquifers are the unconfined to semi-confined Dakota/Cow Springs (D-aquifer) and Navajo/Lukachukai (N-aquifer). The lower Coconino-De Chelly (C-aquifer) occurs under confined conditions and can produce sizeable quantities of water when penetrated (drilled) at depth. Local groundwater conditions may vary from regional groundwater conditions.

Chief areas of groundwater recharge are in the Chuska Mountains along fractures and bedding planes. Aquifers are recharged seasonally from precipitation in the highlands, mainly in winter and spring. Percolation can be rapid, with water traveling more than 10 feet in 10 to 15 minutes, downward along exposed fractures (Cooley and others 1969; Neptune and TSG 2018). Seasonal fracture flow predominates over porosity-based fracture flow.

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



AUM Site

500 ft Contour

Navajo Nation Chapter Boundaries

Elevation (feet)

High : 9824

Low : 4579

Prepared for:

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

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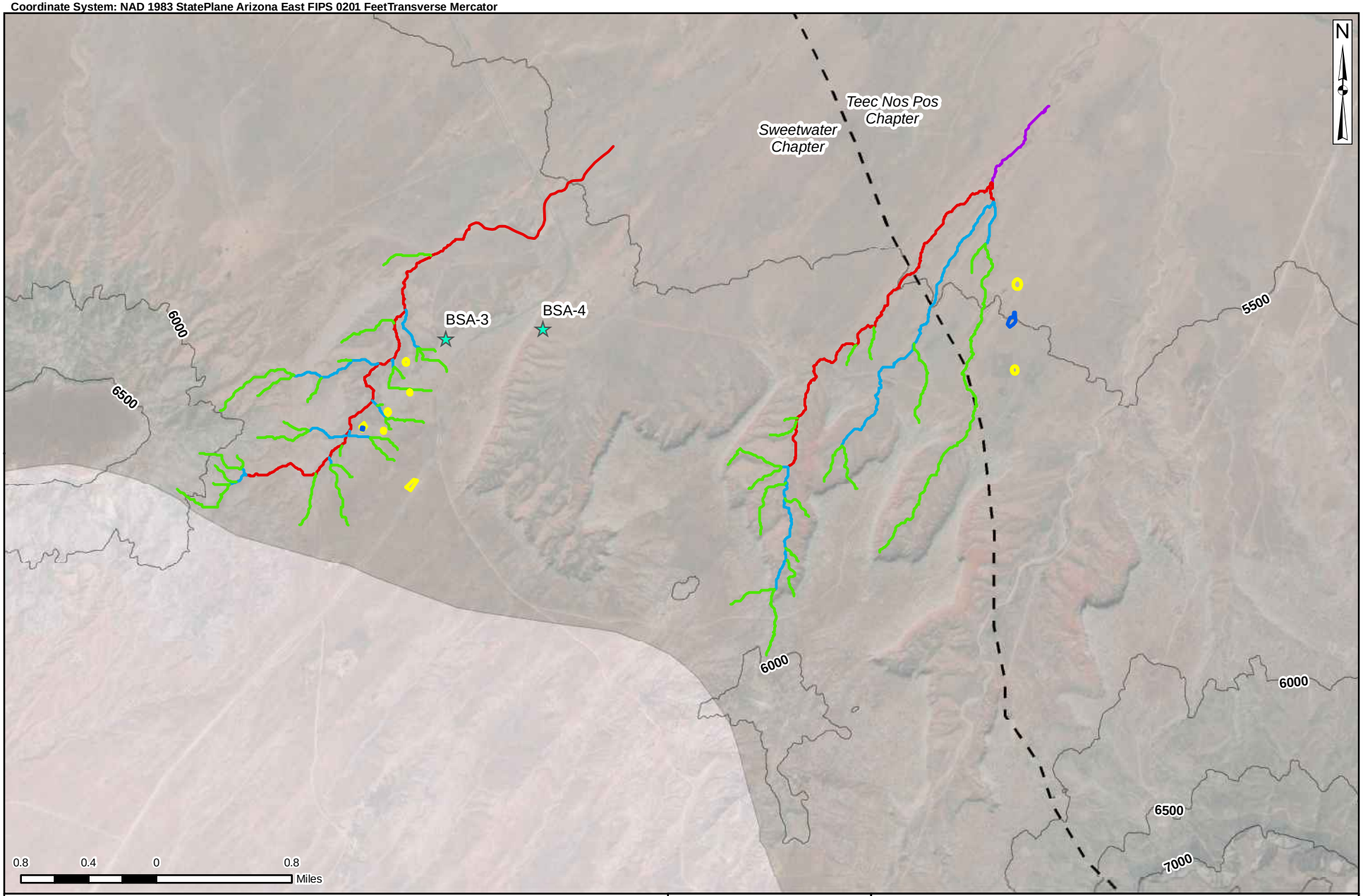
REGIONAL LAND SURFACE ELEVATION MAP

Task Order No.:	Contract No.:	Figure No.:
TO0001	EP-S9-17-03	J-8
Location: NAVAJO NATION	Date: 7/23/2019	

2.3.2 Stream Mapping

During the development of the RSE Work Plan (Tetra Tech 2018), elevation mapping was obtained from the USGS Digital Elevation Model (DEM) which has a 10-meter resolution (Figure J-8). Tse Tah AUMs have mean elevations of 5,500 feet and 5,700 feet above mean sea level (amsl). Cove AUMs have mean elevations as low as 6,400 feet and as high as 7,700 feet amsl. Thirty percent of the AUMs have mean elevations between 7,400 feet and 7,500 feet. The average watershed slope for is 11.1 percent; however, many of the AUMs are located on mesa rims and in cliff sides. The steeper-sloped AUMs generally induce larger surface water runoff rates.

Strahler stream order numbers (Horton 1945; Strahler 1952, 1957) were used to define stream size based on a hierarchy of tributaries. This technique characterizes the location of a drainage reach in a hierarchy from the source, or headwaters, in a downstream direction. In the application of the Strahler stream order to hydrology, each segment of a stream or river within a river network is treated as a node in a tree, with the next segment downstream as its parent. When two first-order streams come together, they form a second-order stream. When two second-order streams come together, they form a third-order stream. Streams of lower order joining a higher order stream do not change the order of the higher stream. Thus, if a first-order stream joins a second-order stream, it remains a second-order stream. Not until a second-order stream combines with another second-order stream does it becomes a third-order stream. The Strahler stream order is typically applied to perennial streams, and not to ephemeral channels such as those within the Cove and Tse Tah regions, where defining stream channels is more difficult. Figure J-9 and Figure J-10 present the results of the stream ordering evaluation for the Tse Tah Region, Cove Valley Region, and Lukachukai Mountains Region.



Drainage Background Study Area
AUM Site Boundary
Non-AUM Target Site Boundary
Navajo Nation Chapter Boundary

Basin (HUC-8)

Chinle. Arizona, New Mexico, Utah.

Lower San Juan-Four Corners. Arizona,Colorado, New Mexico.

Stream Order

1
2
3
4

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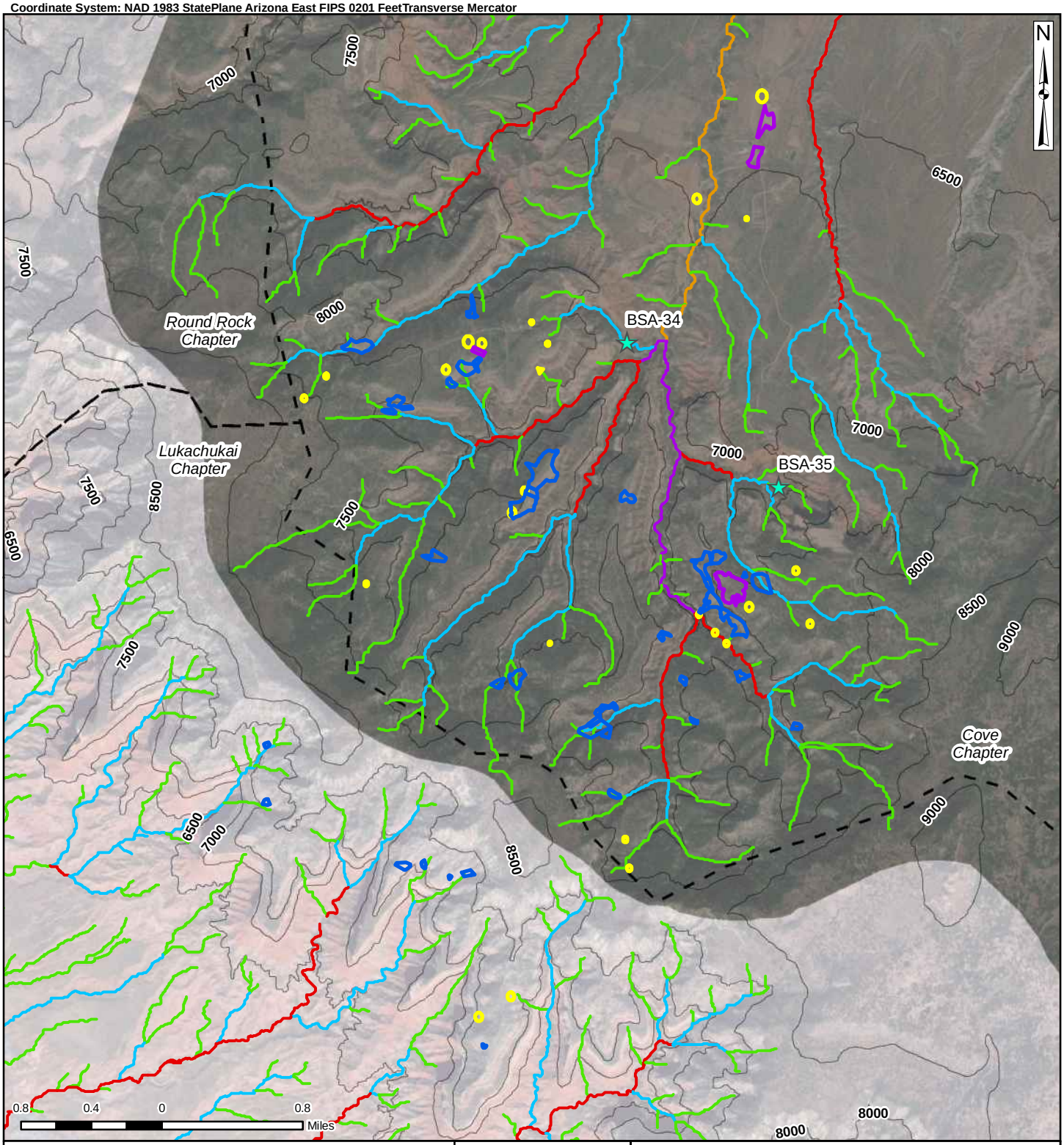
TSE TAH REGION DRAINAGE FEATURES MAP

Task Order No.:	Contract No.:	Figure No.:
TO0001	EP-S9-17-03	J-9
Location: NAVAJO NATION	Date: 7/23/2019	

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



Drainage Background Study Area
AUM Site Boundary
AUM Related Site Boundary
Non-AUM Target Site Boundary
Navajo Nation Chapter Boundaries

Basin (HUC-8)

Chinle. Arizona, New Mexico, Utah.
Middle San Juan. Arizona, Colorado, New Mexico.
500 ft Contour

Stream Order

1
2
3
4
5

Prepared for: United States Environmental Protection Agency

Prepared By: TETRA TECH, 1999 Harrison Street, Suite 500, Oakland, CA 94612

COVE VALLEY REGION AND LUKACHUKAI MOUNTAINS REGION DRAINAGE FEATURES MAP

Task Order No.:	Contract No.:	Figure No.:
TO0001	EP-S9-17-03	J-10
Location: NAVAJO NATION	Date: 7/23/2019	

2.3.3 Migration Pathways

There are many potential migration pathways of contaminated soil from AUMs to drainages. The primary pathway is migration via active surface water transport from eroding waste piles located adjacent to and within drainages during snow melt events and storm runoff events. In addition, surface water transport from eroding waste piles that are not within surface water flow pathways can also occur during high flow storm events. At most AUMs, waste piles were observed to have at least some potential for erosion because of very steep slopes.

There is also potential for aeolian transport, although evidence of windblown contamination was observed at only a few Tronox Mine sites during the RSE investigation. Groundwater may also transport contaminants through the subsurface and to surface water bodies or seeps, particularly for underground mines; the RSE investigation did not evaluate depths to groundwater or impacts from groundwater, therefore further investigation would be required to understand the impacts from groundwater on drainages.

2.4 PREVIOUS DRAINAGE AND SURFACE WATER INVESTIGATIONS

Previous investigations have shown that, from a human health standpoint, some of the drainages leading from the Northern Agency Tronox Mines have been impaired by historical mining operations (Weston 2018; NNEPA 2014). Appendix A of the RSE Work Plan presents a detailed summary of previous site investigations associated with the AUMs and drainages (Tetra Tech 2018).

In March 1999, the U.S. Army Corps of Engineers (USACE) conducted the first regional scientific investigation in the Cove Chapter area, which focused on sampling surface water and groundwater sources used for human consumption. The field investigations identified levels of uranium, arsenic, molybdenum, selenium, and vanadium that exceeded USEPA maximum contaminant levels (MCL) in the Cove Wash watershed (Lameman-Austin 2012, as cited in Weston 2018).

Beginning in May 2009, under contract to the USEPA, Weston visited AUM sites in the Lukachukai Mountains and Tse Tah Region to establish the location and status of each mine. During these visits, features such as adits and waste rock piles were documented, and initial gamma scanning was performed. These site visits resulted in a series of site screen reports for most of the AUM sites included in the RSE Work Plan.

In 2011, Terri Lameman-Austin conducted a study of uranium distribution throughout the Cove Wash watershed as part of a master's degree fulfillment requirement with the assistance of the USGS. A total of seven surface water, three groundwater, and 26 sediment, rock, and soil samples were collected and analyzed for metals, including uranium and other trace metals, major cations and anions, alkalinity, and stable oxygen isotopes to assist in determination of surface water sources (Lameman-Austin 2012, as cited in Weston 2018). Uranium concentrations exceeded the USEPA MCL of 30 micrograms per liter (µg/L) in all surface water samples collected. Arsenic was detected above the USEPA MCL of 10 µg/L in one surface water sample collected within the Cove Wash watershed, and uranium was detected above the MCL in one well sample (Ellison Well, as cited in Weston 2018).

NNEPA collected water samples in 2001, 2011, and 2012 at the Cove Wash tributary in the watershed headwaters that flows intermittently downgradient of the AUM sites, and at the far downgradient end of the Cove Wash watershed. Sampling results for the surface water location in 2001 did not meet the Navajo Nation Surface Water Quality Standards (NNSWQS) for gross alpha radioactivity, chlorine, and selenium. Sampling results for the surface water samples in 2011 and 2012 did not meet NNSWQS standards for gross alpha radioactivity, aluminum, and dissolved oxygen. The assessment recommended that the Cove Wash watershed be designated as "impaired" per the U.S. Clean Water Act Sections 305(b) and 303(d). The assessment also recommended that a total maximum daily load for gross alpha radioactivity be developed for the Cove Wash watershed (NNEPA 2014).

The most comprehensive investigation was the Cove Wash Watershed Assessment (CWWA) performed by Weston under contract for the USEPA between 2015 and 2017 (Weston 2018). As part of the CWWA, surface water, sediment, and subsurface sediment samples were collected from drainage areas in Cove Wash, to delineate the sources contributing to contamination from AUM sites throughout the watershed. Surface water and sediment samples were also collected from identified seeps and springs in the drainage. The Cove Wash watershed was investigated for concentrations of total and dissolved metals, total and dissolved radionuclides, and gross alpha radioactivity during four separate sampling events beginning in 2015 and ending in 2017, and representing high flow and low flow conditions. Media investigated associated with the drainages included surface water collected from stream channels, seeps, and springs; groundwater was also collected from shallow wells located near mined areas or in or above confluences of drainage channels downslope of AUM sites. Screening level surface gamma radiation surveys were also performed in the Cove Wash watershed drainage areas during this CWWA.

The limited data from the CWWA surface water sampling events suggested that uranium concentrations may be highest in surface waters encountered during the low flow season. Surface flows encountered during snowmelt conditions showed high concentrations of total uranium in 82 to 91 percent of the samples collected, suggesting that dilution of contaminants from higher flow volumes is not sufficient to reduce concentrations to below screening levels. Background surface water sampling location concentration ranges displayed some variability, sometimes exceeding the USEPA MCL for drinking water of 30 µg/L, suggesting that further investigation of naturally occurring uranium in surface water and groundwater may be warranted (Weston 2018). Based on CWWA sampling results from events conducted from 2015 to 2017, concentrations of uranium, aluminum, and arsenic in surface waters exceed screening levels in samples collected immediately downgradient of AUMs, all the way to the furthest downstream sampling location near the boundary of the Cove Wash watershed (Weston 2018).

From 2016 to 2017, the Cove Wash Watershed Wetland Delineation was initiated by USEPA and conducted by Weston to delineate wetlands as part of the CWWA (Weston 2017). Potential wetlands were observed within several tributaries throughout the headwaters of the Cove Wash watershed during sampling events and reconnaissance associated with the CWWA during 2015 and 2016. Wetlands were identified at locations in the lower reaches of Cove Wash Middle 1, Cove Wash Middle 2, Cove Wash Middle 3, and Cove Wash North drainages. The wetland delineation identified the presence of 11 wetlands throughout four Cove Wash watershed drainages. Within Cove Wash Middle 1, a total of six wetlands were identified with a total

frontage of 417 feet. Within Cove Wash Middle 2, two wetlands were identified with a total frontage of 98 feet. Within Cove Wash Middle 3, two wetlands were identified with a total frontage of 153 feet. Within Cove Wash North, one wetland was identified with a total frontage of 143 feet (Weston 2017). The dimensions of these wetlands were too small to show on Appendix J figures.

In 2017, the Cove Wash Watershed Irrigation Crops Study was initiated by USEPA and conducted by Lockheed Martin to evaluate COPCs in and around Cove Wash, particularly downstream of a diversion dam in areas that are farmed or show evidence of having been historically farmed (Lockheed Martin 2017). Soil, water, and plants (crops) were sampled, where present, within the area of interest in an effort to delineate the distribution of contaminants related to the mining activities, and to evaluate potential risk posed by contaminants (Lockheed Martin 2017). Soil samples were collected judgmentally from the irrigation canals, the bottoms of the storage ponds, and in cultivated or historically cultivated fields. Water and plant samples were very limited during the field investigation as standing water and crop plants were found in only a couple of locations. A background control soil sample was collected north and outside the area impacted by Cove Wash. In addition, a sample was collected from a dry storage pond west of and not associated with Cove Wash, which might also represent a background control sample. The study found that no conclusions regarding public health significance or human health risk associated with the consumption of water, crops, or livestock from the Cove Wash area could be made based on the screening evaluation (Lockheed Martin 2017).

3.0 BACKGROUND COMPARISON VALUES

Background comparison values were established for sediment and surface water. To establish background levels for sediment, a radiological and metals background investigation was performed as part of the Northern Agency Tronox Mines RSE investigation. Drainage background study areas (BSA) assisted in the assessment of whether mine-related contaminants migrated off site via surface water pathways into drainages from one or more AUM source areas. Surface water background values were established based on maximum concentrations of contaminants found in background samples collected as part of the CWAA (Weston 2018). The following sections describe both sets of background values used to compare with sediment and surface water sample results of the RSE drainage investigation.

3.1 BACKGROUND THRESHOLD VALUES FOR SEDIMENT

BSAs were selected in Appendix B of the RSE Work Plan (Tetra Tech 2018) to characterize background drainage conditions in the Northern Area Tronox Mines region. The rationale for selection of these areas relied on engineering and geologic experience, USEPA guidance, and other federal guidance, including NUREG-1501 (U.S. Nuclear Regulatory Commission [NRC] 1994) and the *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM) (USEPA 2000). One of the challenges in determining representative BSA locations was the relative abundance of AUM sites and associated source areas at mesa tops, in canyons, and near drainage headwaters.

The background study sampling areas for drainages were designed to result in a total area close to the total area of each AUM site background (0.74 acre), and consisted of 30 sediment sampling locations collected within BSA-34 and BSA-35, shown on Figure J-10. BSA-34 was given a 50-foot buffer corresponding with second-order streams, and BSA-35 was given a 25-foot buffer corresponding with first-order streams. Sediment samples were evenly distributed along the length of the stream within the sampling buffer.

Three background areas within drainages were originally proposed (BSA-D1, BSA-D2, and BSA-D3). BSA-34 (originally called BSA-D1) is located along a first-order drainage associated with Middle 1 (also called Middle 1), and BSA-35 (originally called BSA-D2) is at the far upstream portion of Middle 3G. The proposed background drainage location BSA-D3, which was not selected as a final drainage BSA, was in the Tse Tah Region upgradient of the Block K Mine, within the headwaters of northeastern-most drainage, as presented on Figure J-9. The onsite RPM concurred with Tetra Tech that sampling of the Tse Tah Region background area would be eliminated for reasons discussed below, and that the soil background areas selected for the Brodie 1 AUM (BSA-3 and BSA-4) would be most relevant for the Tse Tah West drainage, based on the contributing geology (Figure J-2).

Proposed background drainage location BSA-D3 was not selected as a final drainage BSA because further investigation revealed there are non-Tronox AUMs in the drainage upgradient of the background area. Also, the background drainage in the Tse Tah region is several miles away from the drainage near Brodie 1, so it is not necessarily representative of the Tse Tah West drainage that was sampled during the drainage investigation. The drainage near Block K was not

sampled because it was determined the Block K Mine site was not hydrogeologically connected to the drainage.

Drainage BSA-34 and BSA-35 are located in the Lukachukai Mountains. Neither drainage is adjacent to an AUM and both appear to be unaffected by mine-related activities. Both proposed drainages are characterized by Tertiary Wingate Sandstone (Trw) as the primary geology and incorporate sediment from upgradient uranium-bearing geology of the Lower Morrison Formation (Jml). However, the representative primary soil types for the two BSAs differ. Location BSA-34 is characterized by Wetherill-Tsezhin association soils (Map Symbol 404) with 3 to 15 percent slopes, and location BSA-35 is characterized by Sojourn-Badland complex soils (Map Symbol 411) with 15 to 50 percent slopes. The drainages cut through several layers of geology as they travel down the watershed, therefore the two drainage BSAs may have different ratios of input from geologies contributing to surface sediment. Despite these uncertainties, BSA-34 and BSA-35 were selected as BSAs for the Cove Valley Region and Lukachukai Mountains Region drainages, as these BSAs were selected with the intent to provide representative samples to determine chemical and radiological properties of sediments in non-anthropogenic background locations where no mining has occurred locally.

Background threshold values (BTVs) were developed to compare sediment concentrations in the drainages with those in the selected BSAs. The development of applied BTVs followed the methodology presented in Appendix A of the RSE Report. The BTVs for a given analyte were calculated based on the 95 percent upper tolerance limit (UTL 95-95) or the 95 percent upper simultaneous limit (USL 95). The development of BTVs for the drainages followed the methodology laid out in detail in Appendix A of the RSE Report.

Evaluation of gamma readings for the two Cove Valley sediment BSAs indicate there was no significant difference between the two data sets (BSA-34 and BSA-35). The distribution of the two data sets indicate a unimodal distribution. Attachment J2 presents the summary statistics for BSA-34 and BSA-35 individually and combined, as well as dual histograms of gamma readings for BSA-34 and BSA-35. The data sets were therefore combined into a single data set, resulting in one robust data set, and BTVs were developed to facilitate comparison of sediment results from drainages within the Cove Valley and Lukachukai Mountains with background levels. Background data sets for the two soil BSAs in the Tse Tah West drainage are described in Appendix A of the RSE report.

Table J-4 presents the estimated BTVs for 29 analytes and gamma radiation levels for the Tse Tah drainage (the lower of the BTVs for soil BSA-3 and BSA-4), and the Cove Valley and Lukachukai Mountains drainages (sediment BSA-34 and BSA-35). This Drainage Investigation Report focuses on a subset of analytes associated with mining activities called primary analytes, as well as gamma radiation.

Primary analytes are a subset of analytes identified in the Site-Specific RSE reports (Appendix H of the RSE Report) as being typically associated with uranium-vanadium mining activities and generally more hazardous to the environment and human health than secondary analytes. This drainage report follows the same protocol for identification of primary and secondary analytes as AUMs, as AUMs are the likely sources of contamination to drainages. A total of 29 analytes were evaluated for the drainage investigation, not including gamma radiation. These analytes

include radionuclides and chemical constituents, each with its own applied BTV determined through background investigations.

The primary analytes identified include the following:

- Arsenic
- Lead
- Molybdenum
- Radium-226
- Selenium
- Thorium
- Uranium
- Vanadium

This Drainage Investigation Report focuses on these eight primary analytes and gamma radiation data to assess potential impacts of mining activities on drainages. All other analytes are considered secondary analytes and are not further discussed in this report. Sediment sampling results for the full set of analytes collected are presented in tables within Attachment J1.

Table J-4. Summary of Applied Background Threshold Values for Sediment in Drainages

Analyte	Units	BTVs for Tse Tah Drainage[1]	BTVs for Cove Valley and Lukachukai Mountains Drainages[2]
Aluminum	mg/kg	3,680	4,679
Antimony	mg/kg	0.028	0.12
Arsenic	mg/kg	1.4	2.4
Barium	mg/kg	65	279.60
Beryllium	mg/kg	0.21	0.27
Cadmium	mg/kg	0.073	1.40
Calcium	mg/kg	19,700	60,000
Chromium	mg/kg	4.2	6.9
Cobalt	mg/kg	1.6	3.8
Copper	mg/kg	3.1	3.4
Iron	mg/kg	3,840	6,900
Lead	mg/kg	4	8.0
Lithium	mg/kg	6	13
Magnesium	mg/kg	3,310	8,300
Manganese	mg/kg	180	390
Mercury	mg/kg	0.009	0.954
Molybdenum	mg/kg	0.3	0.19
Nickel	mg/kg	3.5	8.6
Potassium-40	pCi/g	0.46	18.4
Radium-226	pCi/g	0.008	1.16
Radium-228	pCi/g	16	0.799
Selenium	mg/kg	0.031	0.80
Silver	mg/kg	1.7	0.0131
Sodium	mg/kg	0.59	430
Thallium	mg/kg	8.2	0.062
Thorium	mg/kg	16	3.5
Uranium	mg/kg	0.97	0.576
Vanadium	mg/kg	0.24	15
Zinc	mg/kg	16	16
Gamma Radiation	cpm	8,673	12,465

Notes:

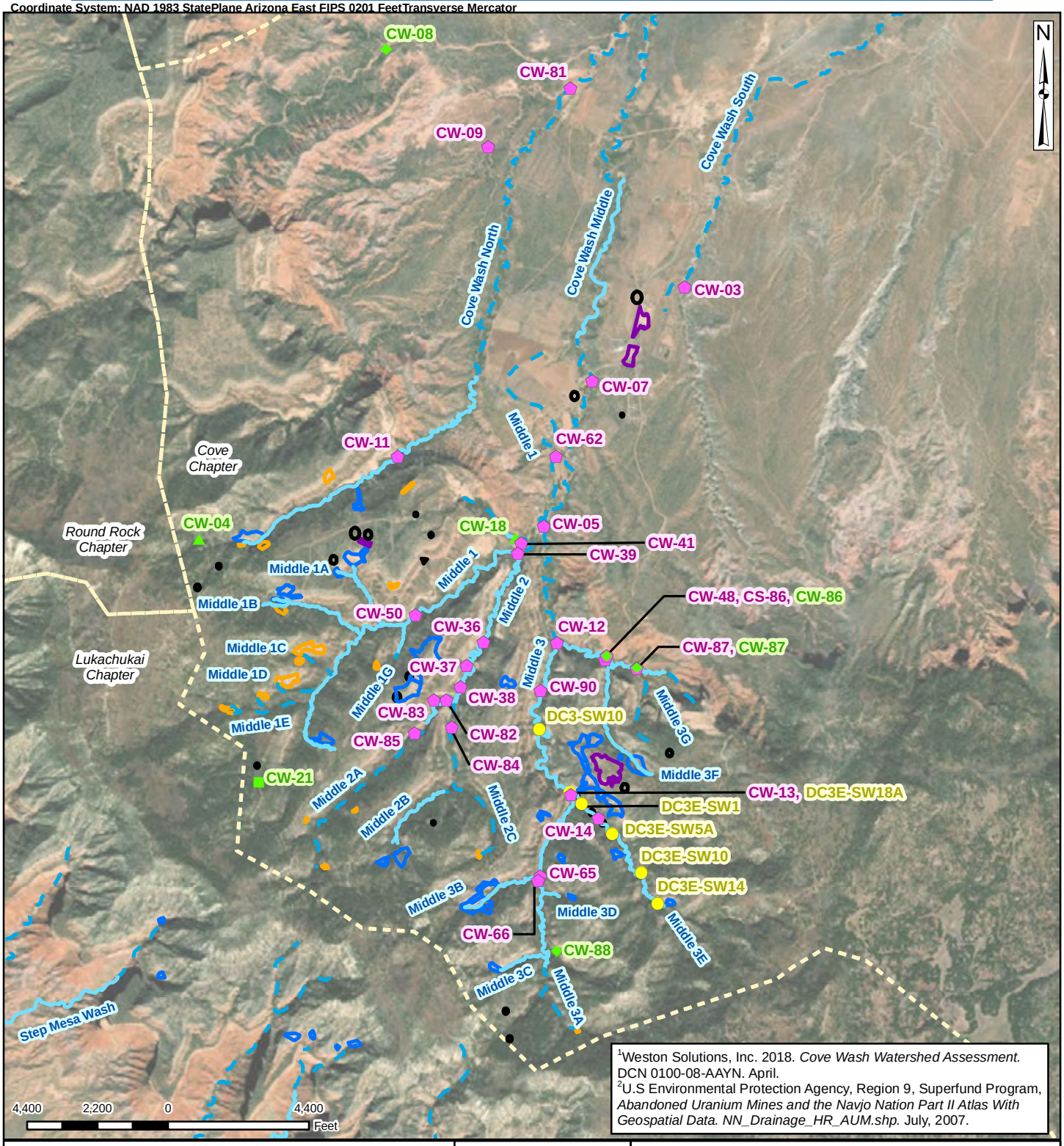
[1] The BTV is the lower of the BTVs for soil in BSA-3 and BSA-4.
[2] BTVs were calculated using a combined data set for sediment BSA-34 and BSA-35.
BSA Background Study Area
BTV Background threshold value
cpm Count per minute
mg/kg Milligrams per kilogram
pCi/g Picocuries per gram

3.2 BACKGROUND CONCENTRATIONS FOR SURFACE WATER

As part of the CWWA, background sample locations for surface water and groundwater (via seeps and springs) were selected within the Cove Valley drainages based on availability of locations hydraulically upgradient of potential contamination from AUMs. Background concentrations of metals and radionuclides in surface water have not been well established; however, the concentrations reported from the CWWA are used as a screening tool in this report. Background locations were selected in mesas at higher elevations than mines (CW-04, CW-21, and CW-88), where available, as well as locations within watershed tributaries at lower elevations that are not hydraulically downgradient of AUMs (CW-08, CW-18, CW-59, CW-86, and CW-87). CWWA background sample locations are presented on Figure J-11 along with the locations of previous CWWA sample locations and the 2018 surface water samples. The sources and locations of the background water sampling locations are presented in Table J-5, and the range of background concentrations of primary analytes are presented in Table J-6. The maximum concentrations detected from the background samples was selected as the comparison criteria for the surface water samples collected as part of the RSE investigation.

The CWWA reported that in the upper parts of the drainages, background surface water samples were limited because of the location of AUMs, and the drainages were often dry. Therefore, background locations at higher elevations were limited to springs and seeps as no running water was located at suitable drainage background locations (CW-04, CW-18, and CW-21), with the exception of sample location CW-88. During the CWWA sampling events, surface waters flowing into Cove Wash from locations surrounding the mesas that did not receive runoff from AUMs were more often present during spring snowmelt sampling events (CW-59, CW-86, and CW-87) (Weston 2018).

The CWWA reported that some non-anthropogenic contribution of uranium to the Cove Wash watershed is present and that elevated uranium concentrations likely derive from the uranium bearing geologic formations throughout the watershed.



[1]Weston Solutions, Inc. 2018. *Cove Wash Watershed Assessment.* DCN 0100-08-AAYN. April.
[2]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navajo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

- Surface Water Sample Location *(Tetra Tech 2018 RSE)*
- Surface Water Sample Location[1] *(Cove Wash Watershed Assessment)*

Background Water Sample Location[1]

- Seep
- Spring
- Surface Water

- AUM Site Boundary
- Non-AUM Target Site Boundary
- AUM Related Site Boundary
- Non-Tronox AUM Site
- Affected Chapter Boundary
- Drainage[2]
- Drainage (Field Mapped)

Prepared for: U.S. EPA Region 9

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TETRA TECH AND WESTON SURFACE WATER SAMPLE LOCATION MAP

Task Order No.:	Contract No.:	Figure No.:
TO0001	EP-S9-17-03	J-11
Location: COVE CHAPTER NAVAJO NATION	Date: 7/11/2019	

Table J-5. Cove Wash Watershed Assessment Surface Water and Groundwater (via Seeps And Springs) Background Locations

Location ID	Source Type	Location	Notes	Elevation Region
CW-04	Seep	Upgradient of Cove Wash North (outside of Tronox AUM Study Area)	Perennial	Higher elevations
CW-08	Surface Water	Cove Wash North Tributary	First sampled during 2017 spring snowmelt	Lower elevations
CW-18	Seep	Middle 1 Tributary (on background drainage BSA-34)	Dry in 2016 low-flow event (intermittent)	Lower elevations
CW-21	Spring	Upgradient of Mesa IV	Mesa IV Spring[1]	Higher elevations
CW-59	Surface Water	Downgradient of Cove Transfer Station	2016 and 2017 Spring event only (intermittent)	Lower elevations
CW-86	Surface Water	Confluence of Middle 3F and Middle 3G	First sampled during 2017 spring snowmelt (intermittent)	Lower elevations
CW-87	Surface Water	Middle 3G (on background drainage BSA-35)	First sampled during 2017 spring snowmelt (intermittent)	Lower elevations
CW-88	Surface Water	Upgradient of Middle 3A near confluence with Middle 3C	First sampled during 2017 spring snowmelt	Higher elevations

Note:
[1] Spring samples were collected in anthropogenically (road, livestock use) influenced areas that were not located directly within a drainage.

Table J-6. Range of Maximum and Minimum Surface Water and Groundwater (via Seeps and Springs) Background Concentrations

Analyte[1]	Units	Cove Wash Watershed Assessment Sampling Event [2]				Maximum Background Concentration
		2015 Low Flow	2016 Spring Snowmelt	2016 Low Flow	2017 Spring Snowmelt	
Arsenic	µg/L	5.4 U–18	3.9 U–9.9 J	3.9 U–5.6 J	3 U–15	18
Lead	µg/L	2.2 U–7.4	2.2 U–5.2	2.2 U	0.9 U–4.5	7.4
Molybdenum	µg/L	2.9 U	0.39 J–3.3	0.38 U–1.5	0.3 U–1.9	3.3
Combined Radium-226/ Radium-228	pCi/L	0.21–2.1 J	0.24–0.76 J	0.35 J	0.25 J–0.52 J	2.1
Selenium	µg/L	4.6 U–4.7 J	4.5 U–8.5	4.5 U	1.5 U–15	15
Thorium [3]	µg/L	-	-	-	-	-
Uranium	µg/L	1.5–4.4	3.2–37	3–34	3.2–180	180
Vanadium	µg/L	3.9 J–22	3.3 J–96	3–3.4	3 U–130	13

Notes:

[1] Metals results presented are for total metals.
[2] Results are from the Cove Wash Watershed Assessment (Weston 2018).
[3] Thorium was not analyzed as part of the Cove Wash Watershed Assessment.
µg/L Micrograms per liter
J Estimated value
pCi/L Picocuries per liter
U Not detected. The associated value is the reporting limit.

4.0 METHODS

This section presents the drainage investigation methods followed for drainage mapping, performing gamma radiation surveys, sediment sampling, surface water sampling, and laboratory analysis of selected metals and radionuclides from drainages in the Northern Agency Tronox Mines study area.

4.1 DRAINAGE MAPPING

All drainages and potential surface water pathways were mapped. Site mapping was performed by a multidisciplinary team of environmental engineers, geologists, and radiation health physicists. The site mapping was completed to ensure the full length of accessible stream reach was documented where accessible. The objectives for conducting site mapping at the Northern Agency Tronox Mine drainages were:

- Identify any drainages or surface water pathways that run from a mine site into an existing drainage (conducted as part of the RSE investigation for each individual mine site)
- Identify surface water or ponded areas
- Identify waste piles adjacent to drainages (technologically enhanced naturally occurring radioactive material [TENORM])
- Visually observe drainage features within areas showing high gamma readings to identify naturally occurring radioactive material (NORM)

Site mapping consisted of recording the geospatial location of drainages or surface water features using handheld Trimble Geo 7XH Global Positioning System (GPS) units with sub-foot accuracy after post-processing. Additionally, the gamma radiation survey Mesa tablets were also capable of recording geospatial locations during the gamma radiation surveys and were used by field staff to geospatially locate drainages and other surface water features discovered during field work. Some portions of the drainages were not mapped because of poor GPS signal resulting from the steep walled portions of the drainage, and other areas were not accessible because of hazardous terrain.

Figures within Attachment J3 present the field-mapped drainages and drainage features associated with AUMs. Waste piles entering drainages were identified as sources of TENORM, as discussed in Appendix H of the RSE Report for each individual mine. NORM was observed in the cliff sides but was not mapped within the drainages.

4.2 GAMMA RADIATION SURVEY

Tetra Tech performed GPS-based gamma radiation surveys of drainages with potential to receive surface water runoff from the Northern Agency Tronox Mines. The gamma radiation survey was conducted between June and September 2018 as part of the Baseline Study and Site Characterization Study. The GPS-based gamma surveys were performed primarily to define the current location and extent of radiological contamination within the drainages. The gamma radiation surveys performed within drainages were conducted following the methods outlined in Appendix C of the RSE Work Plan (Tetra Tech 2018). Field staff used mobile scanning systems with Ludlum Model 44-10 (2- by 2-inch) sodium iodide (NaI) gamma scintillation detectors coupled to Ludlum Model 2221 ratemeters/scalers set in ratemeter mode. The detectors were coupled to Environmental Restoration Group, Inc. (ERG) Model 105 GPS units. The ERG Model 105 GPS consists of a Juniper Mesa 2 field computer and geode GPS receiver. The gamma radiation surveys were conducted by a two-person team traversing drainages in both the upstream and downstream directions and typically a maximum spacing of 2 meters between transects was achieved. In locations where the drainage warranted a different approach, a serpentine surveying approach was conducted to achieve the required scan density. Detector height was 1 meter above ground surface as prescribed in the RSE Work Plan (Tetra Tech 2018). Gamma count rate measurements and associated geospatial coordinates were made and recorded every 1 second. Results of the gamma radiation survey for each drainage surveyed are provided are summarized in Section 5.0 and presented on individual drainage reach figures in Attachment J3. Table J-7 provides a summary of which detection systems were used and when they were used during the drainage gamma radiation surveys.

All Ludlum Model 44-10/2221 instrument systems used in the gamma surveys were calibrated in accordance with the *American National Standard Radiation Protection Instrumentation Test and Calibration, Portable Survey Instruments* (American National Standard Institute [ANSI] 1997), and Standard Operating Procedure (SOP) 002: Calibration of a Radiological Survey Meter, and SOP 001: Calibration of a Radiological Survey Detector in Appendix D of the RSE Work Plan (Tetra Tech 2018). Calibration of the detection systems is required prior to their initial use, at least annually, and after any scheduled or unscheduled maintenance or repair that may affect their operation. General maintenance of the detection systems, such as cleaning, painting, and changing buttons, does not require recalibration. The instruments were function-checked daily, before and at the end of each work day, in accordance with SOP 009: Operational Checkout of Single Detector with Meter in Appendix D of the RSE Work Plan (Tetra Tech 2018). Table J-8 provides a summary of the detection equipment and calibration information.

Table J-7. Detection Systems Used in the RSE Drainage Investigation Survey

Ludlum Model 44-10[1]	Ludlum Model 2221 Ratemeter/Scaler[1]	Dates Used
PR355763	271435	5/23/2018 6/18/2018 6/22/2018 6/23/2018 6/24/2018 8/17/2018 8/19/2018 8/20/2018
PR320678	176947	6/21/2018 6/23/2018 6/24/2018 8/19/2018
PR321856	271429	6/21/2018 6/22/2018 6/23/2018 8/19/2018
PR355781	271424	5/23/2018 6/18/2018 6/19/2018 6/20/2018 6/21/2018 6/23/2018 6/24/2018 8/18/2018
PR355810	271438	6/21/2018 6/23/2018 6/24/2018
PR373554	103984	6/22/2018 6/23/2018 6/24/2018
PR295015	254757	8/16/2018 8/17/2018 8/19/2018
PR303716	149940	6/20/2018 6/21/2018 6/22/2018 6/23/2018 6/24/2018 8/16/2018

Note:

[1] Serial numbers for each radiation instrument used.

Table J-8. Summary of Detection Equipment and Calibration Information

Equipment	Use/Calibration Summary	Relevant RPP SOP No.[1]
Ludlum 2221/ Ludlum 44-10 (or equivalent)	**Use:** Ludlum 2221 ratemeter/scaler instruments were paired with Ludlum 44-10 NaI detectors to measure surface gamma radiation. This detection system was paired with a GPS unit and data logger to record gamma survey and spatial location results in real-time. **Calibration:** Each system (Ludlum 2221/44-10 pair) was calibrated at least annually. Calibration was also performed following any maintenance or repair that could affect functionality. **Functional Checks:** Checks were performed on each system each day that they were used. One check was performed prior to use and one check when all measurement activities had been completed for the day. Checks utilize a standardized source, and net results (source less background counts) must be within ±20% of the results established as part of ongoing control charting.	SOP 001 SOP 002 SOP 009
ERG Model 105 GPS	**Use:** The ERG Model 105 GPS system was used to pair radiation instruments with GPS units to simultaneously record gamma measurements with geospatial locations. The system uses a handheld tablet computer to collect and display survey results in real-time and protect the data from manipulation. **Calibration:** NA **Functional Checks:** NA	NA

Notes:

[1] The SOPs are provided in Appendix D of the RSE Work Plan (Tetra Tech 2018).

ERG Environmental Restoration Group, Inc.
GPS Global positioning system
NA Not applicable
NaI Sodium iodide
RPP Radiation protection program
RSE Removal site evaluation
SOP Standard operating procedure
Tetra Tech Tetra Tech, Inc.

Gamma survey data were collected using the ERG 105 GPS and logged to a binary file such that modifications to the data are precluded. That is, the user has no interaction with the gamma measurements and there are no translation errors in their transmittal. The integrity of the file allows the original field data to be retained and referenced, if necessary, when tracking changes or reverting to the original version. The ERG RadSync and RadScene applications were used to transfer all gamma survey field data to the management computer. Only one computer was used for incoming field data to prevent duplication of data files. Files were not copied manually between the data logger and the project computer. In addition, raw data files were not renamed from their original filename.

The steps taken to validate and verify the gamma survey data were conducted in accordance with SOP 006: Validation and Verification of Gamma Survey Data (in Appendix C [SAP/QAPP] of the RSE Work Plan [Tetra Tech 2018]) as follows:

- The gamma measurements were reviewed in their shapefiles for minimum values to verify that they are within an appropriate range for the Ludlum Model 44-10 and survey area. If low counts were detected, the cause of the counts was assessed. Invalid

measurements could have been made if, for example, a GPS unit was left on unintentionally while traveling in a vehicle.

- The horizontal dilution of precision (HDOP) measurements from the GPS in the GPS-based gamma radiation survey were reviewed to verify that the values do not exceed 3.0. HDOP values that exceed this threshold may have a high positional error and would then be used cautiously during post-processing tasks, such as identifying locations of correlation samples and anomalies.
- Symbology was applied to the gamma measurements, which were then inspected visually for patterns that might indicate detector or cable problems.
- Invalid data of the types described above were removed from the shapefile in accordance with SOP 006.

The steps taken to analyze the gamma survey data were as follows:

- The gamma survey measurements were retained and displayed as counts per minute (cpm). A correlation between high pressure ionization chamber (HPIC) gamma exposure rate and gamma measurements in cpm is presented in Appendix C of the RSE Report. The data were interpreted only in terms of cpm and compared with an applicable BTV.
- The gamma survey measurements were analyzed using statistical software (ProUCL, JMP, and MS Excel), and applicable statistical parameters were generated. Parameters included the number of measurements, arithmetic or geometric mean, median, percentiles, and standard deviation.
- Symbology was applied to the gamma survey measurements according to bins established as multiples of the applicable BTVs.

All QA/QC results and calibration documentation for all radiation detection equipment used in the Northern Agency Tronox Mine RSE investigation are included in the Data Quality Assurance Summary Report as Appendix G of the RSE Report, which presents the daily calibration checks for the gamma radiation surveys within the drainages.

4.3 SEDIMENT SAMPLING

The collection of sediment samples for laboratory analysis involved sampling of the upper 6 inches of sediment within a drainage channel. Sediment sampling was performed following methods outlined in Appendix C of the RSE Work Plan (Tetra Tech 2018). An X-ray fluorescence (XRF) survey was not conducted within the drainages.

Sediment samples were collected from 0 to 6 inches below ground surface (bgs) within 21 drainages; one additional sediment sample was collected from 6 to 12 inches bgs in the Middle 1A drainage. Sediment was sampled in drainage reaches that pass through or near investigation areas (AUM site or Target) to a distance of 1 mile downstream from the investigation area, or to the first intersection with another drainage. Samples were collected within drainages every 100 meters along a drainage reach. The location farthest downstream was collected first to prevent cross-contamination between sample locations.

The exact sample location was selected by reviewing the results of the gamma survey. Sediment samples were collected using stainless-steel hand trowels or soil scoops, which were decontaminated between each sample location. Where sediment conditions made the collection of samples difficult or impossible using a hand trowel, a shovel or mattock was used to loosen sediment before it was collected. Sample material was visually classified, homogenized, placed in appropriate sample containers, and submitted for laboratory analysis. All sediment sampling commenced in each drainage at the most downstream sampling location to prevent cross-contamination between sample locations, which allowed for the most contaminated locations to be sampled last.

Additional judgmental samples were sometimes collected between systematic sampling locations in areas where additional characterization was warranted, for instance areas with relatively high gamma measurements, areas with a waste pile present in the drainage, or areas where the gamma survey equipment did not function properly because of poor GPS signal.

In addition, a subset of sediment samples was collected opportunistically within AUM survey areas during the mine investigations in cases where a waste pile was directly spilling into a drainage (such as at Mesa II Mine 1, P-150). These sediment samples were collected within the mine site boundary in a drainage and are evaluated along with the other sediment samples from the closest drainage.

Sediment sample locations are presented in figures within Attachment J3, and organized by drainage reach. The sediment geospatial locations and associated laboratory report IDs, as well as the analytical results for all sediment samples, are provided in Attachment J1. Sediment samples were analyzed for the suite of metals and radionuclides shown in Table J-9 and Table J-10, respectively. One sediment sample was selected for geochemical analysis of metals and radionuclides as shown in Table J-11 and Table J-12, respectively.

Table J-9. Laboratory Analysis of Metals for Sediment Samples

Analyte	Type	CAS Number	Analytical Method	Number of Sediment Samples Analyzed (0–6 inches)	Number of Sediment Samples Analyzed (6–12 inches)
Aluminum	Metals	7429-90-5	USEPA SW-846 6020B	304	1
Antimony	Metals	7440-36-0	USEPA SW-846 6020B	304	1
Arsenic	Metals	7440-38-2	USEPA SW-846 6020B	304	1
Barium	Metals	7440-39-3	USEPA SW-846 6020B	304	1
Beryllium	Metals	7440-41-7	USEPA SW-846 6020B	304	1
Cadmium	Metals	7440-43-9	USEPA SW-846 6020B	304	1
Calcium	Metals	7440-70-2	USEPA SW-846 6020B	304	1
Chromium	Metals	7440-47-3	USEPA SW-846 6020B	304	1
Cobalt	Metals	7440-48-4	USEPA SW-846 6020B	304	1
Copper	Metals	7440-50-8	USEPA SW-846 6020B	304	1
Iron	Metals	7439-89-6	USEPA SW-846 6020B	304	1
Lead	Metals	7439-92-1	USEPA SW-846 6020B	304	1
Lithium	Metals	7439-93-2	USEPA SW-846 6020B	304	1
Magnesium	Metals	7439-95-4	USEPA SW-846 6020B	304	1
Manganese	Metals	7439-96-5	USEPA SW-846 6020B	304	1
Mercury	Metals	7439-97-6	USEPA SW-846 7471A	304	1
Molybdenum	Metals	7439-98-7	USEPA SW-846 6020B	304	1
Nickel	Metals	7440-02-0	USEPA SW-846 6020B	304	1
Selenium	Metals	7782-49-2	USEPA SW-846 6020B	304	1
Silver	Metals	7440-22-4	USEPA SW-846 6020B	304	1
Sodium	Metals	7440-23-5	USEPA SW-846 6020B	304	1
Thallium	Metals	7440-28-0	USEPA SW-846 6020B	304	1
Thorium	Metals	7440-29-1	USEPA SW-846 6020B	304	1
Uranium	Metals	7440-61-1	USEPA SW-846 6020B	304	1
Vanadium	Metals	7440-62-2	USEPA SW-846 6020B	304	1
Zinc	Metals	7440-66-6	USEPA SW-846 6020B	304	1

Notes:

CAS Chemical Abstracts Service
USEPA U.S. Environmental Protection Agency

Table J-10. Laboratory Analysis of Select Radionuclides for Sediment Samples

Decay Series	Analyte	Type	CAS Number	Analytical Method	Number of Sediment Samples Analyzed (0–6 inches)	Number of Sediment Samples Analyzed (6–12 inches)
Uranium	Uranium-238[1]	Radionuclides	7440-61-1	ASTM D3972 Modified	31	1
	Uranium-234	Radionuclides	13966-29-5	ASTM D3972 Modified	31	1
	Thorium-230	Radionuclides	14269-63-7	ASTM D3972 Modified	31	1
	Radium-226	Radionuclides	13982-63-3	USEPA 901.1	304	1
	Lead-210	Radionuclides	14255-04-0	Eichrom method	31	1
Actinide	Uranium-235	Radionuclides	15117-96-1	ASTM D3972 Modified	31	1
Thorium	Thorium-232[1]	Radionuclides	7440-29-1	ASTM D3972 Modified	31	1
	Radium-228	Radionuclides	15262-20-1	USEPA 901.1	304	1
Potassium	Potassium-40	Radionuclides	13966-00-2	USEPA 901.1	304	1

Notes:

[1] Measured via alpha and gamma spectroscopy. Only the results from the alpha spectroscopy are presented in the report because the detection limits from the gamma spectroscopy are high.

ASTM ASTM International
CAS Chemical Abstracts Service
USEPA U.S. Environmental Protection Agency

Table J-11. Laboratory Geochemical Analysis of Metals for Sediment Samples

Analyte	Geochemical Parameter	CAS Number	Analytical Method	Number of Sediment Samples Analyzed (0–6 inches)	Number of Sediment Samples Analyzed (6–12 inches)
Aluminum	SPLP	7429-90-5	USEPA SW-846 6020B	1	0
Antimony	SPLP	7440-36-0	USEPA SW-846 6020B	1	0
Arsenic	SPLP, TCLP	7440-38-2	USEPA SW-846 6020B	1	0
Barium	SPLP, TCLP	7440-39-3	USEPA SW-846 6020B	1	0
Beryllium	SPLP	7440-41-7	USEPA SW-846 6020B	1	0
Cadmium	SPLP, TCLP	7440-43-9	USEPA SW-846 6020B	1	0
Calcium	SPLP	7440-70-2	USEPA SW-846 6020B	1	0
Chromium	SPLP, TCLP	7440-47-3	USEPA SW-846 6020B	1	0
Cobalt	SPLP	7440-48-4	USEPA SW-846 6020B	1	0
Copper	SPLP	7440-50-8	USEPA SW-846 6020B	1	0
Iron	SPLP	7439-89-6	USEPA SW-846 6020B	1	0
Lead	SPLP, TCLP	7439-92-1	USEPA SW-846 6020B	1	0
Lithium	SPLP	7439-93-2	USEPA SW-846 6020B	1	0
Magnesium	SPLP	7439-95-4	USEPA SW-846 6020B	1	0
Manganese	SPLP	7439-96-5	USEPA SW-846 6020B	1	0
Mercury	SPLP	7439-97-6	USEPA SW-846 7471A	1	0
Molybdenum	SPLP	7439-98-7	USEPA SW-846 6020B	1	0
Nickel	SPLP	7440-02-0	USEPA SW-846 6020B	1	0
Selenium	SPLP, TCLP	7782-49-2	USEPA SW-846 6020B	1	0
Silver	SPLP, TCLP	7440-22-4	USEPA SW-846 6020B	1	0
Sodium	SPLP	7440-23-5	USEPA SW-846 6020B	1	0
Thallium	SPLP	7440-28-0	USEPA SW-846 6020B	1	0
Vanadium	SPLP	7440-62-2	USEPA SW-846 6020B	1	0
Zinc	SPLP	7440-66-6	USEPA SW-846 6020B	1	0
Thorium	SPLP	7440-29-1	USEPA SW-846 6020B	1	0
Uranium	SPLP	7440-61-1	USEPA SW-846 6020B	1	0
paste pH	pH	NA	USDA 60	1	0
Acid-Base Accounting	Total Sulfur, Acid Potential, Neutralization Potential	NA	Modified Sobek Method	1	0

Notes:
CAS Chemical Abstracts Service
NA Not applicable
SPLP Synthetic precipitation leaching procedure
TCLP Toxicity characteristic leaching procedure
USDA U.S. Department of Agriculture
USEPA U.S. Environmental Protection Agency

Table J-12. Laboratory Geochemical Analyses of Radionuclides for Sediment Samples

Decay Series	Analyte	Geochemical Parameter	CAS Number	Analytical Method	Number of Sediment Samples Analyzed (0–6 inches)	Number of Sediment Samples Analyzed (6–12 inches)
Uranium	Uranium-238[1]	SPLP	7440-61-1	ASTM D3972 Modified	1	0
	Uranium-234	SPLP	13966-29-5	ASTM D3972 Modified	1	0
	Thorium-230	SPLP	14269-63-7	ASTM D3972 Modified	1	0
	Radium-226	SPLP	13982-63-3	USEPA 901.1	1	0
	Lead-210	SPLP	14255-04-0	Eichrom method	1	0
	Polonium-210	SPLP	15117-96-1	ASTM D3972 Modified	1	0
Actinide	Uranium-235	SPLP	7440-29-1	ASTM D3972 Modified	1	0
Thorium	Thorium-232[1]	SPLP	15262-20-1	USEPA 901.1	1	0
	Radium-228	SPLP	14274-82-9	ASTM D3972 Modified	1	0
	Thorium-228	SPLP	13966-00-2	USEPA 901.1	1	0

Notes:

[1] Measured via alpha spectroscopy

ASTM ASTM International

CAS Chemical Abstracts Service

SPLP Synthetic precipitation leaching procedure

USEPA U.S. Environmental Protection Agency

4.4 SURFACE WATER SAMPLING

Surface water samples were collected in areas where flowing water was observed during the 2018 field mobilizations as part of the RSE investigation. The sampling team attempted to collect samples at all the sampling stations previously sampled by Weston during the CWAA. All drainages were dry with the exception of Middle 3 and Middle 3E. Surface water was collected at six locations from the two reaches with surface water flow in August and September 2018.

Where possible, surface water samples were collected at drainage locations with flowing water located on or immediately downgradient of investigation areas up to 1 mile downstream from a mine, or until the drainage intersected with another drainage. Before surface water sampling commenced, a water quality meter was submerged in the waterbody to obtain measurements of dissolved oxygen, oxygen reduction potential, temperature, pH, turbidity, and specific conductance. After water quality parameters were measured, surface water samples were collected directly from the waterbody in accordance with SOP 008 of Appendix C of the RSE Work Plan (Tetra Tech 2018). To avoid cross-contamination caused by disturbed sediments, surface water sampling proceeded from downstream to upstream (where applicable) and took place before sediment sampling in the same stream reach.

Surface water sample locations are presented on Figure J-11 and on Middle 3 and Middle 3E figures within Attachment J3. The surface water geospatial locations and associated laboratory report IDs, as well as the analytical results for all surface water samples, are provided in Attachment J1. Surface water samples were analyzed for the suite of metals, radionuclides, and water quality parameters shown in Table J-13, Table J-14, and Table J-15, respectively.

Table J-13. Laboratory Analysis of Metals for Surface Water Samples

Analyte	Type	CAS Number	Analytical Method	Number of Surface Water Samples Analyzed
Aluminum	Metals (Dissolved and Total)	7429-90-5	USEPA SW-846 6020B	8
Antimony	Metals (Dissolved and Total)	7440-36-0	USEPA SW-846 6020B	8
Arsenic	Metals (Dissolved and Total)	7440-38-2	USEPA SW-846 6020B	8
Barium	Metals (Dissolved and Total)	7440-39-3	USEPA SW-846 6020B	8
Beryllium	Metals (Dissolved and Total)	7440-41-7	USEPA SW-846 6020B	8
Cadmium	Metals (Dissolved and Total)	7440-43-9	USEPA SW-846 6020B	8
Calcium	Metals (Dissolved and Total)	7440-70-2	USEPA SW-846 6020B	8
Chromium	Metals (Dissolved and Total)	7440-47-3	USEPA SW-846 6020B	8
Cobalt	Metals (Dissolved and Total)	7440-48-4	USEPA SW-846 6020B	8
Copper	Metals (Dissolved and Total)	7440-50-8	USEPA SW-846 6020B	8
Iron	Metals (Dissolved and Total)	7439-89-6	USEPA SW-846 6020B	8
Lead	Metals (Dissolved and Total)	7439-92-1	USEPA SW-846 6020B	8
Lithium	Metals (Dissolved and Total)	7439-93-2	USEPA SW-846 6020B	8
Magnesium	Metals (Dissolved and Total)	7439-95-4	USEPA SW-846 6020B	8
Manganese	Metals (Dissolved and Total)	7439-96-5	USEPA SW-846 6020B	8
Methyl Mercury	Metals (Total)	22967-92-6	USEPA 1630	8
Mercury	Metals (Total)	7439-97-6	USEPA 1631E	8
Mercury	Metals (Dissolved and Total)	7439-97-6	USEPA SW-846 7470	8
Molybdenum	Metals (Dissolved and Total)	7439-98-7	USEPA SW-846 6020B	8
Nickel	Metals (Dissolved and Total)	7440-02-0	USEPA SW-846 6020B	8
Selenium	Metals (Dissolved and Total)	7782-49-2	USEPA SW-846 6020B	8
Silver	Metals (Dissolved and Total)	7440-22-4	USEPA SW-846 6020B	8
Sodium	Metals (Dissolved and Total)	7440-23-5	USEPA SW-846 6020B	8
Thallium	Metals (Dissolved and Total)	7440-28-0	USEPA SW-846 6020B	8
Thorium	Metals (Dissolved and Total)	7440-29-1	USEPA SW-846 6020B	8
Uranium	Metals (Dissolved and Total)	7440-61-1	USEPA SW-846 6020B	8
Vanadium	Metals (Dissolved and Total)	7440-62-2	USEPA SW-846 6020B	8
Zinc	Metals (Dissolved and Total)	7440-66-6	USEPA SW-846 6020B	8

Notes:

CAS Chemical Abstracts Service
USEPA U.S. Environmental Protection Agency

Table J-14. Laboratory Analysis of Select Radionuclides for Surface Water Samples

Decay Series	Analyte	Type	CAS Number	Analytical Method	Number of Surface Water Samples Analyzed
Uranium	**Uranium-238**[1]	Radionuclides	7440-61-1	ASTM D3972 Modified	8
	Uranium-234	Radionuclides	13966-29-5	ASTM D3972 Modified	8
	Thorium-230	Radionuclides	14269-63-7	ASTM D3972 Modified	8
	Radium-226	Radionuclides	13982-63-3	USEPA 901.1	8
	Lead-210	Radionuclides	14255-04-0	Eichrom method	8
Actinide	**Uranium-235**	Radionuclides	15117-96-1	ASTM D3972 Modified	8
Thorium	**Thorium-232**[1]	Radionuclides	7440-29-1	ASTM D3972 Modified	8
	Radium-228	Radionuclides	15262-20-1	USEPA 901.1	8
Potassium	**Potassium-40**	Radionuclides	13966-00-2	USEPA 901.1	8

Notes:
[1] Measured via alpha spectroscopy
ASTM ASTM International
CAS Chemical Abstracts Service
USEPA U.S. Environmental Protection Agency

Table J-15. Laboratory Analysis of Water Quality Parameters for Surface Water Samples

Analyte	CAS Number	Analytical Method	Number of Surface Water Samples Analyzed
Total Organic Carbon	10-35-5	USEPA 415.1	8
Nitrogen, Total Kjeldahl (TKN)	7727-37-9	USEPA 351.4	8
Chloride	16887-00-6	USEPA 300.0	8
Sulfate	14808-79-8	USEPA 300.0	8
Ammonia as Nitrogen	7664-41-7	USEPA 350.1	8
Nitrate/Nitrite As Nitrogen	1-005	USEPA 353.2	8
Orthophosphate As Phosphate	14265-44-2	USEPA 365.2	5
Sulfide	18496-25-8	USEPA 376.1	8
Bicarbonate as $CaCO_3$	471-34-1	SM2320B	8
Carbonate as $CaCO_3$	3812-32-6	SM2320B	8
Total Alkalinity as $CaCO_3$	NA	SM2320B	8
Total Dissolved Solids	10-33-3	SM2540C	8
Total Suspended Solids	10-32-2	SM2540D	8

Notes:

$CaCO_3$	Calcium carbonate
CAS	Chemical Abstracts Service
NA	Not applicable
SM	Standard Method
USEPA	U.S. Environmental Protection Agency

4.5 CULTURAL AND BIOLOGICAL SURVEYS

Dinetahdoo Cultural Resources Management, LLC, conducted cultural resource surveys under a separate contract with the USEPA. The survey areas included the drainages sampled as part of the RSE Investigation. Cultural survey personnel conducted observational monitoring during ground-disturbing activities of the project and were present during the gamma radiation surveys and sediment sampling. Additionally, Tetra Tech provided cultural survey assistance to USEPA as needed to support initial consultations with the Navajo Nation Heritage and Historic Preservation Department. On February 13, 2018, Tetra Tech provided USEPA a summary of anticipated RSE field activities and sampling locations to support cultural survey work. Furthermore, a summary of the biological desktop study inclusive of the drainages within Lukachukai Mountains Region is presented in the main text of the RSE Report.

4.6 QUALITY ASSURANCE/QUALITY CONTROL

QA/QC procedures were implemented throughout the data collection and analysis tasks completed under Task Order 0001. Specific QA/QC procedures were implemented to both minimize and evaluate potential sources of inaccuracy during sample collection and analysis, including field and laboratory quality control sample analysis. The QA/QC procedures were designed to consider relevant guidance from USEPA, as well as from MARSSIM and the *Multi-Agency Radiological Laboratory Analytical Protocols Manual* (MARLAP) (USEPA 2004).

All the project QA/QC data and results are included in appendices to the RSE and not provided in this report; the gamma radiation survey QA/QC results are in Appendix C, and the soil, sediment, and surface water sampling QA/QC results are in Appendix G. All factory calibration documentation for field equipment is provided in the relevant appendices. Laboratory reports are in Appendix L, and data validation reports are in Appendix M. All laboratory analytical reports underwent 100 percent third-party data validation. Tetra Tech underwent numerous random field audits by USEPA's RPM and Radiation Response Team. All QA/QC results, both field and laboratory, met the performance criteria achieved in the SAP/QAPP of the RSE Work Plan (Tetra Tech 2018).

4.7 STATEMENT ON ACCESSIBILITY

Field personnel made an effort to follow drainages to the headwaters where possible. Where the terrain made the drainage inaccessible such as the presence of a steep cliff or waterfall, the gamma survey was discontinued and re-started at the closest accessible upgradient point.

The onsite USEPA RPM was consulted during field operations and made the final determination for areas considered inaccessible for any type of field sampling, based on the project DQOs and the health and safety of the project team.

5.0 RESULTS AND ASSESSMENT OF OFFSITE MIGRATION OF CONTAMINANTS TO DRAINAGES

This section presents a comparison of the sediment sampling and gamma survey results to applied BTVs, as presented in Table J-4, for the drainage investigation. For each drainage and drainage reach, the potential for offsite migration of contaminants from AUMs and Targets to drainages is assessed. In addition, surface water sampling results are compared to the Cove Wash watershed background sample results for surface water and groundwater (Weston 2018), as presented in Table J-6. The results of geochemical analyses for a single sediment sample are presented following the surface water results.

The presentation of sediment sampling results focuses on the primary analytes identified in the Site-Specific RSE reports (Appendix H of the RSE Report) and introduced in Section 3.0. The results for primary analytes are presented on figures introduced in this section, regardless of whether the concentrations exceed applied BTVs. All other analytes are considered secondary analytes and are provided in Attachment J1.

This results section is organized by drainage and drainage reach (if applicable). For each drainage and drainage reach, an overview of the sediment sampling conducted within each drainage reach is presented, along with an overview of the gamma radiation survey performed and a comparison of raw gamma radiation survey results to background gamma data. Sediment sampling results for primary analytes are compared to applied BTVs and gamma survey transect data along each drainage are presented in figure sets for each drainage within Attachment J3. Each drainage figure set contains an index map followed by a series of figures, presenting both gamma survey and sediment hits boxes for primary analytes in an upgradient to downgradient sequence along a drainage reach. Gamma survey measurements are presented for the full drainage reach even in cases where sediment samples were not collected along the full drainage reach (that is, the Tommy James drainage). Surface water was rarely encountered in drainages (only in Middle 3 and Middle 3E drainages); therefore, surface water results are discussed separately in Section 5.10 along with a comparison to previous investigation water quality investigation results.

For each drainage or drainage reach, a sediment results summary table comparing primary analyte concentrations to an applied BTV is provided, along with standard summary statistics. The final row of the summary table presents the maximum primary analyte concentration divided by the applied BTV, which allows for evaluation of the magnitude of contamination in each drainage.

In addition, gamma radiation survey data for each drainage are summarized and compared to an applied BTV and to the distribution of gamma data from the combined drainage background data set. A table presenting summary statistics for the gamma radiation survey is presented, followed by two plots. The first plot is an individual value plot showing the spread and median value of the gamma radiation survey data collected along a drainage compared to gamma survey results for a background data set. The second plot is a box plot showing the quartiles and median values of drainage and background data sets.

The evaluation of sediment sampling results and gamma measurements compared to applied BTVs enables evaluation of the apparent contributions from AUMs and Targets. Primary analyte concentrations in sediment and maximum gamma measurement exceeding two times applied BTVs may potentially indicate an impact from NORM or nearby mines or Targets; primary analyte concentrations and gamma measurements lower than these thresholds, or with a median gamma measurement less than the applied gamma BTV, are considered to be similar to background levels.

A discussion of surface water results follows the evaluation of sediment sampling and gamma survey results for all of the drainages. Results for primary analytes in surface water within a drainage were compared to the maximum concentrations detected in background sample locations collected during the CWWA (Weston 2018). In addition, surface water results were compared to the range of surface water concentrations in samples collected during the CWAA in 2014 and 2015. The discussion is limited to analytes that were identified in the CWAA report as exceeding screening level and background ranges, which we deemed to be associated with AUMs within the Cove Wash watershed, including total aluminum, total arsenic, total barium, total beryllium, total lead, total mercury, total molybdenum, total combined radium (evaluated in this report separately as radium-226 and radium-228), total selenium, total thallium, total uranium, total vanadium, dissolved cadmium, dissolved copper, and total adjusted gross alpha radiation.

One opportunistic sediment sample was collected in an ephemeral drainage bisecting a mine waste pile to evaluate the potential leachability of mine waste mixed with sediment. The results of the single geochemical sediment sample are presented following the surface water results.

5.1 TSE TAH WEST DRAINAGE

The Tse Tah West drainage runs west to east and is located north of the Brodie 1 AUM site, as shown in Figure J-2. Brodie 1 Mine and non-AUM Target T2 (BR-02) are located upgradient of the southwestern branch of the drainage, and non-AUM Target T4 (BR-04) is upgradient of the southeastern branch of the drainage.

A total of 17 sediment samples were collected within the Tse Tah West drainage in August 2018, and analyzed for the suite of metals and radionuclides presented in Table J-9 and Table J-10. A gamma survey was performed along an approximately 2-mile reach of the Tse Tah West drainage on August 19, 2018. The results of sediment sampling for primary analytes and the gamma survey are described in the following subsections and presented within the Tse Tah West results figures in Attachment J3 (Figure DM1-I, Figures DM1-1 through DM1-3).

5.1.1 Sediment Sampling Results

Sediment results for primary analytes collected at 17 locations are compared with BTVs from BSA-3 and BSA-4, and presented in Table J-16. Four samples exceeded the BTV for at least one analyte, but no BTV was exceeded by more than a factor of two. Molybdenum exceeded the BTV at sample location DM1-SD15, which is one of the samples collected downgradient of Brodie 1 Mine and Target T4 (BR-04) (Figure DM1-2). In sample DM1-SD15, both radium-226 and uranium slighted exceeded the BTV. Uranium also exceeded the BTV in two other samples; one approximately halfway down the drainage and the second-most downgradient sample (Figures DM1-2 and DM1-4). Selenium was not detected in any of the samples.

Table J-16. Sediment Results for Primary Analytes in the Tse Tah West Drainage

Field Sample ID	Drainage Channel ID	Sample Date	Arsenic		Lead		Molybdenum		Radium-226			Selenium		Thorium		Uranium		Vanadium	
			Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Activity (pCi/g)	TPU	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q
DM1-SD1-01-081918	Tse Tah West	8/19/2018	0.94		2.0		0.10	J	0.57	0.16	J-	<0.99	U	1.1		0.45		4.1	
DM1-SD2-01-081918	Tse Tah West	8/19/2018	1.0		1.7		0.14	J	<0.38	0.24	UJ	<0.97	U	0.9		**0.70**		4.4	
DM1-SD3-01-081918	Tse Tah West	8/19/2018	0.92		2.3		0.12	J	0.49	0.19	LT	<0.93	U	**1.3**		0.56		4.6	
DM1-SD4-01-081918	Tse Tah West	8/19/2018	0.7		1.8		0.08	J	0.64	0.21	J-	<0.94	U	1.0		0.51		3.7	
DM1-SD5-01-081918	Tse Tah West	8/19/2018	1.1		**3.1**		0.18	J	0.57	0.17	LT	<0.96	U	1.2		0.42		4.8	
DM1-SD6-01-081918	Tse Tah West	8/19/2018	0.73		1.3		0.14	J	0.42	0.15	J-	<0.97	U	0.7		0.31		3.0	
DM1-SD7-01-081918	Tse Tah West	8/19/2018	0.65		1.5		0.07	J	0.41	0.14	J-	<0.99	U	1.0		0.46		3.5	
DM1-SD8-01-081918	Tse Tah West	8/19/2018	0.71		1.9		0.08	J	0.5	0.15	J-	<0.98	U	1.1		0.49		4.0	
DM1-SD9-01-081918	Tse Tah West	8/19/2018	0.61		1.6		0.08	J	<0.33	0.16	UJ	<0.95	U	0.9		0.36		3.5	
DM1-SD10-01-081918	Tse Tah West	8/19/2018	0.79		1.7		0.11	J	0.49	0.19	LT	<0.97	U	1.0		0.47		4.3	
DM1-SD11-01-081918	Tse Tah West	8/19/2018	1.0		2.2		0.13	J	0.6	0.15	LT	<1	U	1.2		0.62		4.4	
DM1-SD12-01-081918	Tse Tah West	8/19/2018	0.80		1.6		0.10	J	<0.36	0.24	UJ	<0.95	U	0.9		0.42		3.4	
DM1-SD13-01-081918	Tse Tah West	8/19/2018	0.59		1.5		0.07	J	0.5	0.16	J-	<0.99	U	1.0	J	0.39		3.2	
DM1-SD14-01-081918	Tse Tah West	8/19/2018	1.0		2.3		0.10	J	**0.98**	0.21	J-	<0.97	U	**1.3**		0.68		**5.5**	
DM1-SD15-01-081918	Tse Tah West	8/19/2018	0.75		1.5		**0.51**		0.42	0.15	J-	<0.96	U	0.8		0.47		3.3	
DM1-SD16-01-081918	Tse Tah West	8/19/2018	**1.3**		2.2		0.15	J	0.47	0.14	J-	<0.94	U	1.2		0.39		4.3	
DM1-SD17-01-081918	Tse Tah West	8/19/2018	0.93		2.3		0.13	J	0.39	0.17	J-	<0.99	U	1.2		0.30		4.0	
Number of Measurements			17		17		17		17			17		17		17		17	
Number of Detects			17		17		17		14			0		17		17		17	
Number of Nondetects			0		0		0		3			17		0		0		0	
Minimum			0.59		1.3		0.07		0.39			-		0.74		0.30		3.0	
Maximum			1.3		3.1		0.51		0.98			-		1.3		0.70		5.5	
Average			0.85		1.9		0.13		0.53			-		1.0		0.47		4.0	
Median			0.80		1.8		0.11		0.50			-		1.0		0.46		4.0	
Standard Deviation			0.19		0.45		0.10		0.15			-		0.17		0.12		0.65	
90th Percentile			1.0		2.3		0.16		0.63			-		1.2		0.64		4.7	
95th Percentile			1.1		2.5		0.25		0.76			-		1.3		0.68		4.9	
99th Percentile			1.3		3.0		0.46		0.94			-		1.3		0.70		5.4	
Relative Standard Deviation			0.22		0.23		0.75		0.28			-		0.16		0.25		0.16	
BTV (mg/kg)			1.4		4.0		0.30		0.97			0.46		1.7		0.59		8.2	
Maximum/BTV (unitless)			0.93		0.78		1.7		1.01			-		0.76		1.2		0.67	

Notes:
The maximum concentration is presented in **bold**.
Shaded red indicates that the result exceeds the applied BTV.

<	The analyte was analyzed for, but was not detected. The reporting limit is shown in the result column.
-	Not analyzed
BTV	Background threshold value
ID	Identification
J	Estimated value
J-	Estimated value, may be biased low.
LT	Result less than requested minimum detectable concentration, but greater than the sample-specific detectable concentration.
mg/kg	Milligrams per kilogram
pCi/g	Picocuries per gram
Q	Qualifier
TPU	Total propagated uncertainty
U	Not detected. The associated value is the reporting limit.
UJ	Not considered detected. The associated value is the reported concentration, which is estimated.

5.1.2 Gamma Radiation Survey Results

In general, a majority of the gamma radiation measurements within the Tse Tah West drainage are in the range of the background data set for BSA-4 (lowest BTV), with an upper range of measurements less than twice the applied BTV of 8,673 cpm. Table J-17 provides summary statistics for the gamma radiation measurements within the drainage. Approximately 15 percent of measurements exceeded the applied gamma BTV within the Tse Tah West drainage, and the majority of the measurements exceeding the applied gamma BTV were within the drainages immediately downgradient of Brodie 1 Mine and non-AUM Target T2 (BR-02), and non-AUM Target T4 (BR-04) (Figure J-12). The spread of gamma radiation data within the drainage encompasses the range of background gamma measurements up to a maximum gamma count rate measurement of 16,196 cpm. A box plot showing the quartiles of the data sets is provided in Figure J-13. The box plot displays the median of the drainage gamma radiation data set as less than the background data set median and below the applied gamma BTV. Although 15 percent of the gamma measurements exceed the applied gamma BTV in the Tse Tah West drainage, overall, the impact is limited to just downstream of the Brodie 1 Mine AUM and non-AUM Target T2 (BR-02) and outcropping of NORM at non-AUM Target T4 (BR-04).

Table J-17. Summary of Gamma Radiation Survey Results for the Tse Tah West Drainage

Summary Statistic	Units	Gamma Radiation Survey Results
Applied Gamma BTV	cpm	8,673
Measurements	#	9,560
Minimum	cpm	3,234
Maximum	cpm	16,196
Average	cpm	7,929
Median	cpm	7,843
Standard Deviation	cpm	1,024
90th Percentile	cpm	9,025
95th Percentile	cpm	9,911
99th Percentile	cpm	11,392
Measurements Above Gamma BTV	#	1,412
Measurements Above Gamma BTV	%	15

Notes:

BTV Background threshold value
cpm Counts per minute

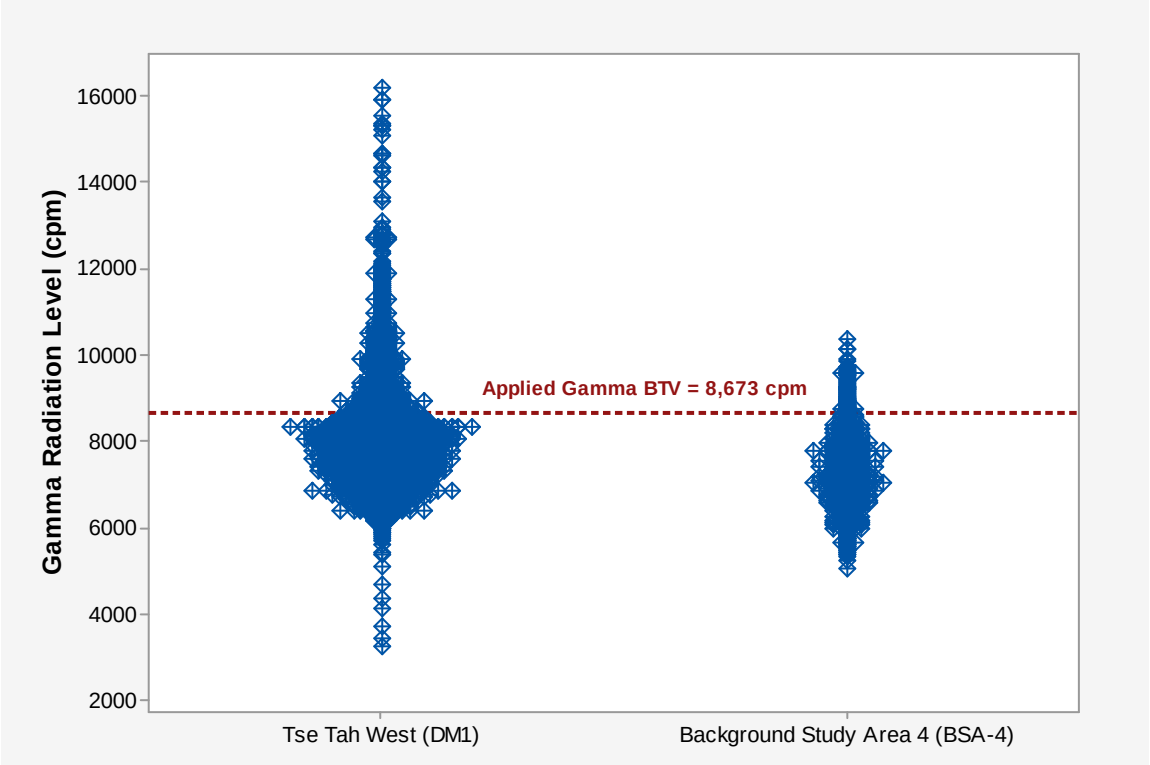


Figure J-12. Individual Value Plot of Gamma Radiation Levels within the Tse Tah West Drainage and BSA-4

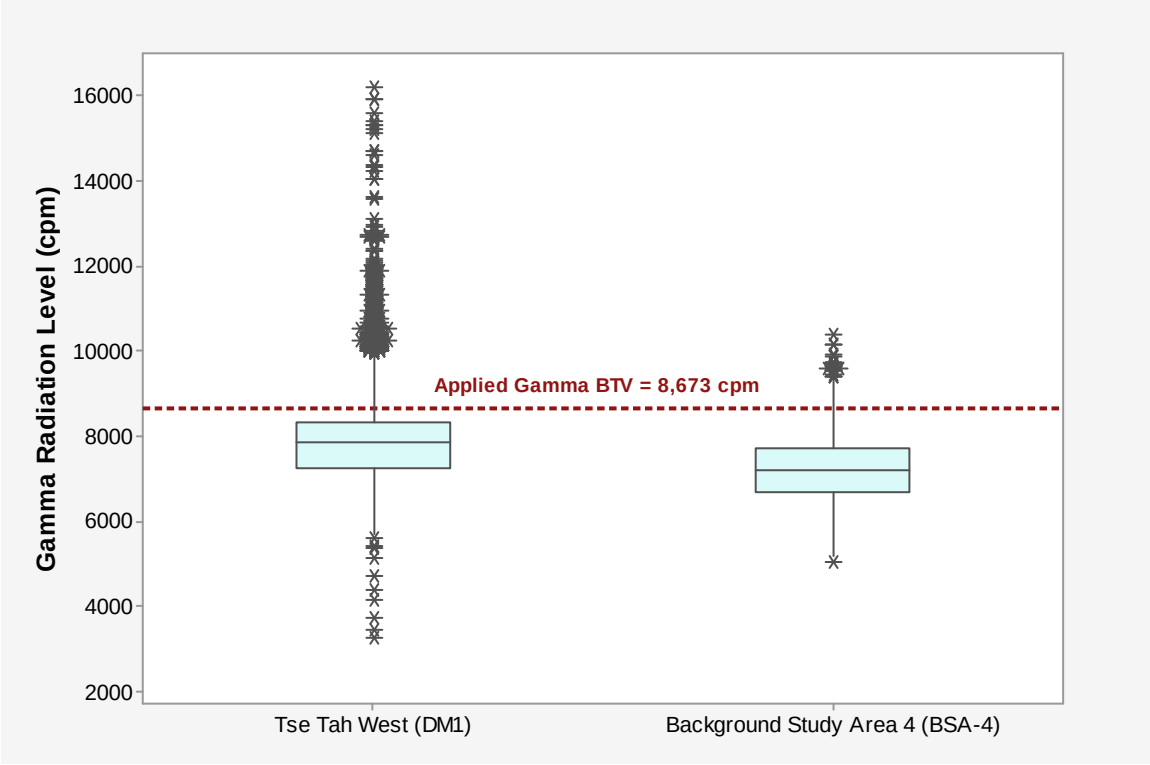


Figure J-13. Box Plot of Gamma Radiation Levels within the Tse Tah West Drainage and BSA-4

5.1.3 Potential Contribution from AUMs and Targets

Based on the sediment sample results for primary analytes and the maximum gamma survey measurement not exceeding twice the applied BTVs, Brodie 1 Mine does not appear to contribute to elevated concentrations of mine-related contaminants or gamma radiation in the Tse Tah West drainage.

5.2 COVE WASH NORTH DRAINAGE

Cove Wash North originates just north of Mesa VI Mine and flows directly through Waste Pile M13C and the adjacent non-Tronox mine (NA-0319), as shown in Figure J-3. Local surface drainages also flow through Waste Piles M13A and M13B before continuing downgradient to the northeast. Frank Jr. Mine is located upslope to the east of the drainage approximately a third of the way down the sampling area. Non-Tronox mines Mesa V New Lease, Cato No. 1 Pit, and Cato No. 2 Mine are also present within the drainage area of Cove Wash North. The direction of surface water flow is generally from southwest to northeast, following the general trend of the downward slope of the mountains.

A total of 32 sediment samples were collected from the Cove Wash North drainage in June 2018; two of those samples were judgmental samples collected immediately below waste piles associated with Mesa VI Mine (DCWN-SD28A), within a drainage running through Mesa VI Mine (DCWN-SD28B). Sediment samples were analyzed for the suite of metals and radionuclides presented in Table J-9 and Table J-10. A gamma survey was performed along an approximately 2-mile reach of the Cove Wash North drainage on June 24, 2018. The results of sediment sampling for primary analytes and the gamma survey are described in the following subsections and presented within the Cove Wash North drainage results figures in Attachment J3 (Figure DCWN-I, Figures DCWN-1 through DCWN-6).

5.2.1 Sediment Sampling Results

Sediment results for primary analytes collected at 32 locations are compared with BTVs from BSA-34 and BSA-35 and presented in Table J-18. Results for arsenic, molybdenum, radium-226, uranium, and vanadium exceeded the BTV in at least four (arsenic) and up to 15 (radium-226) samples throughout the extent of the wash. The maximum concentrations of arsenic and molybdenum exceeded the BTV by more than three times in the upgradient portion of the wash (sample DCWN-SD30 for arsenic and DCWN-SD28B for molybdenum) in the area near Mesa VI Mine and non-Tronox mine NA-0319. The maximum concentration of radium-226 was just under twice the BTV at DCWN-SD17, located immediately downgradient of Frank Jr. Mine and non-Tronox mine Cato No. 2. The maximum concentration of uranium exceeded the BTV by four times at a location mid-way down the drainage in sample DCWN-SD11 below the entry point for erosive soils from non-Tronox mine Cato No. 1; however, the majority of the BTV exceedances occurred in the upgradient portion of the drainage near Mesa VI Mine and the non-Tronox mines. The vanadium results exceeded the BTV in the far upgradient portion of the wash and in the samples collected mid-way down the wash, with the maximum concentration from sample DCWN-SD19 exceeding the BTV by over three times.

Table J-18. Sediment Results for Primary Analytes in the Cove Wash North Drainage

Field Sample ID	Drainage Channel ID	Sample Date	Arsenic		Lead		Molybdenum		Radium-226			Selenium		Thorium		Uranium		Vanadium	
			Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Activity (pCi/g)	TPU	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q
DCWN-SD1-01-062418	Cove Wash North	6/24/2018	1.6		4.3		0.07	J	0.43	0.16	J-	0.60	J	2.3		0.26		8.2	
DCWN-SD2-01-062418	Cove Wash North	6/24/2018	1.6		3.3		0.22		1.4	0.26	J-	0.39	J	2.5		0.35		6.8	
DCWN-SD3-01-062418	Cove Wash North	6/24/2018	1.4		2.9		0.18	J	0.63	0.19	J-	0.34	J	1.2		0.27		8.5	
DCWN-SD4-01-062418	Cove Wash North	6/24/2018	1.7	J	3.5	J	0.10	J	1.17	0.2	J-	0.45	J	1.7	J	0.49	J	15	J
DCWN-SD5-01-062418	Cove Wash North	6/24/2018	6.7		3.2		0.14	J	1.3	0.26	J-	0.38	J	1.3		0.42		15	
DCWN-SD6-01-062418	Cove Wash North	6/24/2018	1.0		2.8		0.11	J	0.65	0.16	J-	0.32	J	1.3		0.36		10	
DCWN-SD7-01-062418	Cove Wash North	6/24/2018	1.0		2.9		0.11	J	1.14	0.24	J-	<1	U	1.2		0.60		12	
DCWN-SD8-01-062418	Cove Wash North	6/24/2018	1.3		3.3		0.16	J	0.76	0.23	J-	0.45	J	1.4		0.49		8.0	
DCWN-SD9-01-062418	Cove Wash North	6/24/2018	1.1		2.8		0.12	J	0.7	0.21	J-	<0.99	U	1.2		0.47		11	
DCWN-SD10-01-062418	Cove Wash North	6/24/2018	0.9		2.2		0.11	J	0.57	0.2	LT	<0.93	U	0.9		0.44		7.2	
DCWN-SD11-01-062418	Cove Wash North	6/24/2018	2.0		**6.5**	J	0.28		<0.43	0.25	UJ	0.57	J	**2.7**	J	**2.40**	J	15	
DCWN-SD12-01-062418	Cove Wash North	6/24/2018	1.7		3.4		0.21		0.76	0.21	J-	0.37	J	1.4		1.20		12	
DCWN-SD13-01-062418	Cove Wash North	6/24/2018	1.5		2.1		0.12	J	1.32	0.26	J-	<1.1	U	0.9		0.42		22	
DCWN-SD14-01-062418	Cove Wash North	6/24/2018	0.9		1.9		0.09	J	1.05	0.23	J-	<1	U	1.1		0.30		19	
DCWN-SD15-01-062418	Cove Wash North	6/24/2018	1.1		2.7		0.14	J	0.74	0.22	LT	<1.1	U	1.1		0.82		19	
DCWN-SD16-01-062418	Cove Wash North	6/24/2018	1.4		2.6		0.18	J	1.59	0.34		0.42	J	1.4		0.71		19	
DCWN-SD17-01-062418	Cove Wash North	6/24/2018	1.2		2.9		0.30		**3.05**	0.49		0.44	J	1.1		1.20		41	
DCWN-SD18-01-062418	Cove Wash North	6/24/2018	0.8		1.9		0.13	J	0.44	0.16	LT	<0.95	U	1.0		0.29		6.4	
DCWN-SD19-01-062418	Cove Wash North	6/24/2018	1.4	J	3.0		0.22		<0.34	0.2	UJ	<0.98	U	1.3		0.38	J	**47**	J
DCWN-SD20-01-062418	Cove Wash North	6/24/2018	1.3		2.8		0.20		0.71	0.2	J-	<0.96	U	1.3		0.59		8.8	
DCWN-SD21-01-062418	Cove Wash North	6/24/2018	1.7		2.9		0.24		0.86	0.22	J-	0.38	J	1.5		0.48		8.7	
DCWN-SD22-01-062418	Cove Wash North	6/24/2018	1.1		2.6		0.18	J	0.53	0.18	LT	<0.99	U	1.3		0.49		9.1	
DCWN-SD23-01-062418	Cove Wash North	6/24/2018	1.0		2.9		0.13	J	<0.41	0.22	UJ	0.34	J	1.5		0.55		7.9	
DCWN-SD24-01-062418	Cove Wash North	6/24/2018	1.6		3.1		0.18	J	1.22	0.26	J-	<0.98	U	1.5		0.55		9.3	
DCWN-SD25-01-062418	Cove Wash North	6/24/2018	1.5		3.5		0.24		0.67	0.17	LT	0.37	J	1.6		0.69		10	
DCWN-SD26-01-062418	Cove Wash North	6/24/2018	2.6		2.5		0.43		0.71	0.19	J-	<0.97	U	1.0		0.41		8.6	
DCWN-SD27-01-062418	Cove Wash North	6/24/2018	2.0		3.0		0.43		0.72	0.21	LT	0.36	J	1.9		0.74		8.8	
DCWN-SD28-01-062418	Cove Wash North	6/24/2018	2.4		3.7		0.41		1.49	0.33		0.48	J	1.7		0.94		11	
DCWN-SD28A-01-062418	Cove Wash North	6/24/2018	1.6		2.7		0.32		<0.29	0.17	UJ	<0.99	U	1.2		0.44		5.2	
DCWN-SD28B-01-062418	Cove Wash North	6/24/2018	3.4		4.2		**0.62**		0.94	0.22	J+	**0.75**	J	2.2		1.30		11	
DCWN-SD29-01-062418	Cove Wash North	6/24/2018	1.7		3.3		0.26		1.14	0.25		0.39	J	1.6		0.82		29	
DCWN-SD30-01-062418	Cove Wash North	6/24/2018	**8.3**		3.6		0.22		1.33	0.29	J-	0.32	J	1.6		0.77		17	
Number of Measurements			32		32		32		32			32		32		32		32	
Number of Detects			32		32		32		28			19		32		32		32	
Number of Nondetects			0		0		0		4			13		0		0		0	
Minimum (mg/kg)			0.82		1.9		0.07		0.43			0.32		0.90		0.26		5.2	
Maximum (mg/kg)			8.3		6.5		0.62		3.05			0.75		2.7		2.4		47	
Average (mg/kg)			1.9		3.1		0.21		1.00			0.43		1.5		0.65		14	
Median (mg/kg)			1.5		2.9		0.18		0.81			0.39		1.4		0.49		11	
Standard Deviation (mg/kg)			1.6		0.84		0.12		0.52			0.11		0.44		0.42		9.5	
90th Percentile (mg/kg)			2.6		3.7		0.40		1.43			0.58		2.2		1.2		22	
95th Percentile (mg/kg)			4.9		4.2		0.43		1.56			0.62		2.4		1.2		34	
99th Percentile (mg/kg)			7.8		5.8		0.56		2.66			0.72		2.6		2.1		45	
Relative Standard Deviation			0.84		0.27		0.57		0.52			0.26		0.30		0.65		0.68	
BTV (mg/kg)			2.4		8.0		0.19		1.2			0.80		3.5		0.58		15	
Maximum/BTV (unitless)			3.5		0.8		3.3		2.6			0.9		0.8		4.2		3.1	

Table J-18. Sediment Results for Primary Analytes in the Cove Wash North Drainage (Continued)

Notes:

The maximum concentration is presented in **bold**.
Shaded **red** indicates that the result exceeds the applied BTV.

<	The analyte was analyzed for, but was not detected. The reporting limit is shown in the result column.
BTV	Background threshold value
ID	Identification
J	Estimated value
J-	Estimated value, may be biased low.
J+	Estimated value, may be biased high.
LT	Result less than requested minimum detectable concentration, but greater than the sample-specific detectable concentration.
mg/kg	Milligrams per kilogram
pCi/g	Picocuries per gram
Q	Qualifier
TPU	Total propagated uncertainty
U	Not detected. The associated value is the reporting limit.
UJ	Not considered detected. The associated value is the reported concentration, which is estimated.

5.2.2 Gamma Radiation Survey Results

In general, a majority of the radiation levels measured within the Cove Wash North drainage are in the range of the combined background data set for BSA-34 and BSA-35, with an upper range of measurements in the range of three to four times the applied gamma BTV of 12,465 cpm. Table J-19 provides summary statistics for the gamma radiation measurements within the drainage. Eleven percent of measurements exceeded the applied gamma BTV with the Cove Wash North drainage. Figure J-14 displays gamma radiation survey data collected within the drainage compared to the background drainage gamma survey results. The spread of gamma radiation levels within the drainage encompasses the range of background gamma measurements up to a maximum gamma count rate measurement of 42,052 cpm, a measurement greater than three times the applied gamma BTV. A box plot showing the quartiles of the data sets is provided in Figure J-15. The box plot displays the median of the drainage radiation levels as approximately the same as background data set median and below applied gamma BTV.

Waste piles associated with the Mesa VI Mine exist at the origin of the drainage and the gamma radiation levels below these waste piles are within a range of one to two times the applied gamma BTV. The maximum gamma radiation level of 42,052 cpm was observed downgradient from Waste Pile M14. Portions of the drainage gamma survey were not logged because of loss of GPS signal resulting from the steep canyon walls within the Cove Wash North drainage.

Table J-19. Summary of Gamma Radiation Survey Results for the Cove Wash North Drainage

Summary Statistic	Units	Gamma Radiation Survey Results
Applied Gamma BTV	cpm	12,465
Measurements	#	17,163
Minimum	cpm	6,757
Maximum	cpm	42,052
Average	cpm	10,829
Median	cpm	10,619
Standard Deviation	cpm	1,833
90th Percentile	cpm	12,602
95th Percentile	cpm	13,399
99th Percentile	cpm	15,957
Measurements Above Gamma BTV	#	1,948
Measurements Above Gamma BTV	%	11

Notes:

BTV Background threshold value
cpm Counts per minute

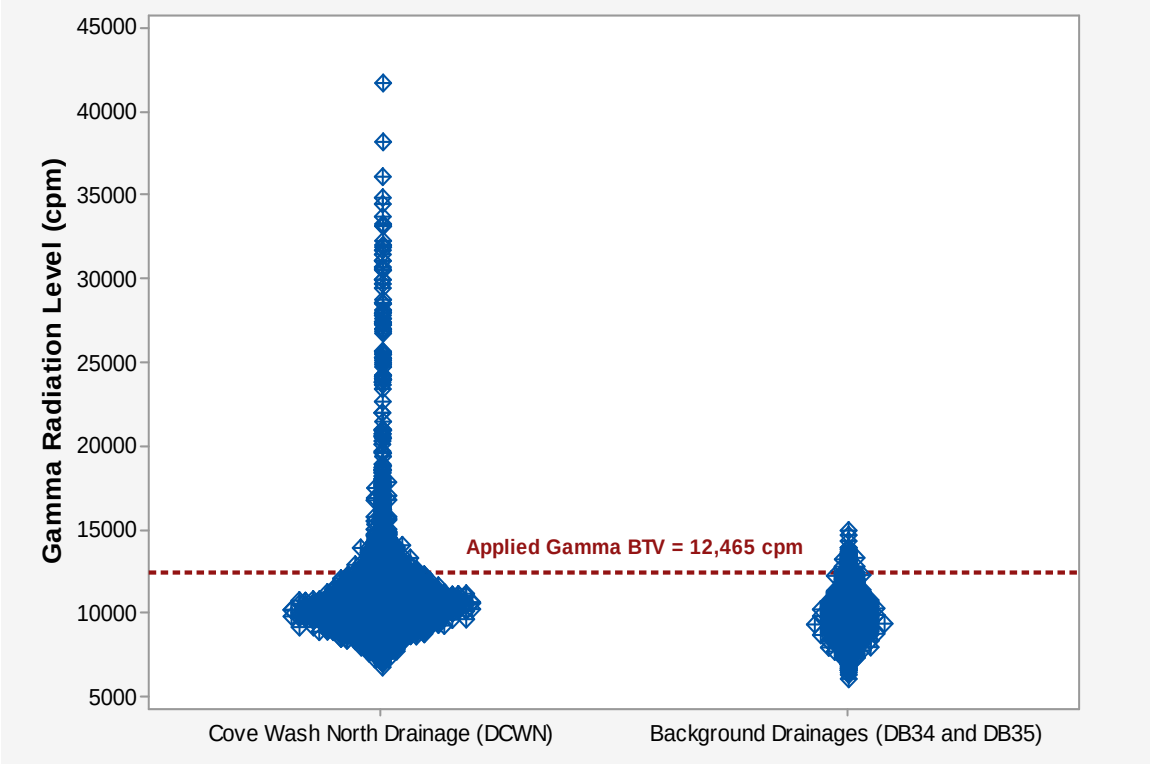


Figure J-14. Individual Value Plot of Gamma Radiation Levels within the Cove Wash North Drainage and Background Drainages

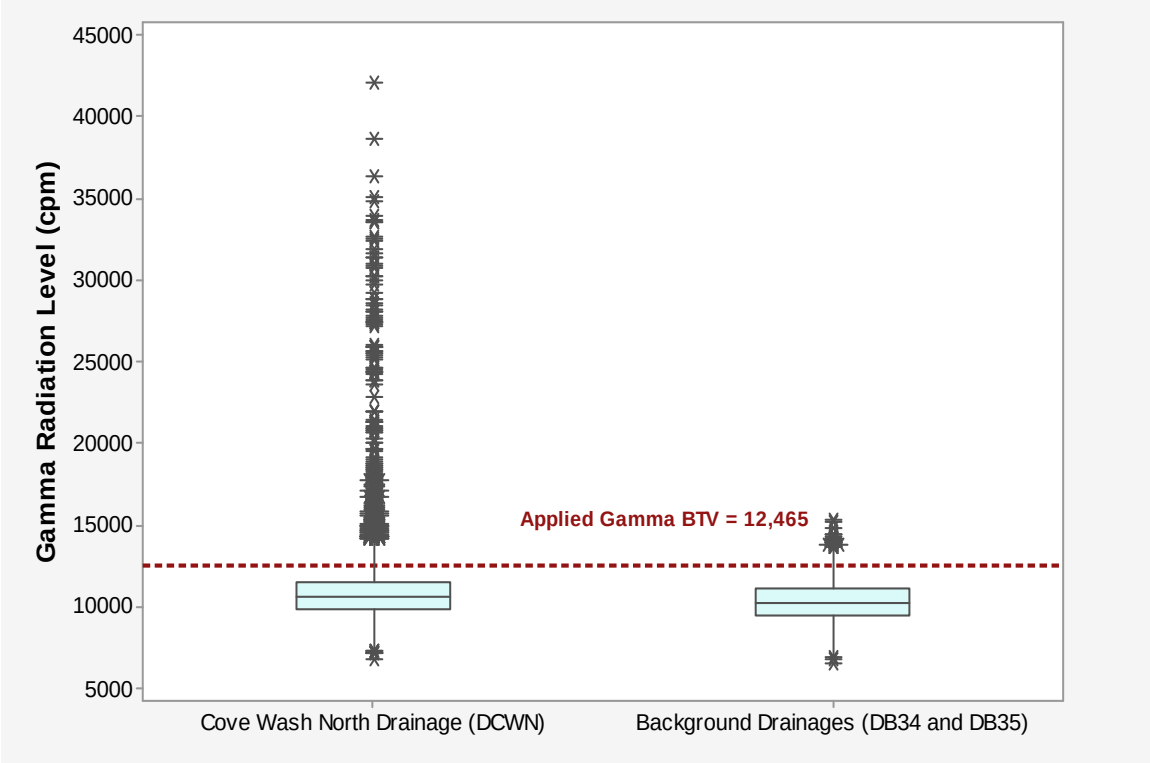


Figure J-15. Box Plot of Gamma Radiation Levels within the Cove Wash North Drainage and Background Drainages

5.2.3 Potential Contribution from AUMs

Based on the arsenic, molybdenum, radium-226, uranium, and vanadium sediment sample results exceeding twice their respective BTVs, Mesa VI Mine, non-Tronox mines, and Frank Jr. Mine appear to contribute to elevated concentrations of mine contaminants in the Cove Wash North drainage. Although the maximum gamma measurement exceeds twice the applied BTV, the median gamma survey measurement is below the applied BTV for the drainage, indicating that as a whole, radiation levels within the drainage are similar to background levels. Gamma measurements exceeding twice the applied BTV are limited to an area downgradient of Frank Jr. Mine. Additional investigation may be warranted to further identify the lateral and vertical extents of contamination. Concentrations of primary analytes and gamma measurements in the Cove Wash North drainage are relatively low when compared to concentrations detected in the Lukachukai Mountains drainages located further south.

5.3 MIDDLE 1 DRAINAGES

Middle 1 is the largest drainage in the Lukachukai Mountains Region. The direction of surface water flow is generally from southwest to northeast within the Middle 1 drainage, following the general trend of the downward slope of the mountains.

5.3.1 Middle 1

Middle 1 originates just north of Mesa IV, West Mine, and passes directly through Waste Pile M23 associated with the mine. It then flows northeast, where the following drainages merge into Middle 1 from the north side of the drainage: Middle 1E, Middle 1D, Middle 1C, Middle 1B, and Middle 1A. Upgradient of the Middle 1E, Middle 1D, and Middle 1C drainages, which were not sampled as part of the RSE investigation, are the non-Tronox mines Mesa IV 1/4 Mine; NA-0316; South Portal, Frank No. 1 Mine; Frank No. 2; and East Portal, and Frank No. 1 Mine. Potential inputs to the Middle 1B drainage are soils from Mesa IV 1/2 Mine and Simpson 181; Mesa V Mine – 508; and non-Tronox mine North Portal, Frank No. 1 Mine. Potential inputs to the Middle 1A drainage are soils from Mesa V Mine – 103, Mesa V Incline, and Mesa V Adit. Further downgradient, Middle 1G flows into Middle 1, providing inputs from Mesa IV Mine No. 2, Mesa IV Mine No. 3, Mesa IV Mine No. 1, and non-Tronox mine Cov068. Middle 1 merges with Middle 2 and flows into Cove Wash North towards the Cove Transfer Station. Immediately below the convergence of Middle 1, Middle 2, and Middle 3, some water is diverted to an irrigation canal west of the Cove Wash Middle flowing towards the north, labeled as "Middle 1."

A total of 33 sediment samples were collected from the Middle 1 drainage in June 2018; one of those samples (DC1-SD81) was a judgmental sample collected above an obstruction where the gamma scan showed an increase in activity. Sediment samples were analyzed for the suite of metals and radionuclides presented in Table J-9 and Table J-10. A gamma survey was performed along an approximately 2.2 miles of the Middle 1 drainage on June 20, 21, and 23, 2018. The results of sediment sampling for primary analytes and the gamma survey are described in the following subsections and presented within the Middle 1 drainage results figures in Attachment J3 (Figure DC1-I, Figures DC1-1 through DC1 -7).

5.3.1.1 Sediment Sampling Results

Sediment results for primary analytes collected at 33 locations are compared with BTVs from BSA-34 and BSA-35 and presented in Table J-20. Results from 30, 32, and 27 of the radium-226, uranium, and vanadium samples exceeded their respective BTVs. In addition, 9, 1, 18, and 12 sample results exceeded the BTVs for arsenic, lead, molybdenum, and selenium, respectively. The location of the maximum concentration of the primary analytes varied.

The sample location immediately downgradient of Mesa IV, West Mine (DC1-SD31) had concentrations of molybdenum, radium-226, and vanadium slightly elevated above the BTVs, and a uranium concentration approximately four times the BTV.

The maximum concentrations of radium-226 and vanadium (both at DC1-SD25) and uranium (at DC1-SD23) were all from samples in the middle upper portion of Middle 1 drainage, immediately downgradient of where Middle 1C drainage merges with Middle 1; results exceeded the BTVs by 15, 7, and 49 times, respectively.

The maximum concentrations for arsenic (sample DC1-SD14) and molybdenum (DC1-SD17) were both in the middle portion of the drainage, immediately downgradient of where Middle 1B and Middle 1G drainages merge with Middle 1, and exceeded the BTVs by an order of magnitude. Elevated concentrations of most primary contaminants continue all the way downgradient to the confluence with Middle 2 drainage.

Table J-20. Sediment Results for Primary Analytes in the Middle 1 Drainage

Field Sample ID	Drainage Channel ID	Sample Date	Arsenic		Lead		Molybdenum		Radium-226			Selenium		Thorium		Uranium		Vanadium	
			Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Activity (pCi/g)	TPU	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q
DC1-SD1-01-062118	Middle 1	6/21/2018	2.7		4.4		0.52		6.59	0.89	J-	0.98	J	1.7		8.1		63	
DC1-SD2-01-062118	Middle 1	6/21/2018	2.4		3.6		0.42		5.17	0.72	J-	1.00		1.3		7.6		44	
DC1-SD3-01-062118	Middle 1	6/21/2018	3.1		3.9		0.33		2.03	0.37	J-	0.52	J	2.2		1.3		12	
DC1-SD4-01-062118	Middle 1	6/21/2018	1.6		3.1		0.36		2.33	0.37		0.45	J	1.2		5.3		30	
DC1-SD5-01-062118	Middle 1	6/21/2018	3.0		3.1		0.62		4.3	0.63		0.58	J	1.1		11		57	
DC1-SD6-01-062118	Middle 1	6/21/2018	1.6		2.5		0.98		6.6	0.86		0.44	J	1.0		5.3		48	
DC1-SD7-01-062118	Middle 1	6/21/2018	1.9		2.8		0.61		5.38	0.73		0.81	J	1.6		7.0		49	
DC1-SD8-01-062118	Middle 1	6/21/2018	1.6		2.9		0.44		3.77	0.56		<1.2	U	1.2		5.4		30	
DC1-SD8A-01-062118	Middle 1	6/21/2018	2.0		**8.6**		0.26		8.2	1	J-	0.91	J	1.2		11		100	
DC1-SD9-01-062118	Middle 1	6/21/2018	2.8		4.4		0.69		8.3	1.1		1.10		1.5		14		73	
DC1-SD10-01-062118	Middle 1	6/21/2018	2.7		3.5		0.54		6.49	0.85		0.87	J	1.6		8.2	J	42	J
DC1-SD11-01-062118	Middle 1	6/21/2018	2.2		3.5		0.50		6.1	0.84		0.93	J	1.4		11		58	
DC1-SD12-01-062118	Middle 1	6/21/2018	2.0		3.4		0.49		5.39	0.68		0.79	J	1.2		8.6		53	
DC1-SD13-01-062118	Middle 1	6/21/2018	3.1		3.7		0.84		11	1.4	J-	1.30		2.2		9.0		58	
DC1-SD14-01-062118	Middle 1	6/21/2018	**24.0**		5.1		0.88		10.2	1.3		1.10	J	1.2		6.3		57	
DC1-SD15-01-062118	Middle 1	6/21/2018	<0.23	U	<0.23	U	<0.23	U	16.5	2		<1.2	U	<0.023	U	0.002	J	<0.58	U
DC1-SD16-01-062118	Middle 1	6/21/2018	2.5		4.9		0.32		5.65	0.8		1.40		**3.0**		13		88	
DC1-SD17-01-062118	Middle 1	6/21/2018	3.4	J	4.9	J	**1.90**	J	6.27	0.86		1.10		2.2	J	12		76	J
DC1-SD18-01-062118	Middle 1	6/21/2018	1.1		2.2		0.19	J	6.34	0.85	J-	0.55	J	0.9		8.9		79	
DC1-SD19-01-062118	Middle 1	6/21/2018	1.2		2.9		0.11	J	5.69	0.79		0.69	J	1.2		9.2		55	
DC1-SD20-01-062118	Middle 1	6/21/2018	1.3		2.7		0.16	J	4.98	0.64		0.74	J	1.3		5.8		29	
DC1-SD21-01-062118	Middle 1	6/21/2018	1.3		4.4		0.11	J	13.1	1.6		**2.10**		1.7		7.7		85	
DC1-SD22-01-062118	Middle 1	6/21/2018	1.0		2.9		0.07	J	6.41	0.87		0.73	J	1.4		6.6		35	
DC1-SD23-01-062318	Middle 1	6/23/2018	1.0		3.0		0.12	J	15.1	1.9		1.30		1.2		**27**		100	
DC1-SD24-01-062318	Middle 1	6/23/2018	0.7		1.7		0.08	J	3.97	0.59		0.36	J	1.0		5.2		25	
DC1-SD25-01-062318	Middle 1	6/23/2018	1.8		3.7		0.16	J	**18.2**	2.3		0.81	J	1.4		26		**120**	J
DC1-SD26-01-062318	Middle 1	6/23/2018	1.3		3.3		0.11	J	8.9	1.2		0.58	J	1.5		9.6		57	
DC1-SD27-01-062318	Middle 1	6/23/2018	0.9		2.8		0.09	J	14.3	1.7		0.51	J	1.3		26		**120**	
DC1-SD28-01-062318	Middle 1	6/23/2018	1.0		2.6		0.09	J	1.17	0.26		0.36	J	1.9		1.1		9.5	
DC1-SD29-01-062318	Middle 1	6/23/2018	0.9		2.1		0.07	J	1.02	0.25		<0.95	U	1.0		0.7		11	
DC1-SD30-01-062318	Middle 1	6/23/2018	1.0		2.6		0.09	J	1.09	0.29		0.34	J	1.2		0.9		12	
DC1-SD31-01-062318	Middle 1	6/23/2018	2.0		3.8		0.20		2.04	0.34		0.63	J	1.3		2.1		24	
DC1-SD32-01-062318	Middle 1	6/23/2018	1.4		3.0		0.10	J	0.8	0.21	LT	<0.99	U	1.5		0.8		10	
Number of Measurements			33		33		33		33			33		33		33		33	
Number of Detects			32		32		32		33			29		32		33		32	
Number of Nondetects			1		1		1		0			4		1		0		1	
Minimum (mg/kg)			0.7		1.7		0.07		0.8			0.34		0.9		0.0		9.5	
Maximum (mg/kg)			24.0		8.6		1.90		18.2			2.10		3.0		27		120	
Average (mg/kg)			2.5		3.5		0.39		6.8			0.83		1.5		8.5		53	
Median (mg/kg)			1.7		3.2		0.29		6.1			0.79		1.3		7.7		54	
Standard Deviation (mg/kg)			3.99		1.25		0.38		4.55			0.38		0.44		6.8		31	
90th Percentile (mg/kg)			3.1		4.9		0.83		14.1			1.30		2.2		14		99	
95th Percentile (mg/kg)			3.2		5.0		0.93		15.7			1.36		2.2		26		109	
99th Percentile (mg/kg)			17.6		7.5		1.61		17.7			1.90		2.8		27		120	
Relative Standard Deviation			1.59		0.36		0.98		0.67			0.46		0.31		0.8		0.58	
BTV (mg/kg)			2.4		8.0		0.19		1.2			0.80		3.5		0.58		15	
Maximum/BTV (unitless)			10		1.1		10		16			2.6		0.86		47		7.9	

Table J-20. Sediment Results for Primary Analytes in the Middle 1 Drainage (Continued)

Notes:

The maximum concentration is presented in **bold**.
Shaded **red** indicates that the result exceeds the applied BTV.

<	The analyte was analyzed for, but was not detected. The reporting limit is shown in the result column.
BTV	Background threshold value
ID	Identification
J	Estimated value
J-	Estimated value, may be biased low.
LT	Result less than requested minimum detectable concentration, but greater than the sample-specific detectable concentration.
mg/kg	Milligrams per kilogram
pCi/g	Picocuries per gram
Q	Qualifier
TPU	Total propagated uncertainty
U	Not detected. The associated value is the reporting limit.

5.3.1.2 Gamma Radiation Survey Results

The Middle 1 drainage was gamma surveyed over a length of approximately 2.2 miles on June 20, June 21, and June 23, 2018. In general, the radiation levels within the Middle 1 drainage exceeded the applied gamma BTV for the combined BSA-34 and BSA-35 data set, with an upper range of measurements in the range of four to five times applied gamma BTV of 12,465 cpm. Table J-21 provides summary statistics for the gamma radiation measurements within the drainage. Eighty-one percent of measurements exceeded the applied gamma BTV. Figure J-16 displays gamma radiation survey data collected within the drainage compared to the background drainage gamma survey results. The spread of gamma radiation levels within the drainage encompasses the range of background gamma measurements up to a maximum gamma count rate measurement of 52,483 cpm, a measurement greater than four times the applied gamma BTV. A box plot showing the quartiles of the data sets is provided in Figure J-17. The box plot displays the median of the drainage radiation levels above the background data set median and above applied gamma BTV.

Much of the drainage measured one to two times the applied gamma BTV, with localized areas of gamma measurements of two to three times the BTV. The maximum gamma radiation level of 52,483 cpm was observed below the confluence of the Middle 1C and Middle 1. Portions of the Middle 1 gamma survey were not logged because of poor GPS signal.

Table J-21. Summary of Gamma Radiation Survey Results for the Middle 1 Drainage

Summary Statistic	Units	Gamma Radiation Survey Results
Applied Gamma BTV	cpm	12,465
Measurements	#	25,049
Minimum	cpm	7,261
Maximum	cpm	52,483
Average	cpm	17,019
Median	cpm	16,106
Standard Deviation	cpm	5,133
90th Percentile	cpm	23,465
95th Percentile	cpm	25,818
99th Percentile	cpm	33,801
Measurements Above Gamma BTV	#	20,314
Measurements Above Gamma BTV	%	81

Notes:

BTV Background threshold value
cpm Counts per minute

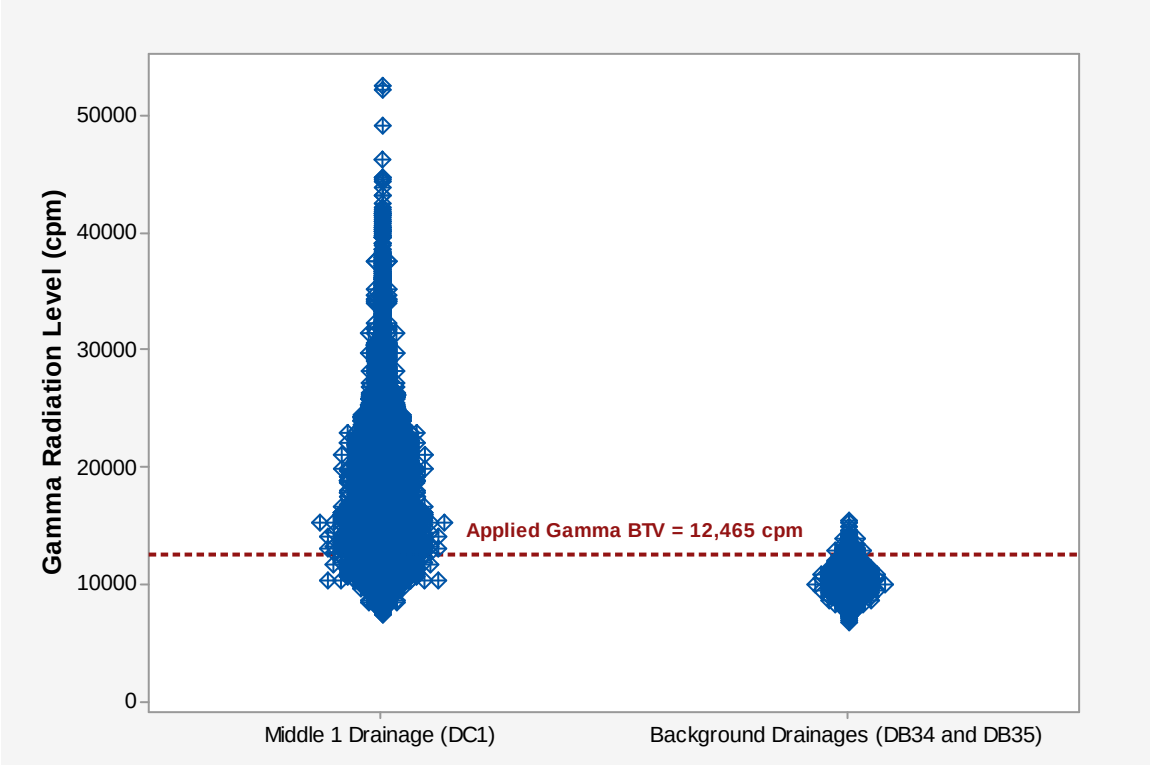


Figure J-16. Individual Value Plot of Gamma Radiation Levels within the Middle 1 Drainage and Background Drainages

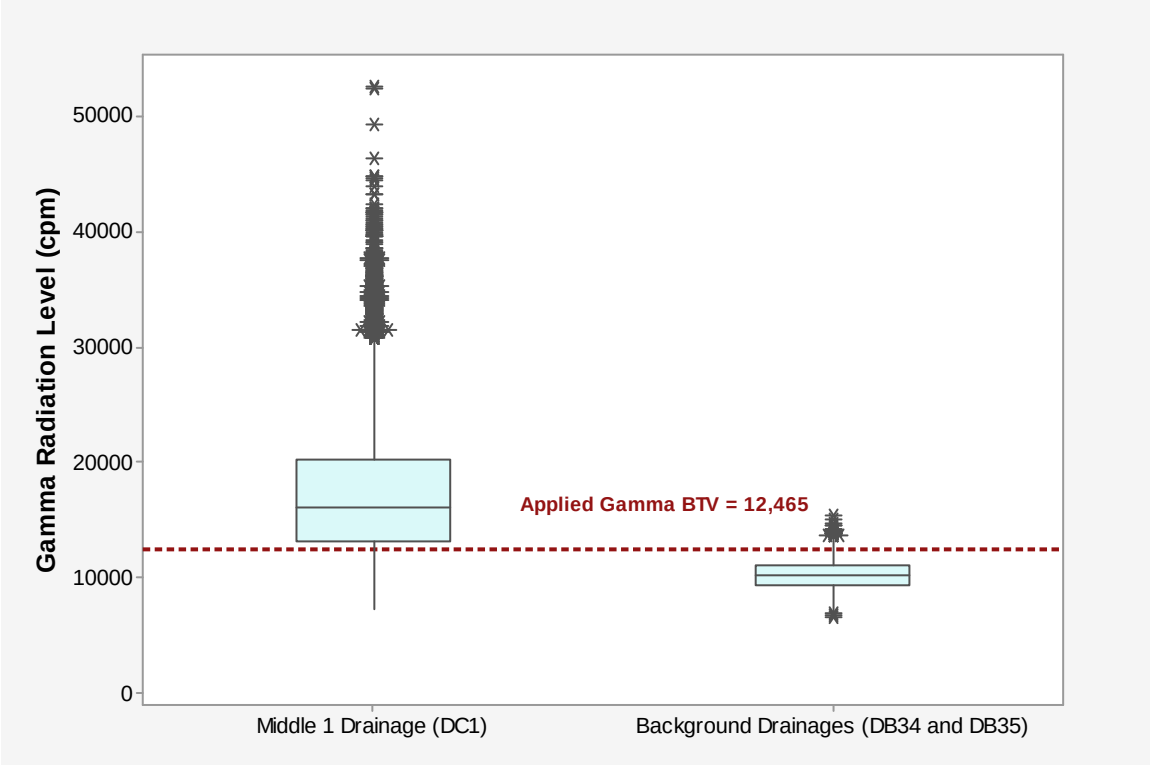


Figure J-17. Box Plot of Gamma Radiation Levels within the Middle 1 Drainage and Background Drainages

5.3.1.3 Potential Contribution from AUMs

Based on the arsenic, molybdenum, radium-226, uranium, and vanadium sediment sample results exceeding twice their respective BTVs, Mesa IV, West Mine appears to contribute to elevated concentrations of uranium in the far upgradient portion of the Middle 1 drainage, but likely does not contribute to elevated concentrations of other primary analytes. Non-Tronox mines and Tronox mines located within the contributing watershed likely contribute to elevated concentrations of mine contaminants in the middle and lower portions of Middle 1 drainage. The maximum gamma measurement exceeded twice the applied BTV, while the median gamma survey measurement was below the applied BTV for the drainage, indicating that as a whole, radiation levels within the drainage are similar to background levels. However, gamma measurements exceeded the applied BTV in many areas of the drainage downgradient of the confluence of Middle 1D, indicating that upgradient mines contribute to elevated radiation levels in the drainage. Additional investigation may be warranted to further identify the lateral and vertical extents of contamination.

5.3.2 Middle 1A

Middle 1A is a second-order stream originating from Mesa V on the north side of Middle 1 drainage; two third-order drainages merge to create Middle 1A drainage. The southernmost third-order stream originates above Mesa V Mine – 103 and passes directly through Waste Pile M17. The northernmost third-order drainages originates immediately upgradient of Mesa V Adit and Mesa V Incline, and has small drainages that pass directly through both sites, and through Waste Piles M16A and M16B, associated with Mesa V Adit. Middle 1A merges with Middle 1.

A total of nine surface sediment samples and one subsurface sediment sample were collected from the Middle 1A drainage in June 2018, including one judgmental sample location (DC1A-SD7A), which included a surface and subsurface sediment sample. Sediment samples were analyzed for the suite of metals and radionuclides presented in Table J-9 and Table J-10. A gamma survey was performed along an approximately 0.5-mile reach of the Middle 1B drainage on June 20, 2018. The results of sediment sampling for primary analytes and the gamma survey are described in the following subsections and presented within the Middle 1A drainage results figures in Attachment J3 (Figure DC1A-I, Figures DC1A -1 and DC1A-2).

5.3.2.1 Sediment Sampling Results

Sediment results for primary analytes collected at nine locations are compared with BTVs from BSA-34 and BSA-35 and presented in Table J-22. Results for arsenic, molybdenum, radium-226, uranium, and vanadium exceeded the BTV in all of the samples collected. For molybdenum, radium-226, uranium, and vanadium, the maximum concentration was exhibited in the sample collected at DC1A-SD7A along the drainage within Waste Pile M17 associated with Mesa V Mine – 103. The maximum concentrations exceeded the corresponding BTV by 19, 62, 260, and 24 times. The radium-226 concentration from this location was the second highest detected concentration off all samples collected within the drainage investigation, and the uranium concentration was the highest detected concentration. Lead exceeded the BTV in the subsurface sample collected at DC1A-SD7A, and selenium exceeded the BTV in five samples, with the maximum concentration at the surface and subsurface samples at the additional sample location DC1A-SD7A.

The maximum concentration of arsenic was in sample DC1A-SD6, collected immediately downgradient of Mesa V Adit Waste Pile M16A; it exceeded the BTV by three times. Although the concentrations were higher at the location within Mesa V Mine – 103, the concentrations of molybdenum, radium, selenium, uranium, and vanadium exceeded the BTVs by 14, 32, 5, 75, and 22 times, respectively.

Elevated concentrations continue downgradient, though are relatively lower. The radium-226 results exceeded the BTV by 32 times at location DC1A-SD5, and by five times at downgradient location DC1A-SD1, located just before the confluence with Middle 1. Molybdenum, selenium, radium-226, uranium, and vanadium concentrations follow the same general downward trend from upgradient to downgradient; however, sample DC1A-SD2 exhibits a uranium concentration higher than most of the upgradient samples.

Table J-22. Sediment Results for Primary Analytes in the Middle 1A Drainage

Field Sample ID	Drainage Channel ID	Sample Date	Arsenic		Lead		Molybdenum		Radium-226			Selenium		Thorium		Uranium		Vanadium	
			Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Activity (pCi/g)	TPU	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q
DC1A-SD1-01-062018	Middle 1A	6/20/2018	3.1		3.6		0.89		5.26	0.74		0.57	J	1.5		6.9		52	
DC1A-SD2-01-062018	Middle 1A	6/20/2018	4.1		4.0		1.10	J	18.4	2.3	J	0.66	J	1.7	J	43	J	73	J
DC1A-SD3-01-062018	Middle 1A	6/20/2018	7.1		6.2		1.70		17.4	2.1	J-	1.40		**2.4**		14		79	
DC1A-SD4-01-062018	Middle 1A	6/20/2018	6.0		5.0		1.60		9.2	1.2		0.72	J	2.0		11		330	
DC1A-SD5-01-062018	Middle 1A	6/20/2018	3.9		4.6		2.20		37.4	4.5		2.80		1.7		26		160	
DC1A-SD6-01-062018	Middle 1A	6/20/2018	**7.5**		5.6		2.70		31.1	3.8	J-	1.20		2.3		24		180	
DC1A-SD7-01-062018	Middle 1A	6/20/2018	2.5		4.7		1.00		8.9	1.1		1.30		1.8		26		59	
DC1A-SD7A-01-062018	Middle 1A	6/20/2018	5.3		8.0		**3.70**		**72**	8.5	J-	**6.50**		2.2		**150**		**360**	
DC1A-SD7A-0612-01-062018	Middle 1A	6/20/2018	4.5		**11.0**		2.60		47.6	5.7	M3	6.30		1.1		120		340	
Number of Measurements			9		9		9		9			9		9		9		9	
Number of Detects			9		9		9		9			9		9		9		9	
Number of Nondetects			0		0		0		0			0		0		0		0	
Minimum (mg/kg)			2.5		3.6		0.89		5.3			0.57		1.1		6.9		52.0	
Maximum (mg/kg)			7.5		11		3.70		72			6.50		2.4		150		360	
Average (mg/kg)			4.9		5.9		1.94		27.5			2.38		1.9		46.8		181	
Median (mg/kg)			4.5		5.0		1.70		18.4			1.30		1.8		26.0		160	
Standard Deviation (mg/kg)			1.72		2.33		0.94		21.95			2.37		0.42		51.7		129	
90th Percentile (mg/kg)			7.2		8.6		2.90		52.5			6.34		2.3		126.0		344	
95th Percentile (mg/kg)			7.3		9.8		3.30		62.2			6.42		2.4		138		352	
99th Percentile (mg/kg)			7.5		10.8		3.62		70.0			6.48		2.4		148		358	
Relative Standard Deviation			0.35		0.40		0.48		0.80			1.00		0.22		1.1		0.71	
BTV (mg/kg)			2.4		8.0		0.19		1.2			0.80		3.5		0.58		15	
Maximum/BTV (unitless)			3.1		1.4		19		62			8.1		0.69		260		24	

Notes:
The maximum concentration is presented in **bold**.
Shaded **red** indicates that the result exceeds the applied BTV.

BTV	Background threshold value
ID	Identification
J	Estimated value
J-	Estimated value, may be biased low.
M3	The requested minimum detected concentration was not met, but the reported activity is greater than the reported minimum
mg/kg	Milligrams per kilogram
pCi/g	Picocuries per gram
Q	Qualifier
TPU	Total propagated uncertainty

5.3.2.2 Gamma Radiation Survey Results

In general, the radiation levels within the Middle 1A drainage exceeded the applied gamma BTV, with an upper range of measurements greater than 10 times applied gamma BTV for the combined BSA-34 and BSA-35 data set of 12,465 cpm. Table J-23 provides summary statistics for the gamma radiation measurements within Middle 1A. Ninety-five percent of measurements exceeded the applied gamma BTV. Figure J-18 displays gamma radiation survey data collected within the drainage compared to the background drainage gamma survey results. The spread of gamma radiation levels within the drainage encompasses the range of background gamma measurements up to a maximum gamma count rate measurement of 122,692 cpm, a measurement greater than 10 times the applied gamma BTV. A box plot showing the quartiles of the data sets is provided in Figure J-19. The box plot displays the median of the drainage radiation levels above the background data set median and above applied gamma BTV.

Much of the drainage measures two to three times the applied gamma BTV, with localized areas of gamma measurements of three to four times the BTV. The maximum gamma radiation level of 122,692 cpm was measured directly downgradient of Waste Pile M17. The unreclaimed waste piles existing at the origin of the Middle 1A drainage appear to be actively contributing sediments exhibiting elevated gamma measurements into the Middle 1A drainage. In general, gamma radiation levels decrease over the length of the drainage in the downstream direction away from the upstream waste piles.

Table J-23. Summary of Gamma Radiation Survey Results for the Middle 1A Drainage

Summary Statistic	Units	Gamma Radiation Survey Results
Applied Gamma BTV	cpm	12,465
Measurements	#	6,219
Minimum	cpm	8,094
Maximum	cpm	122,692
Average	cpm	33,298
Median	cpm	23,822
Standard Deviation	cpm	20,291
90th Percentile	cpm	64,656
95th Percentile	cpm	72,596
99th Percentile	cpm	85,921
Measurements Above Gamma BTV	#	5,914
Measurements Above Gamma BTV	%	95%

Notes:
BTV Background threshold value
cpm Counts per minute

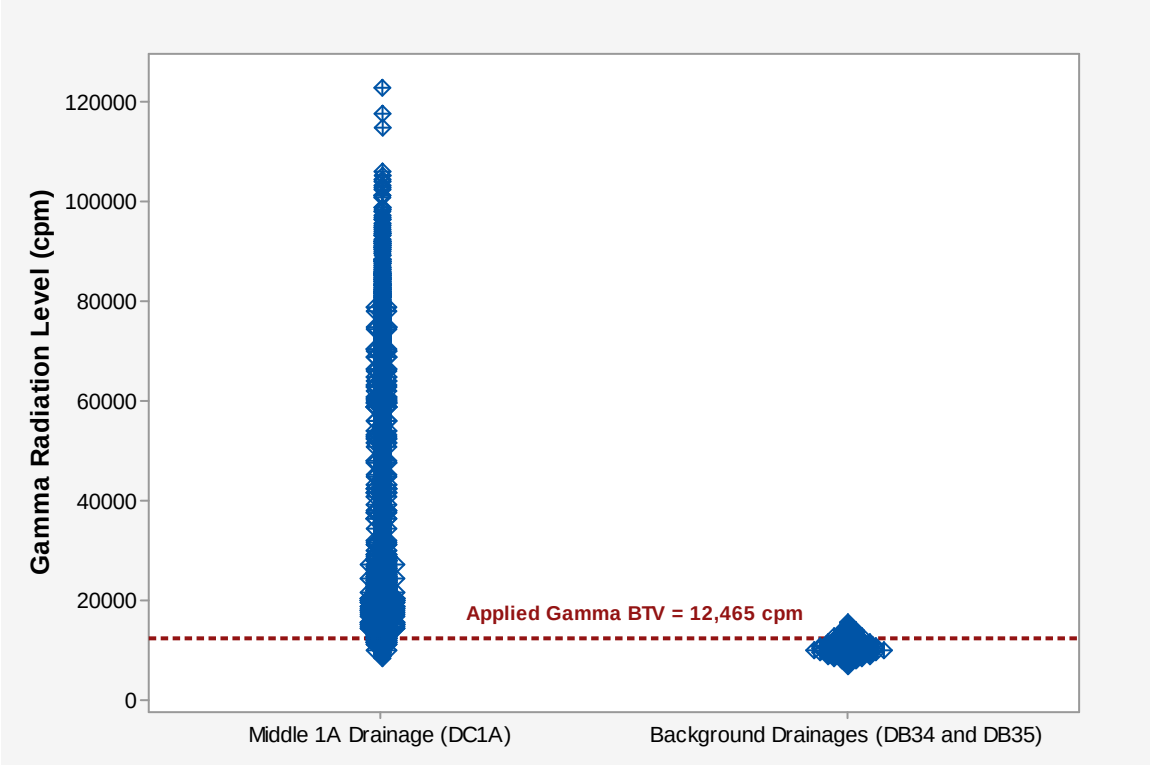


Figure J-18. Individual Value Plot of Gamma Radiation Levels within the Middle 1A Drainage and Background Drainages

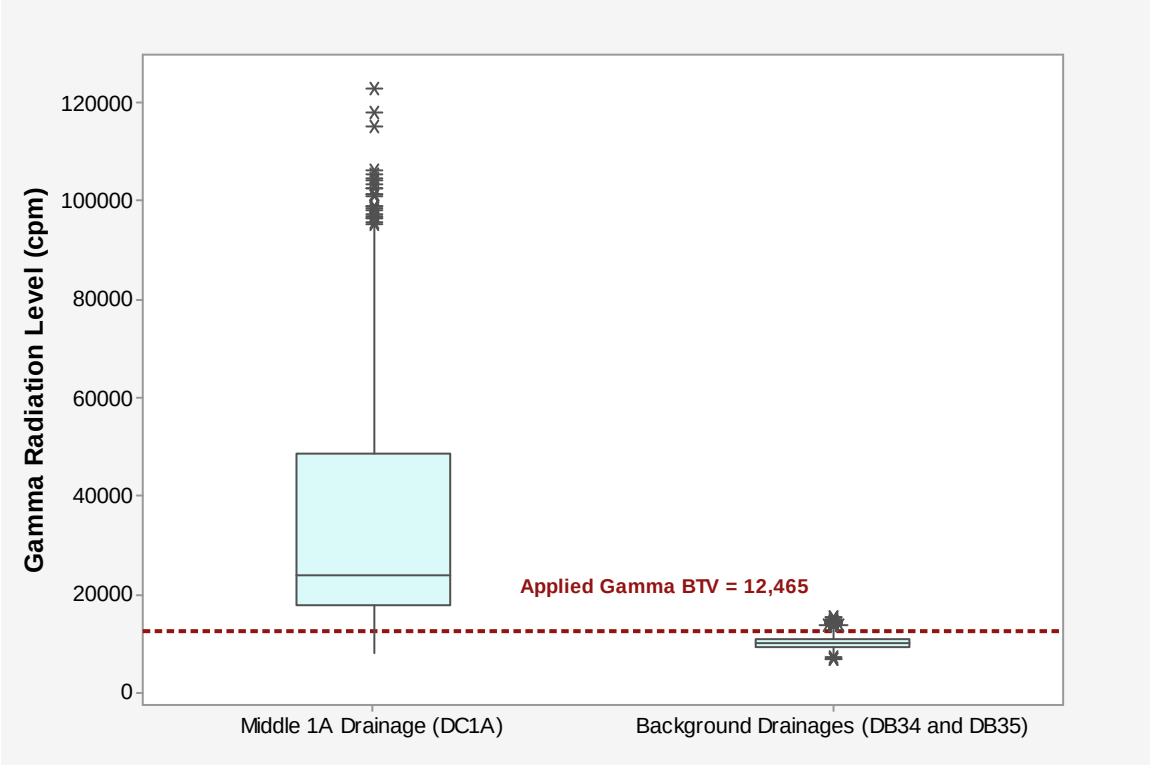


Figure J-19. Box Plot of Gamma Radiation Levels within the Middle 1A Drainage and Background Drainages

5.3.2.3 Potential Contribution from AUMs

Based on the arsenic, molybdenum, radium-226, uranium, and vanadium sample results greatly exceeding twice their respective BTVs, the Middle 1A drainage is impacted by mines within the watershed (Mesa V Mine – 103, Mesa V Incline, and Mesa V Adit). Concentrations of primary analytes in the Middle 1A drainage are some of the highest detected in the Northern Agency Tronox Mine study area. The radium-226 concentration from the sample below Mesa V Mine – 103 was the second highest detected concentration off all samples collected within the drainage investigation, and the uranium concentration was the highest detected concentration. Gamma measurements support the conclusion that the Middle 1A drainage may be impacted by the upgradient mines; the maximum concentration exceeds twice the applied BTV, and the median concentration exceeds the applied BTV. Additional investigation may be warranted to further identify the lateral and vertical extents of contamination.

5.3.3 Middle 1B

Middle 1B is a second-order drainage that flows into Middle 1 to the east of the Middle 1A drainage, and merges with Middle 1 upgradient of Middle 1A. The drainage originates just upgradient of Mesa IV 1/2 Mine and Simpson 181 and non-Tronox mine North Portal, Frank No. 1. Water drains through Waste Pile M19 associated with Mesa IV 1/2 Mine and Simpson 181 into Middle 1B. A smaller drainage was also mapped flowing directly through Waste Pile M18 associated with Mesa V Mine – 508.

A total of 12 surface sediment samples were collected from the Middle 1B drainage in June 2018; two of those samples (DC1B-SD5A and DC1B-SD8A) were judgmental samples collected because of elevated gamma readings. The sample at location DC1B-SD8A was collected within a waste pile from a non-Tronox mine. A gamma survey was performed along an approximately 0.7-mile reach of the Middle 1B drainage on June 21, 2018. The results of sediment sampling for primary analytes and the gamma survey are described in the following subsections and presented within the Middle 1B drainage results figures in Attachment J3 (Figure DC1B-I, Figures DC1B -1 and DC1B -2).

5.3.3.1 Sediment Sampling Results

Sediment results for primary analytes collected at 12 locations are compared with BTVs from BSA-34 and BSA-35 and presented in Table J-24. A total of 12 surface sediment samples were collected from the Middle 1B drainage in June 2018; two of those samples (DC1B-SD5A and DC1B-SD8A) were judgmental samples collected because of elevated gamma readings. The sample at location DC1B-SD8A was collected within a waste pile from a non-Tronox mine. In the sample collected upgradient of all the mines, BTVs for none of the primary analytes were exceeded. In the remainder of the samples, molybdenum, radium-226, uranium, and vanadium exceeded the corresponding BTVs. Lead and thorium results did not exceed their corresponding BTVs.

The maximum concentrations of radium-226 and uranium occurred at the upgradient location DC1B-SD8A, collected within a waste pile associated with non-Tronox mine North Portal, Frank No. 1, with results that exceeded the BTV by 28 and 59 times, respectively. The maximum result for vanadium also exhibited a greatly elevated concentration over the BTV – the result for sample DC1B-SD5A exceeded the BTV by 112 times.

The maximum concentration of molybdenum exceeded the BTV by an order of a magnitude (10 times) from location DC1B-SD5, which is located about halfway down the drainage. All the other concentrations exceeded the BTV by less than an order of magnitude. Arsenic results exceeded the BTV in four samples, and the maximum concentration was less than twice the BTV. Selenium results exceeded the BTV in all but two of the samples – the maximum concentration from the most downgradient sample DC1B-SD1 greatly exceeded the rest of the results – it exceeded the BTV by almost nine times.

Table J-24. Sediment Results for Primary Analytes in the Middle 1B Drainage

Field Sample ID	Drainage Channel ID	Sample Date	Arsenic		Lead		Molybdenum		Radium-226			Selenium		Thorium		Uranium		Vanadium	
			Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Activity (pCi/g)	TPU	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q
DC1B-SD1-01-062118	Middle 1B	6/21/2018	1.5		3.8		0.35		7.16	0.96		**7.10**		1.8		7.8		53	
DC1B-SD2-01-062118	Middle 1B	6/21/2018	4.2	J	3.0		0.34		6.51	0.86	J	0.94	J	1.4		25	J	75	J
DC1B-SD3-01-062118	Middle 1B	6/21/2018	1.5		2.9		0.23		6.12	0.83		0.52	J	1.3		6.7		29	
DC1B-SD4-01-062218	Middle 1B	6/22/2018	1.6		2.7		0.27		4.48	0.64		2.60		1.1		13	J	39	J
DC1B-SD5-01-062218	Middle 1B	6/22/2018	3.2		**6.2**		**1.20**		18.3	2.3		1.70		1.5		13		63	
DC1B-SD5A-01-062218	Middle 1B	6/22/2018	**4.4**		4.6		1.10		10.4	1.3		3.50		1.6		13		**1700**	
DC1B-SD6-01-062218	Middle 1B	6/22/2018	1.5		2.8		0.36		11.1	1.4		0.90	J	1.5		14		61	
DC1B-SD7-01-062218	Middle 1B	6/22/2018	1.8		2.9		0.23		8.5	1.1		1.50		1.7		9.6		62	
DC1B-SD7A-01-062218	Middle 1B	6/22/2018	2.2		3.9		0.52		15.3	2		1.80		1.8		21		67	
DC1B-SD8-01-062218	Middle 1B	6/22/2018	1.8		3.3		0.42		14.7	1.8		1.80		1.7		15		65	
DC1B-SD8A-01-062218	Middle 1B	6/22/2018	1.6		4.1		0.49		**33.1**	4		2.90	J	**2.2**	J	**34**	J	150	J
DC1B-SD9-01-062218	Middle 1B	6/22/2018	1.1		2.7		0.10	J	0.64	0.2	LT	0.43	J	1.8		0.4		7.9	
Number of Measurements			12		12		12		12			12		12		12		12	
Number of Detects			12		12		12		12			12		12		12		12	
Number of Nondetects			0		0		0		0			0		0		0		0	
Minimum (mg/kg)			1.1		2.7		0.10		0.6			0.43		1.1		0.4		7.9	
Maximum (mg/kg)			4.4		6.2		1.20		33.1			7.10		2.2		34.0		1,700	
Average (mg/kg)			2.2		3.6		0.47		11.4			2.14		1.6		14.4		198	
Median (mg/kg)			1.7		3.2		0.36		9.5			1.75		1.7		13.0		63	
Standard Deviation (mg/kg)			1.11		1.04		0.34		8.46			1.82		0.29		8.9		474	
90th Percentile (mg/kg)			4.1		4.6		1.04		18.0			3.44		1.8		24.6		143	
95th Percentile (mg/kg)			4.3		5.3		1.15		25.0			5.12		2.0		29		847	
99th Percentile (mg/kg)			4.4		6.0		1.19		31.5			6.70		2.2		33		1,530	
Relative Standard Deviation			0.50		0.29		0.73		0.74			0.85		0.18		0.6		2.40	
BTV (mg/kg)			2.4		8.0		0.19		1.2			0.80		3.5		0.58		15	
Maximum/BTV (unitless)			1.8		0.78		6.3		29			8.9		0.63		59		112	

Notes:
The maximum concentration is presented in **bold**.
Shaded **red** indicates that the result exceeds the applied BTV.

BTV	Background threshold value
ID	Identification
J	Estimated value
LT	Result less than requested minimum detectable concentration, but greater than the sample-specific detectable concentration.
mg/kg	Milligrams per kilogram
pCi/g	Picocuries per gram
Q	Qualifier
TPU	Total propagated uncertainty

5.3.3.2 Gamma Radiation Survey Results

In general, the radiation levels within the Middle 1B drainage exceeded the applied gamma BTV with an upper range of measurements greater than 10 times applied gamma BTV for the combined BSA-34 and BSA-35 data set of 12,465 cpm. Table J-25 provides summary statistics for the gamma radiation measurements within Middle 1B. Ninety-one percent of measurements exceeded the applied gamma BTV. Figure J-20 displays gamma radiation survey data collected within the drainage compared to the background drainage gamma survey results. The spread of gamma radiation levels within the drainage encompasses the range of background gamma measurements up to a maximum gamma count rate measurement of 198,565 cpm, a measurement greater than 10 times the applied gamma BTV. A box plot showing the quartiles of the data sets is provided in Figure J-21. The box plot displays the median of the drainage radiation levels above the background data set median and above applied gamma BTV.

The maximum gamma radiation level of 198,565 cpm was observed adjacent to an unreclaimed waste pile associated with a non-Northern Agency Tronox AUM site, the Frank No. 1 Mine. The waste pile found at the Frank No. 1 Mine lies in direct contact with the Middle 1B drainage. Additionally, elevated gamma measurements above four times the applied gamma BTV were found immediately downstream of Waste Pile M19. Localized areas of elevated gamma measurements, in the range of three to four times the applied gamma BTV, exist throughout the Middle 1B drainage. In general, gamma levels within the Middle 1B decrease in the downstream direction away from the Frank No. 1 Mine and Mesa V Mine-508.

Table J-25. Summary of Gamma Radiation Survey Results for the Middle 1B Drainage

Summary Statistic	Units	Gamma Radiation Survey Results
Applied Gamma BTV	cpm	12,465
Measurements	#	11,819
Minimum	cpm	7,404
Maximum	cpm	198,565
Average	cpm	28,532
Median	cpm	24,593
Standard Deviation	cpm	19,393
90th Percentile	cpm	45,270
95th Percentile	cpm	53,332
99th Percentile	cpm	132,110
Measurements Above Gamma BTV	#	10,788
Measurements Above Gamma BTV	**%**	91

Notes:
BTV Background threshold value
cpm Counts per minute

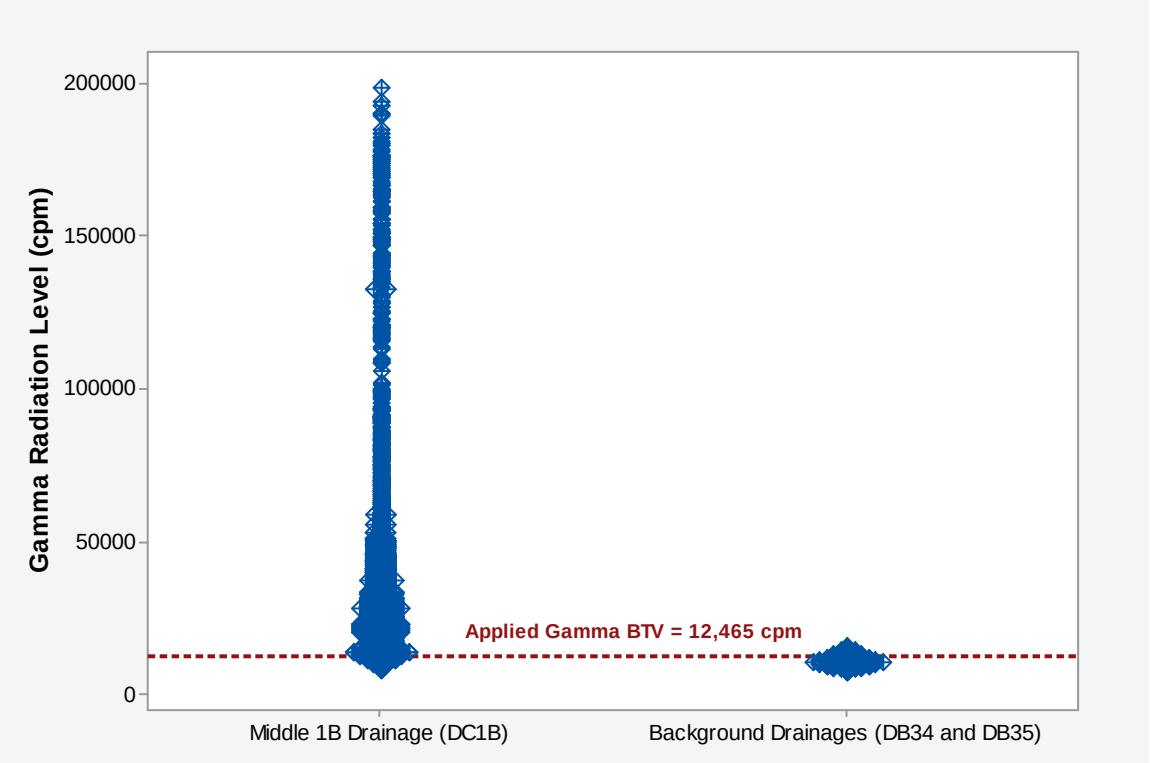


Figure J-20. Individual Value Plot of Gamma Radiation Levels within the Middle 1B Drainage and Background Drainages

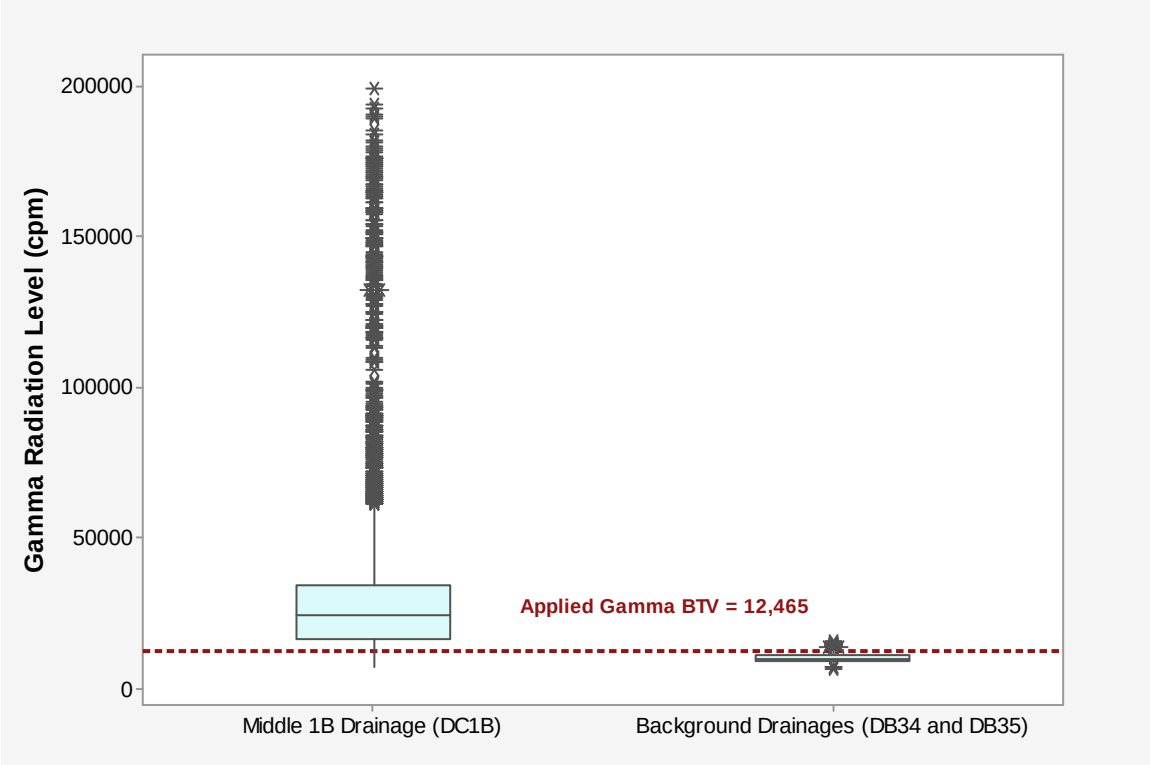


Figure J-21. Box Plot of Gamma Radiation Levels within the Middle 1B Drainage and Background Drainages

5.3.3.3 Potential Contribution from AUMs

Based on the molybdenum, radium-226, selenium, uranium, and vanadium sample results greatly exceeding twice their respective BTVs, the Middle 1B drainage is impacted by mines within the reach (Mesa IV 1/2 Mine and Simpson 181, Mesa V Mine – 508, and non-Tronox mine North Portal, Frank No. 1). Gamma measurements support the conclusion that the Middle 1B drainage may be impacted by the upgradient mines; the maximum concentration greatly exceeds twice the applied BTV, and the median concentration exceeds the applied BTV. Additional investigation may be warranted to further identify the lateral and vertical extents of contamination.

5.3.4 Middle 1G

Middle 1G originates on Mesa IV downgradient of Mesa IV Mine No. 2, Mesa IV Mine No. 3, Mesa IV Mine No. 1, and non-Tronox mine Cov068. Middle 1G merges with Middle 1, which flows into Cove Wash North towards the Cove Transfer Station.

Three surface sediment samples were collected from the Middle 1G drainage in June 2018 and analyzed for the suite of metals and radionuclides presented in Table J-9 and Table J-10. A gamma survey was performed along an approximately 0.2-mile reach of the Middle 1G drainage on June 21, 2018. The results of sediment sampling for primary analytes and the gamma survey are described in the following subsections and presented within the Cove Wash North drainage results figures in Attachment J3 (Figure DC1G-I and Figure DC1G-1).

5.3.4.1 Sediment Sampling Results

Sediment results for primary analytes collected at three locations are compared with BTVs from BSA-34 and BSA-35 and presented in Table J-26. In the most upgradient sample collected downgradient of Mesa IV Mine No. 1, and Mesa IV Mine No. 3, BTVs for none of the primary analytes were exceeded. Results for molybdenum, radium-226, uranium, and vanadium exceeded the BTVs in the two most downgradient samples located downgradient of the drainage path from Waste Pile M21E associated with Mesa IV Mine No. 2. Arsenic, lead, selenium, and thorium results did not exceed their corresponding BTVs.

The maximum concentration for molybdenum, radium-226, and vanadium was from the most downgradient sample (DC1G-SD1) before the drainage entered Middle 1, and exceeded the BTVs by three, four, and four times, respectively. For uranium, the maximum concentration exceeded the BTV in the middle sample (DC1G-SD2) by over five times.

Table J-26. Sediment Results for Primary Analytes in the Middle 1G Drainage

Field Sample ID	Drainage Channel ID	Sample Date	Arsenic		Lead		Molybdenum		Radium-226			Selenium		Thorium		Uranium		Vanadium	
			Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Activity (pCi/g)	TPU	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q
DC1G-SD1-01-062118	Middle 1G	6/21/2018	**1.9**		3.9		**0.60**		**5.2**	0.73	J-	0.48	J	1.1		1.4		**64**	
DC1G-SD2-01-062118	Middle 1G	6/21/2018	1.5		**4.0**		0.41		3.53	0.53	J+	**0.60**	J	**1.4**		**3.2**		23	
DC1G-SD3-01-062118	Middle 1G	6/21/2018	1.1		2.4		0.12	J	0.67	0.21	J-	0.40	J	1.0		0.3		9.4	
Number of Measurements			3		3		3		3			3		3		3		3	
Number of Detects			3		3		3		3			3		3		3		3	
Number of Nondetects			0		0		0		0			0		0		0		0	
Minimum (mg/kg)			1.1		2.4		0.12		0.67			0.40		1.0		0.31		9.4	
Maximum (mg/kg)			1.9		4.0		0.60		5.20			0.60		1.4		3.2		64	
Average (mg/kg)			1.5		3.4		0.38		3.13			0.49		1.2		1.6		32	
Median (mg/kg)			1.5		3.9		0.41		3.53			0.48		1.1		1.4		23	
Standard Deviation (mg/kg)			0.40		0.90		0.24		2.29			0.10		0.21		1.5		28	
90th Percentile (mg/kg)			1.8		4.0		0.56		4.87			0.58		1.3		2.8		56	
95th Percentile (mg/kg)			1.9		4.0		0.58		5.03			0.59		1.4		3.0		60	
99th Percentile (mg/kg)			1.9		4.0		0.60		5.17			0.60		1.4		3.2		63	
Relative Standard Deviation			0.27		0.26		0.64		0.73			0.20		0.18		0.9		0.88	
BTV (mg/kg)			2.4		8.0		0.19		1.2			0.80		3.5		0.58		15	
Maximum/BTV (unitless)			0.79		0.50		3.2		4.5			0.75		0.40		5.6		4.2	

Notes:
The maximum concentration is presented in **bold**.
Shaded **red** indicates that the result exceeds the applied BTV.
BTV Background threshold value
ID Identification
J Estimated value
mg/kg Milligrams per kilogram
pCi/g Picocuries per gram
Q Qualifier
TPU Total propagated uncertainty

5.3.4.2 Gamma Radiation Survey Results

In general, the radiation levels within the Middle 1G drainage are within a range of one to two times the applied gamma BTV for the combined BSA-34 and BSA-35 data set of 12,465 cpm. Table J-27 provides summary statistics for the gamma radiation measurements within the drainage. Thirty-three percent of measurements exceeded the applied gamma BTV. Figure J-22 displays gamma radiation survey data collected within the drainage compared to the background drainage gamma survey results. The spread of gamma radiation levels within the drainage encompasses the range of background gamma measurements up to a maximum gamma count rate measurement of 19,014 cpm. A box plot showing the quartiles of the data sets is provided in Figure J-23. The box plot displays the median of the drainage radiation levels above the background data set median but below applied gamma BTV.

Table J-27. Summary of Gamma Radiation Survey Results for the Middle 1G Drainage

Summary Statistic	Units	Gamma Radiation Survey Results
Applied Gamma BTV	cpm	12,465
Measurements	#	2,984
Minimum	cpm	6,307
Maximum	cpm	19,014
Average	cpm	11,692
Median	cpm	11,403
Standard Deviation	cpm	1,784
90th Percentile	cpm	14,238
95th Percentile	cpm	14,766
99th Percentile	cpm	15,802
Measurements Above Gamma BTV	#	993
Measurements Above Gamma BTV	%	33

Notes:
BTV Background threshold value
cpm Counts per minute

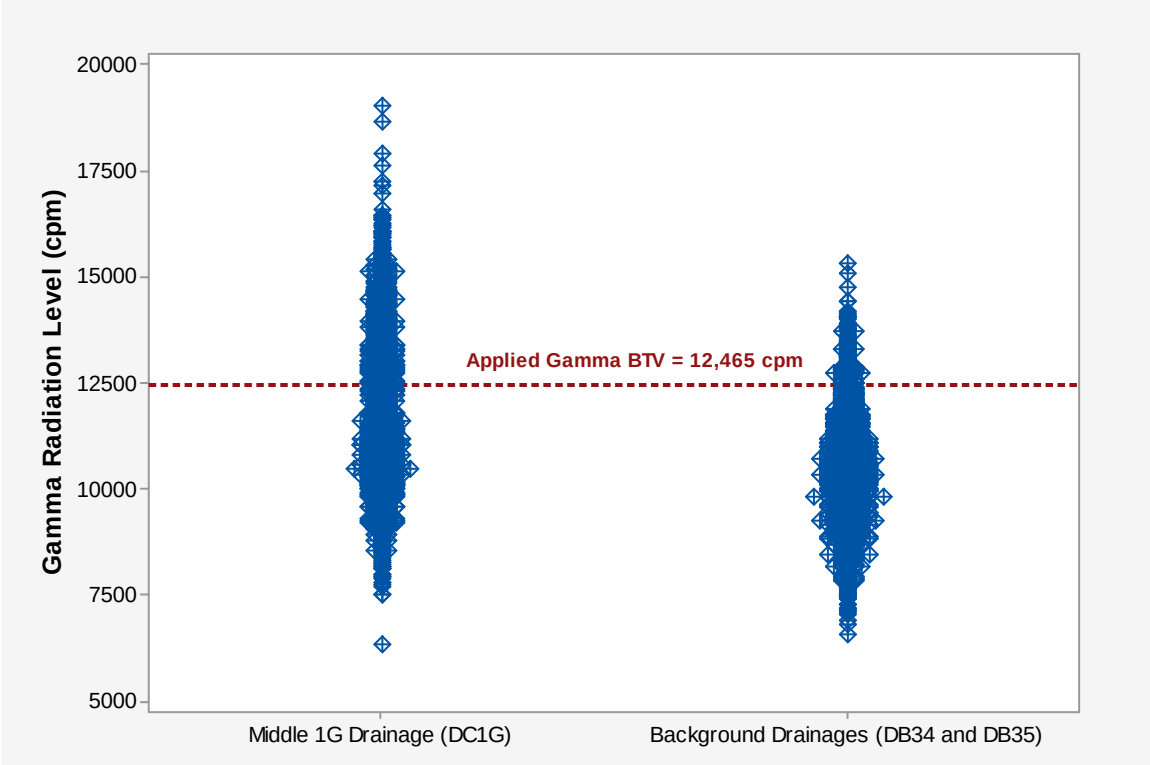


Figure J-22. Individual Value Plot of Gamma Radiation Levels within the Middle 1G Drainage and Background Drainages

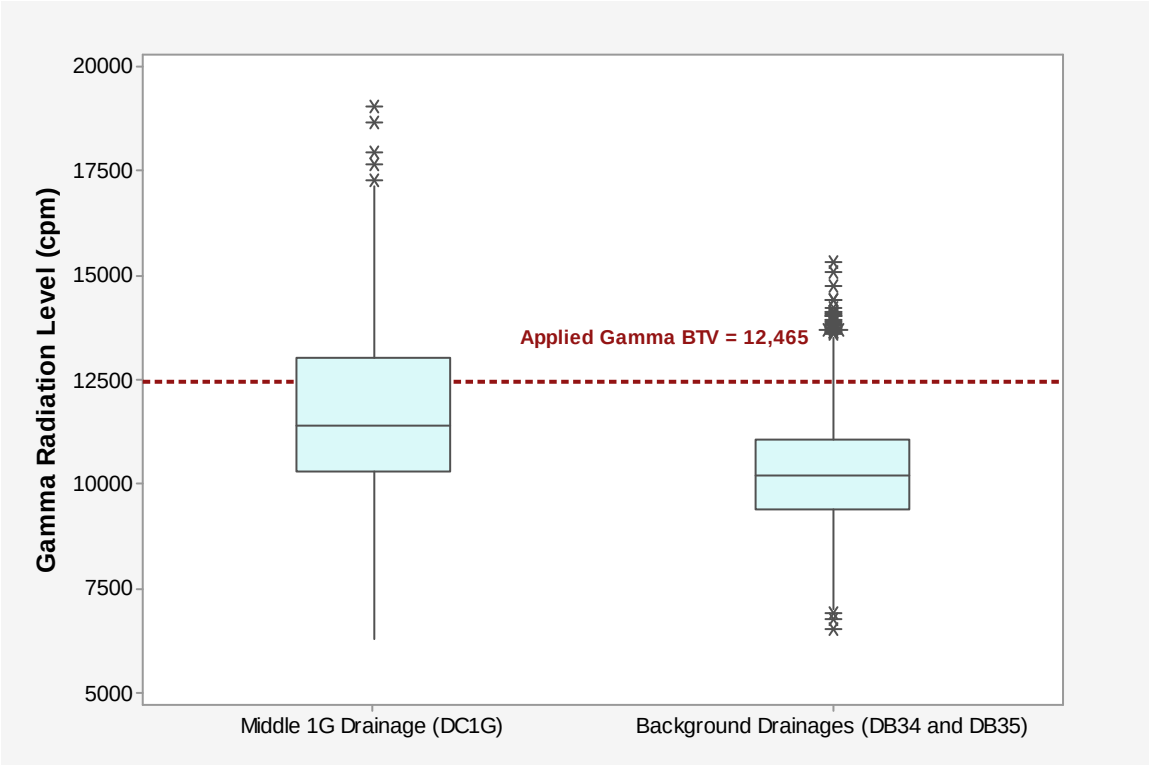


Figure J-23. Box Plot of Gamma Radiation Levels within the Middle 1G Drainage and Background Drainages

5.3.4.3 Potential Contribution from AUMs

Based on the molybdenum, radium-226, uranium, and vanadium sediment sample results exceeding twice their respective BTVs, Mesa IV Mine No. 2 appears to contribute to elevated concentrations of mine contaminants in the Middle 1G drainage. Gamma measurements do not support this conclusion, as the maximum gamma measurement does not twice the applied BTV, and the median gamma survey measurement is below the applied BTV for the drainage; therefore, additional investigation may be warranted to correlate gamma and metals results. Concentrations of primary analytes and gamma measurements in Middle 1G drainage are relatively low when compared to concentrations detected in the rest of the Lukachukai Mountains drainages.

5.4 COVE WASH MIDDLE DRAINAGE

The Cove Wash Middle drainage runs west of the Cove Transfer Station I, Cove Transfer Station South on Figure J-3. Cove Transfer Station II is located north of the sampled stream extent. Water from all the Lukachukai Mountains Region drainages (Middle 1 and its tributaries, Middle 2 and its tributaries, and Middle 3 and its tributaries) flows into the Cove Wash Middle drainage. The direction of surface water flow is generally from south to north within the Cove Valley drainages, following the general trend of the downward slope of the mountains.

A total of 21 sediment samples were collected from the Cove Wash Middle drainage in June 2018 and analyzed for the suite of metals and radionuclides presented in Table J-9 and Table J-10. A gamma survey was performed along an approximately 1.1-mile reach of the Cove Wash Middle drainage on June 24, 2018. The results of sediment sampling for primary analytes and the gamma survey are described in the following subsections and presented within the Cove Wash Middle results figures in Attachment J3 (Figure DT9-I, Figures DT9-1 through DCT9-4).

5.4.1 Sediment Sampling Results

Sediment results for primary analytes collected at 21 locations are compared with BTVs from BSA-34 and BSA-35 and presented in Table J-28. All 21 samples exceeded the BTV for both radium-226 and uranium, and the BTV for all primary analytes was exceeded in at least one sample. The highest concentrations of all primary analytes (except thorium, which was slightly higher at a downstream location) were at sample location DT9-SD12, located about 1,500 feet northwest of the Cove Transfer Station and 2,000 feet northeast of Cove Transfer Station South; every analyte exceeded the BTV at the sample location, and the only exceedance of lead and one of the two exceedances of selenium and thorium was also at that location. The maximum concentration of arsenic, molybdenum, radium-226, selenium, uranium, and vanadium exceeded the BTV by 2, 4, 9, 3, 47, and 7 times, respectively.

Table J-28. Sediment Results for Primary Analytes in the Cove Wash Middle Drainage

Field Sample ID	Drainage Channel ID	Sample Date	Arsenic		Lead		Molybdenum		Radium-226			Selenium		Thorium		Uranium		Vanadium	
			Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Activity (pCi/g)	TPU	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q
DT9-SD1-01-062418	Cove Wash Middle	6/24/2018	1.3		2.7		0.10	J	1.4	0.28	J-	<0.98	U	1.7		1.1	J	9.5	J
DT9-SD2-01-062418	Cove Wash Middle	6/24/2018	2.9		5.7		0.28		6.5	0.86		0.99	J	2.5		8.4		31	
DT9-SD3-01-062418	Cove Wash Middle	6/24/2018	2.3		4.1		0.19	J	3.0	0.46	J-	0.52	J	2.0		4.0		20	
DT9-SD4-01-062418	Cove Wash Middle	6/24/2018	1.5		3.3		0.12	J	2.0	0.37		0.47	J	1.7		2.6		15	
DT9-SD5-01-062418	Cove Wash Middle	6/24/2018	1.6		3.0		0.12	J	2.1	0.34	J-	0.40	J	2.5		2.2		12	
DT9-SD6-01-062418	Cove Wash Middle	6/24/2018	1.9		5.5		0.16	J	3.0	0.47	J-	0.44	J	1.9		1.1		15	
DT9-SD7-01-062418	Cove Wash Middle	6/24/2018	1.0		2.8		0.11	J	1.4	0.28	J-	<0.96	U	**4.6**		1.3		9.3	
DT9-SD8-01-062418	Cove Wash Middle	6/24/2018	3.8	J	5.1		0.26		2.7	0.37	J-	0.69	J	2.4		3.9		19	
DT9-SD9-01-062418	Cove Wash Middle	6/24/2018	1.1		2.7		0.13	J	1.8	0.3		0.32	J	1.2		1.9		13	
DT9-SD10-01-062418	Cove Wash Middle	6/24/2018	2.6		4.5		0.31		5.4	0.72		0.80	J	2.0		7.7		34	
DT9-SD11-01-062418	Cove Wash Middle	6/24/2018	1.3		3.1		0.07	J	2.1	0.38		0.39	J	1.6		3.0	J	12	
DT9-SD12-01-062418	Cove Wash Middle	6/24/2018	**5.7**		**11**		**0.73**		**10.9**	1.4		**2.3**		4.5		**27**		**100**	
DT9-SD13-01-062418	Cove Wash Middle	6/24/2018	1.8		3.7		0.10	J	2.5	0.35		0.42	J	1.6		1.1		8.4	
DT9-SD14-01-062418	Cove Wash Middle	6/24/2018	1.1		2.6		0.10	J	1.9	0.36		0.34	J	1.3		2.4		11	
DT9-SD15-01-062418	Cove Wash Middle	6/24/2018	1.3		3.4		0.10	J	2.3	0.36	J-	0.52	J	1.7	J	3.2	J-	22	J
DT9-SD16-01-062418	Cove Wash Middle	6/24/2018	2.4		5.1		0.20	J	4.6	0.64		0.71	J	2.5		5.7		23	
DT9-SD17-01-062418	Cove Wash Middle	6/24/2018	1.8		3.0		0.12	J	1.8	0.32	J-	0.35	J	1.7		1.3		8.8	
DT9-SD18-01-062418	Cove Wash Middle	6/24/2018	1.5		3.2		0.10	J	1.8	0.34	J-	0.51	J	2.1		3.6		16	
DT9-SD19-01-062418	Cove Wash Middle	6/24/2018	0.9		2.3		0.07	J	1.4	0.23	J-	<0.95	U	1.2		1.0		9.7	
DT9-SD20-01-062418	Cove Wash Middle	6/24/2018	1.2		2.4		0.09	J	1.6	0.33		0.34	J	1.4		1.5		8.8	
DT9-SD21-01-062418	Cove Wash Middle	6/24/2018	1.2		2.5		0.07	J	1.4	0.28		0.31	J	1.5		1.0		11	
Number of Measurements			21		21		21		21			21		21		21		21	
Number of Detects			21		21		21		21			18		21		21		21	
Number of Nondetects			0		0		0		0			3		0		0		0	
Minimum (mg/kg)			0.92		2.3		0.07		1.37			0.31		1.2		1.0		8	
Maximum (mg/kg)			5.7		11		0.73		10.9			2.3		4.6		27		100	
Average (mg/kg)			1.9		3.9		0.17		2.94			0.60		2.1		4.0		19	
Median (mg/kg)			1.5		3.2		0.12		2.10			0.46		1.7		2.4		13	
Standard Deviation (mg/kg)			1.1		1.9		0.15		2.28			0.46		0.92		5.7		20	
90th Percentile (mg/kg)			2.9		5.5		0.28		5.42			0.86		2.5		7.7		31	
95th Percentile (mg/kg)			3.8		5.7		0.31		6.51			1.2		4.5		8.4		34	
99th Percentile (mg/kg)			5.3		9.9		0.65		10.0			2.1		4.6		23		87	
Relative Standard Deviation			0.6		0.5		0.88		0.78			0.77		0.44		1.4		1.0	
BTV (mg/kg)			2.4		8.0		0.19		1.2			0.80		3.5		0.58		15	
Maximum/BTV (unitless)			2.4		1.4		3.8		9.4			2.9		1.3		47		6.6	

Notes:
The maximum concentration is presented in **bold**.
Shaded **red** indicates that the result exceeds the applied BTV.

<	The analyte was analyzed for, but was not detected. The reporting limit is shown in the result column.
BTV	Background threshold value
ID	Identification
J	Estimated value
J-	Estimated value, may be biased low.
mg/kg	Milligrams per kilogram
pCi/g	Picocuries per gram
Q	Qualifier
TPU	Total propagated uncertainty

5.4.2 Gamma Radiation Survey Results

In general, the radiation levels within the Cove Wash Middle drainage exceeded the applied gamma BTV for the combined BSA-34 and BSA-35 data set, with an upper range of measurements between two and three times the applied gamma BTV of 12,465 cpm. Table J-29 provides summary statistics for the gamma radiation measurements within the Cove Wash Middle drainage. Sixty-four percent of measurements exceeded the applied gamma BTV. Figure J-24 displays gamma radiation survey data collected within the drainage compared to the background drainage gamma survey results. The spread of gamma radiation levels within the drainage encompasses the range of background gamma measurements up to a maximum gamma count rate measurement of 27,097 cpm, a measurement greater than two times the applied gamma BTV. A box plot showing the quartiles of the data sets is provided in Figure J-25. The box plot displays the median of the drainage radiation levels above the background data set median and above applied gamma BTV.

Table J-29. Summary of Gamma Radiation Survey Results for the Cove Wash Middle Drainage

Summary Statistic	Units	Gamma Radiation Survey Results
Applied Gamma BTV	cpm	12,465
Measurements	#	9,910
Minimum	cpm	6,471
Maximum	cpm	27,097
Average	cpm	12,926
Median	cpm	12,921
Standard Deviation	cpm	1,506
90th Percentile	cpm	14,609
95th Percentile	cpm	15,213
99th Percentile	cpm	16,865
Measurements Above Gamma BTV	#	6,325
Measurements Above Gamma BTV	%	64%

Notes:
BTV Background threshold value
cpm Counts per minute

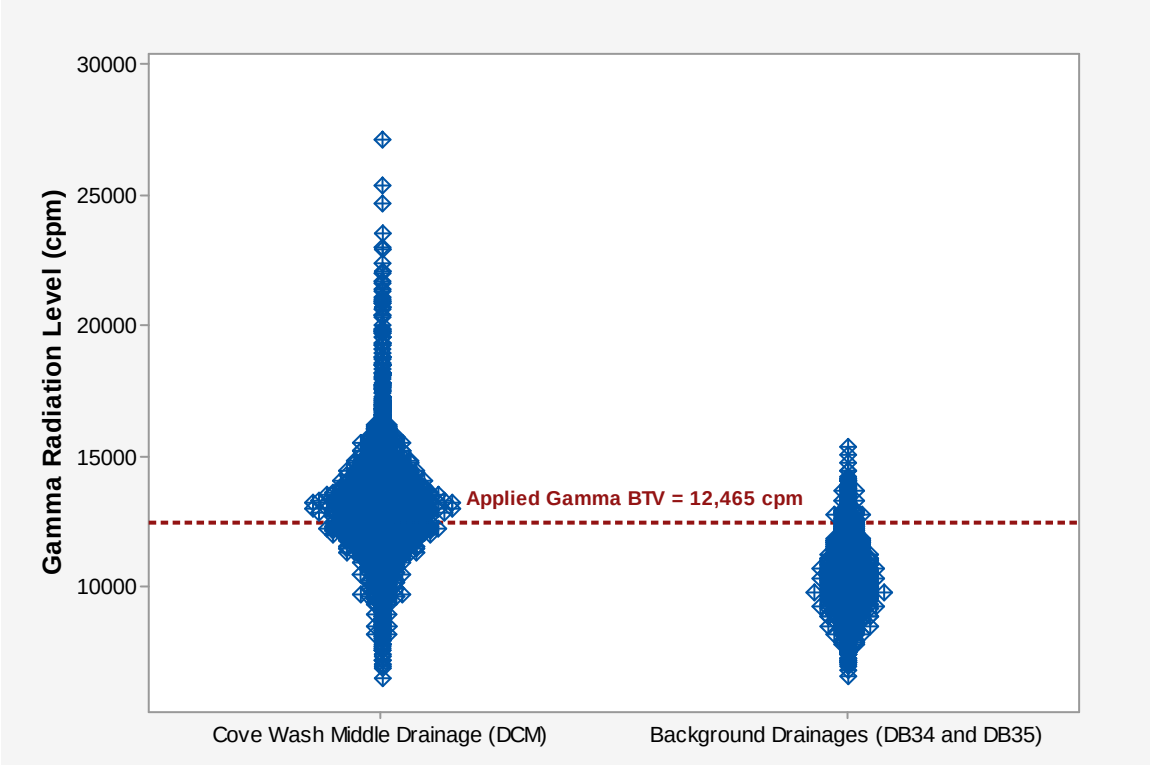


Figure J-24. Individual Value Plot of Gamma Radiation Levels within the Cove Wash Middle Drainage and Background Drainages

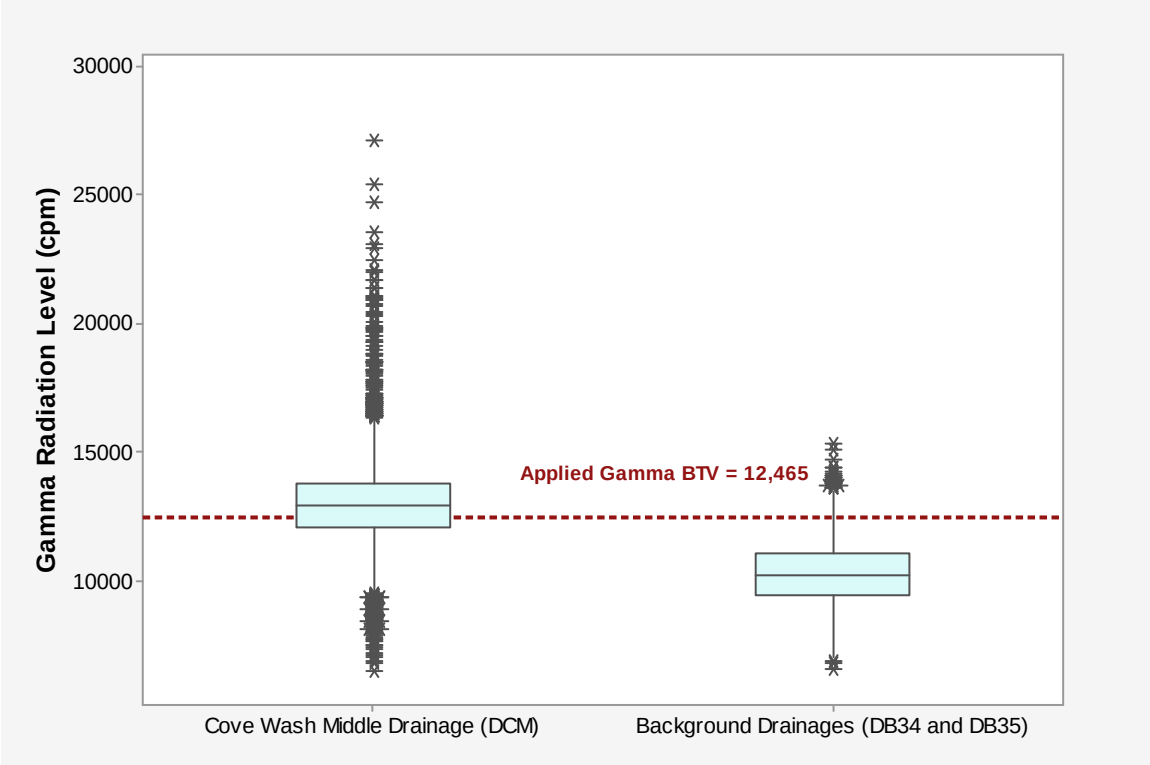


Figure J-25. Box Plot of Gamma Radiation Levels within the Cove Wash Middle Drainage and Background Drainages

5.4.3 Potential Contribution from AUMs

Based on the arsenic, molybdenum, radium-226, selenium, uranium, and vanadium sediment sample results exceeding twice their respective BTVs, the Cove Wash Middle drainage appears to be impacted by upgradient mines in the Lukachukai Mountains. Gamma measurements support the conclusion that the Cove Wash Middle drainage may be impacted by the upgradient mines; the maximum concentration exceeded twice the applied BTV, and the median concentration exceeded the applied BTV. Additional investigation may be warranted to further identify the lateral and vertical extents of contamination.

5.5 MIDDLE 2 DRAINAGES

Middle 2 drainage is located south of Middle 1, and receives inputs from Middle 2A to the southwest, and from Middle 2B and Middle 2C (via Middle 2B) to the south. The direction of surface water flow is generally from southwest to northeast within the Middle 2 drainage, following the general trend of the downward slope of the mountains.

5.5.1 Middle 2

As indicated above, the Middle 2 drainage receives inputs from Middle 2A to the southwest, and from Middle 2B and Middle 2C (via Middle 2B) to the south. Mesa IV Mine No. 2 and Mesa IV Mine No. 3 are located north of Mesa IV Mine No. 1, downgradient of the confluence of Middle 2A with Middle 2. Mesa II Pit is located on the southeast side of the drainage, downgradient of the confluence with Middle 2A. The direction of surface water flow is generally from south-southwest to north-northeast within the Middle 2 drainage. The Middle 2 drainage merges with Middle 1 drainage, which flows into Cove Wash North.

A total of 18 surface sediment samples were collected from the Middle 2 drainage in June 2018. In addition, two opportunistic sediment samples were collected downgradient of a waste pile associated with Mesa IV Mine No. 2, within the drainage in September 2018. Sediment samples were analyzed for the suite of metals and radionuclides presented in Table J-9 and Table J-10.

A gamma survey was performed along an approximately 1.2-mile reach of the Middle 2 drainage on June 21, 2018. The results of sediment sampling results for primary analytes and the gamma survey are described in the following subsections and presented within the Middle 2 drainage results figures in Attachment J3 (Figure DC2-I, Figures DC2-1 through DC2-4).

5.5.1.1 Sediment Sampling Results

Sediment results for primary analytes collected at 18 locations in the Middle 2 drainage are compared with BTVs from BSA-34 and BSA-35 and presented in Table J-30. All results for uranium, and 17, 19, and 18 results for molybdenum, radium-226, and vanadium, respectively, exceeded the BTVs. Results for arsenic and selenium exceeded the corresponding BTVs in four and three samples, respectively.

The maximum concentrations of all primary analytes except vanadium were detected in the Mesa IV Mine No. 2 samples. The maximum result for molybdenum exceeded the BTV by six times, and the maximum results for radium-226 and uranium exceeded the BTV substantially – by 43 and 154 times. The maximum concentration of vanadium from sample DC2-SD5 exceeded the BTV by 50 times. At the same location, uranium also exceeded the BTV dramatically (43 times) and radium-226 and selenium concentrations were more than double the BTVs.

Within the drainage, radium-226 concentrations exceeded the BTV by an average of six times, with the highest concentrations occurring just downgradient of the confluence with the Middle 2A drainage, and immediately below Mesa IV Mine No. 2 and Mesa II Pit.

Table J-30. Sediment Results for Primary Analytes in the Middle 2 Drainage

Field Sample ID	Drainage Channel ID	Sample Date	Arsenic		Lead		Molybdenum		Radium-226			Selenium		Thorium		Uranium		Vanadium	
			Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Activity (pCi/g)	TPU	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q
DC2-SD1-01-062118	Middle 2	6/21/2018	1.2		2.4		0.35		3.75	0.53	J-	0.46	J	1.3		2.5		19	
DC2-SD2-01-062118	Middle 2	6/21/2018	1.3		2.9		0.28		4.71	0.69		0.60	J	1.3		4.1		68	
DC2-SD3-01-062118	Middle 2	6/21/2018	1.5		2.6		0.21		5.11	0.65	J-	0.41	J	1.3		4.1		33	
DC2-SD4-01-062118	Middle 2	6/21/2018	1.4		3.2		0.21		4.37	0.62	J-	0.41	J	1.1		8.9		37	
DC2-SD5-01-062118	Middle 2	6/21/2018	1.8		5.4		0.24		3.56	0.5	J-	1.80		1.2		25		**760**	
DC2-SD6-01-062118	Middle 2	6/21/2018	3.8		6.1		0.53		4.64	0.65	J-	0.58	J	1.6		3.0		130	
DC2-SD7-01-062118	Middle 2	6/21/2018	2.5		2.8		0.35		4.64	0.67	J-	0.37	J	1.2		1.4		35	
DC2-SD8-01-062118	Middle 2	6/21/2018	1.7		2.6		0.22		4.73	0.64	J	0.41	J	1.1		2.0		23	
DC2-SD9-01-062118	Middle 2	6/21/2018	1.4		2.7		0.23		7.9	1	J-	1.40		1.0		29		67	
DC2-SD10-01-062118	Middle 2	6/21/2018	1.1		2.7		0.19	J	3.94	0.6		0.34	J	1.1		3.0		20	
DC2-SD11-01-062118	Middle 2	6/21/2018	1.1		2.3		0.27		3.65	0.56		0.42	J	1.1		9.1		27	
DC2-SD12-01-062118	Middle 2	6/21/2018	1.2		2.3		0.21	J	5.49	0.77		0.41	J	1.0		2.1		22	
DC2-SD13-01-062118	Middle 2	6/21/2018	1.4		2.9		0.36		2.85	0.46		0.40	J	1.3		4.5		19	
DC2-SD14-01-062118	Middle 2	6/21/2018	1.4		2.5		0.28		3.22	0.48		0.45	J	1.2		3.7		46	
DC2-SD15-01-062118	Middle 2	6/21/2018	1.0		2.4		0.12	J	7.8	1	J-	0.40	J	1.1		0.9		15	
DC2-SD16-01-062118	Middle 2	6/21/2018	2.3	J	2.6		0.55		6.48	0.88	J	0.34	J	1.3		3.1	J	110	J
DC2-SD17-01-062118	Middle 2	6/21/2018	1.0		2.9		0.10	J	0.86	0.23	LT	<1.1	U	1.1		0.9		3.1	
DC2-SD18-01-062118	Middle 2	6/21/2018	1.4		2.4	J	0.21		8.1	1		0.37	J	1.2	J	2.1	J	23	J
M21-SD1-01-091218	Middle 2	9/12/2018	2.9		6.4		0.56		**49.8**	5.9		2.20		**1.8**		**89**		230	
M21-SD2-01-091218	Middle 2	9/12/2018	**4.1**		**8.0**		**1.30**		42.5	5.1		**2.60**		1.7		**89**		180	
Number of Measurements			20		20		20		20			20		20		20		20	
Number of Detects			20		20		20		20			19		20		20		20	
Number of Nondetects			0		0		0		0			1		0		0		0	
Minimum (mg/kg)			1.0		2.3		0.10		0.86			0.34		1.0		0.90		3.1	
Maximum (mg/kg)			4.1		8.0		1.30		49.8			2.6		1.8		89		760	
Average (mg/kg)			1.8		3.4		0.34		8.91			0.76		1.3		14		93	
Median (mg/kg)			1.4		2.7		0.26		4.68			0.41		1.2		3.4		34	
Standard Deviation (mg/kg)			0.90		1.7		0.26		12.9			0.70		0.22		27		168	
90th Percentile (mg/kg)			3.0		6.1		0.55		11.5			1.9		1.6		35		185	
95th Percentile (mg/kg)			3.8		6.5		0.60		42.9			2.2		1.7		89		257	
99th Percentile (mg/kg)			4.0		7.7		1.16		48.4			2.5		1.8		89		659	
Relative Standard Deviation			0.51		0.48		0.77		1.45			0.92		0.18		1.9		1.80	
BTV (mg/kg)			2.4		8.0		0.19		1.2			0.80		3.5		0.58		15	
Maximum/BTV (unitless)			1.7		1.0		6.8		43			3.3		0.51		155		50	

Notes:
The maximum concentration is presented in **bold**.
Shaded **red** indicates that the result exceeds the applied BTV.

<	The analyte was analyzed for, but was not detected. The reporting limit is shown in the result column.
BTV	Background threshold value
ID	Identification
J	Estimated value
J-	Estimated value, may be biased low.
LT	Result less than requested minimum detectable concentration, but greater than the sample-specific detectable concentration.
mg/kg	Milligrams per kilogram
pCi/g	Picocuries per gram
Q	Qualifier
TPU	Total propagated uncertainty
U	Not detected. The associated value is the reporting limit.

5.5.1.2 Gamma Radiation Survey Results

Radiation levels were found within the Middle 2 drainage that exceed the applied gamma BTV for the combined BSA-34 and BSA-35 data set and with an upper range of measurements two to three times the applied gamma BTV of 12,465 cpm. Table J-31 provides summary statistics for the gamma radiation measurements within Middle 2. Sixty-nine percent of measurements exceeded the applied gamma BTV. Figure J-26 displays gamma radiation survey data collected within the drainage compared to the background drainage gamma survey results. The spread of gamma radiation levels within the drainage encompasses the range of background gamma measurements up to a maximum gamma count rate measurement of 27,299 cpm, a measurement between two and three times the applied gamma BTV. A box plot showing the quartiles of the data sets is provided in Figure J-27. The box plot displays the median of the drainage radiation levels above the background data set median and above applied gamma BTV.

Gamma measurements within the Middle 2 drainage appear fairly consistent throughout and in general, are within one to two times the applied gamma BTV. Portions of the Middle 2 gamma survey were not logged because of poor GPS signal.

Table J-31. Summary of Gamma Radiation Survey Results for the Middle 2 Drainage

Summary Statistic	Units	Gamma Radiation Survey Results
Applied Gamma BTV	cpm	12,465
Measurements	#	7,815
Minimum	cpm	7,783
Maximum	cpm	27,299
Average	cpm	14,042
Median	cpm	13,450
Standard Deviation	cpm	2,923
90th Percentile	cpm	18,142
95th Percentile	cpm	20,163
99th Percentile	cpm	22,973
Measurements Above Gamma BTV	#	5,405
Measurements Above Gamma BTV	%	69

Notes:
BTV Background threshold value
cpm Counts per minute

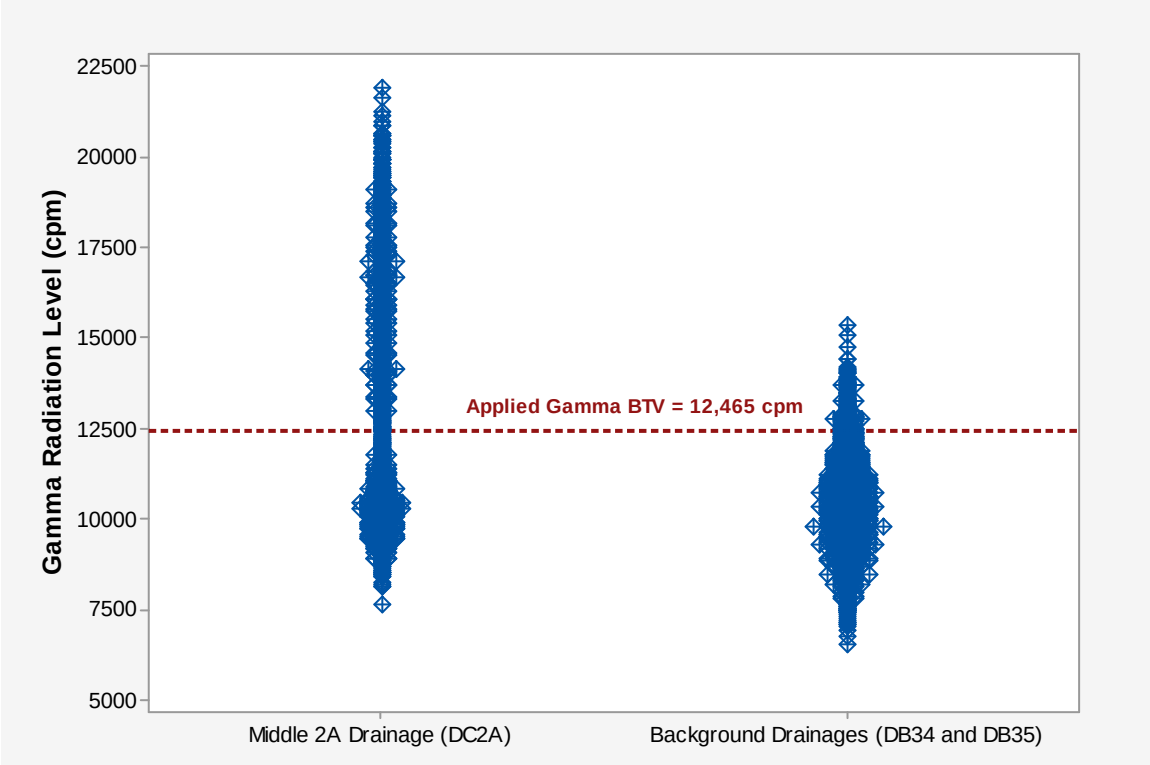


Figure J-26. Individual Value Plot of Gamma Radiation Levels within the Middle 2 Drainage and Background Drainages

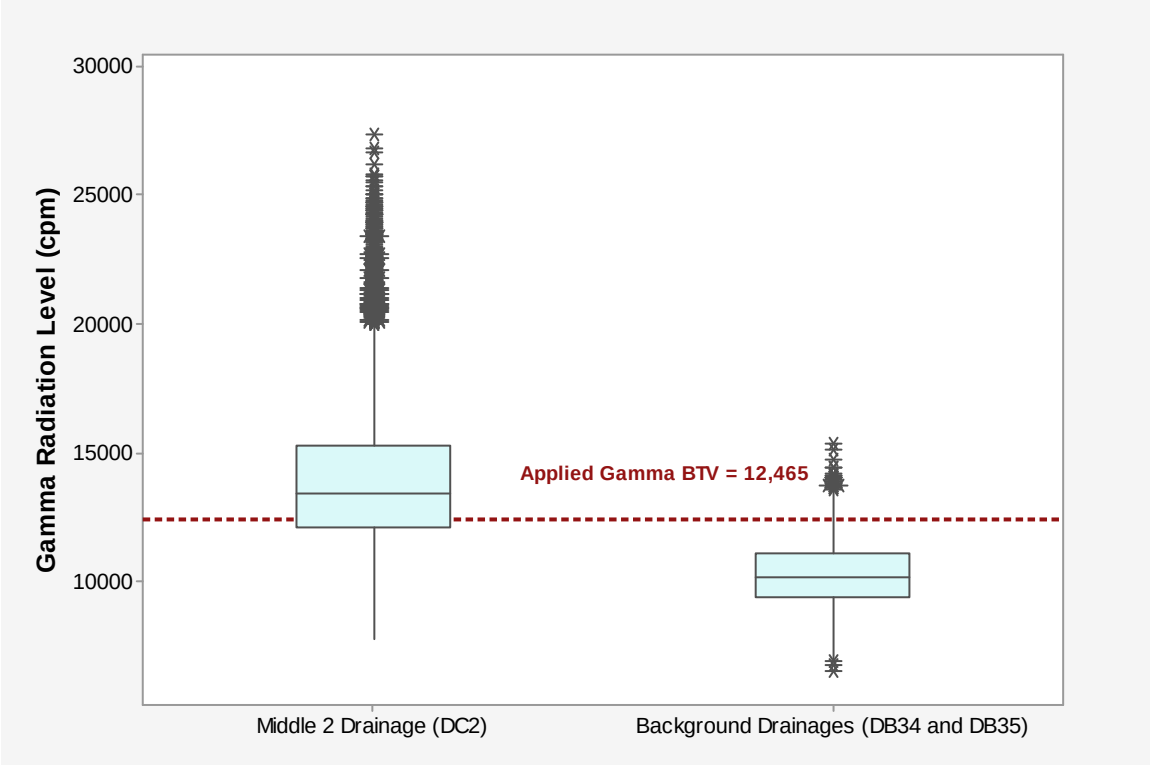


Figure J-27. Box Plot of Gamma Radiation Levels within the Middle 2 Drainage and Background Drainages

5.5.1.3 Potential Contribution from AUMs

Multiple Tronox and non-Tronox mines appear to contribute to elevated concentrations of mine contaminants in the Middle 2 drainage based on concentrations of molybdenum, radium-226, selenium, uranium, and vanadium greatly exceeding their respective BTVs. The results of the opportunistic sediment samples collected downgradient of the Mesa IV Mine No. 2 waste piles confirm that soils from this mine contribute to elevated concentrations in the drainage. Gamma measurements support the conclusion that the Middle 2 drainage may be impacted by upgradient mines; the maximum concentration exceeds twice the applied BTV, and the median concentration exceeds the applied BTV. Additional investigation may be warranted to further identify the lateral and vertical extents of contamination.

5.5.2 Middle 2A

Multiple non-Tronox mines are located along the upgradient portions of the Middle 2A drainage, and Tronox mine Mesa IV Mine No. 1 is located northwest of the Middle 2A drainage, immediately before the confluence of Middle 2A with Middle 2. The direction of surface water flow is generally from southwest to northeast within the Cove Valley drainages, following the general trend of the downward slope of the mountains.

A total of five surface sediment samples were collected from the Middle 2A drainage in June 2018. Sediment samples were analyzed for the suite of metals and radionuclides presented in Table J-9 and Table J-10. A gamma survey was performed along an approximately 0.3-mile reach of the Middle 2A drainage on June 23, 2018. The results of sediment sampling for primary analytes and the gamma survey are described in the following subsections and presented within the Middle 2A drainage results figures in Attachment J3 (Figure DC2A-I and Figure DC2A-1.

5.5.2.1 Sediment Sampling Results

Sediment results for primary analytes collected at five locations are compared with BTVs from BSA-34 and BSA-35 and presented in Table J-32. Results for molybdenum, radium-226, uranium, and vanadium exceeded the BTVs in one to three samples. The maximum concentration for these analytes occurred primarily in the most downgradient sample (DC2A-SD19) below Mesa IV Mine No. 1; radium-226 exceeded the BTVs by six times, while vanadium exceeded the BTV by 12 times. The maximum concentration for uranium was in sample DC2A-SD20, also located below Mesa IV Mine No. 1; it exceeded the BTV by 40 times. Uranium and vanadium also exceeded the BTVs in the sample upgradient of the input from Mesa IV Mine No. 1 by a factor of three.

Table J-32. Sediment Results for Primary Analytes in the Middle 2A Drainage

Field Sample ID	Drainage Channel ID	Sample Date	Arsenic		Lead		Molybdenum		Radium-226			Selenium		Thorium		Uranium		Vanadium	
			Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Activity (pCi/g)	TPU	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q
DC2A-SD19-01-062118	Middle 2A	6/21/2018	1.5		3.4		**0.25**		**6.81**	0.9	J-	0.37	J	**1.3**		3.4		**180**	
DC2A-SD20-01-062118	Middle 2A	6/21/2018	**2.0**		**3.7**		0.19	J	6.03	0.84		**0.55**	J	1.2		**23**		51	
DC2A-SD21-01-062118	Middle 2A	6/21/2018	1.3		3.2		0.10	J	0.9	0.23	LT	0.53	J	1.2		1.3		52	
DC2A-SD22-01-062118	Middle 2A	6/21/2018	1.0		2.6		0.11	J	0.7	0.21	LT	0.34	J	**1.3**		0.6		7.0	
DC2A-SD23-01-062118	Middle 2A	6/21/2018	0.8		1.9		0.08	J	<0.36	0.2	UJ	<0.97	U	0.9		0.3		5.1	
Number of Measurements			5		5		5		5			5		5		5		5	
Number of Detects			5		5		5		4			4		5		5		5	
Number of Nondetects			0		0		0		1			1		0		0		0	
Minimum (mg/kg)			0.8		1.9		0.08		0.70			0.34		0.9		0.28		5.1	
Maximum (mg/kg)			2.0		3.7		0.25		6.81			0.55		1.3		23		180	
Average (mg/kg)			1.3		3.0		0.15		3.61			0.45		1.2		6		59	
Median (mg/kg)			1.3		3.2		0.11		3.47			0.45		1.2		1.3		51	
Standard Deviation (mg/kg)			0.48		0.7		0.07		3.3			0.11		0.18		10		71	
90th Percentile (mg/kg)			1.8		3.6		0.23		6.6			0.5		1.3		15		129	
95th Percentile (mg/kg)			1.9		3.6		0.24		6.7			0.5		1.3		19		154	
99th Percentile (mg/kg)			2.0		3.7		0.25		6.8			0.5		1.3		22		175	
Relative Standard Deviation			0.36		0.24		0.50		0.90			0.24		0.15		1.7		1.21	
BTV (mg/kg)			2.4		8.0		0.19		1.2			0.80		3.5		0.58		15	
Maximum/BTV (unitless)			0.83		0.5		1.3		5.9			0.69		0.37		40		12	

Notes:
The maximum concentration is presented in **bold**.
Shaded **red** indicates that the result exceeds the applied BTV.

<	The analyte was analyzed for, but was not detected. The reporting limit is shown in the result column.
BTV	Background threshold value
ID	Identification
J	Estimated value
J-	Estimated value, may be biased low.
LT	Result less than requested minimum detectable concentration, but greater than the sample-specific detectable concentration.
mg/kg	Milligrams per kilogram
pCi/g	Picocuries per gram
Q	Qualifier
TPU	Total propagated uncertainty
U	Not detected. The associated value is the reporting limit.
UJ	Not considered detected. The associated value is the reported concentration, which is estimated.

5.5.2.2 Gamma Radiation Survey Results

Radiation levels within the Middle 2A drainage exceed the applied gamma BTV with an upper range of measurements between one and two times applied gamma BTV for the combined BSA-34 and BSA-35 data set of 12,465 cpm. Table J-33 provides summary statistics for the gamma radiation measurements within Middle 2A. Forty-three percent of measurements exceeded the applied gamma BTV. Figure J-28 displays gamma radiation survey data collected within the drainage compared to the background drainage gamma survey results. The spread of gamma radiation levels within the drainage encompasses the range of background gamma measurements up to a maximum gamma count rate measurement of 21,909 cpm. A box plot showing the quartiles of the data sets is provided in Figure J-29. The box plot displays the median of the drainage radiation levels above the background data set median and below the applied gamma BTV.

The Middle 2A drainage appears to exhibit gamma measurements in the range of background until runoff originating from the Mesa IV Mine No. 2 enters the drainage and measurements increase to between one and two times the applied gamma BTV.

Table J-33. Summary of Gamma Radiation Survey Results for the Middle 2A Drainage

Summary Statistic	Units	Gamma Radiation Survey Results
Applied Gamma BTV	cpm	12,465
Measurements	#	1,973
Minimum	cpm	7,638
Maximum	cpm	21,909
Average	cpm	12,840
Median	cpm	11,315
Standard Deviation	cpm	3,297
90th Percentile	cpm	17,830
95th Percentile	cpm	18,686
99th Percentile	cpm	20,156
Measurements Above Gamma BTV	#	842
Measurements Above Gamma BTV	%	43

Notes:
BTV Background threshold value
cpm Counts per minute

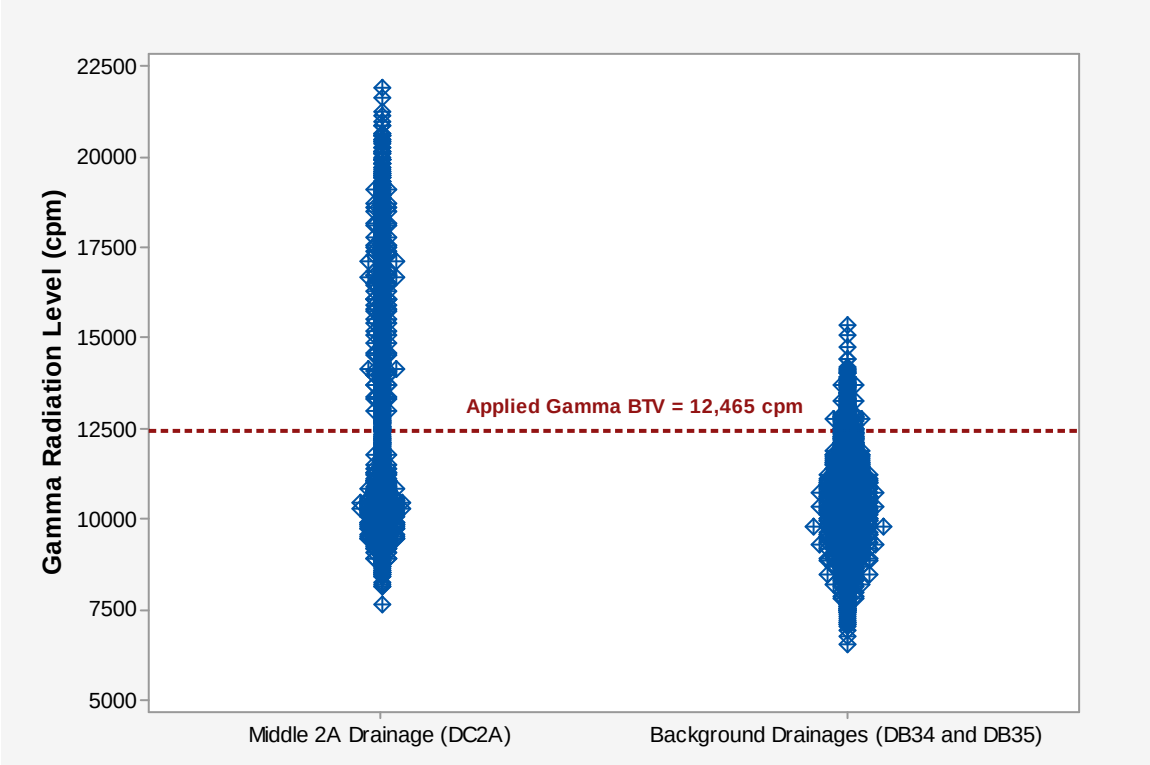


Figure J-28. Individual Value Plot of Gamma Radiation Levels within the Middle 2A Drainage and Background Drainages

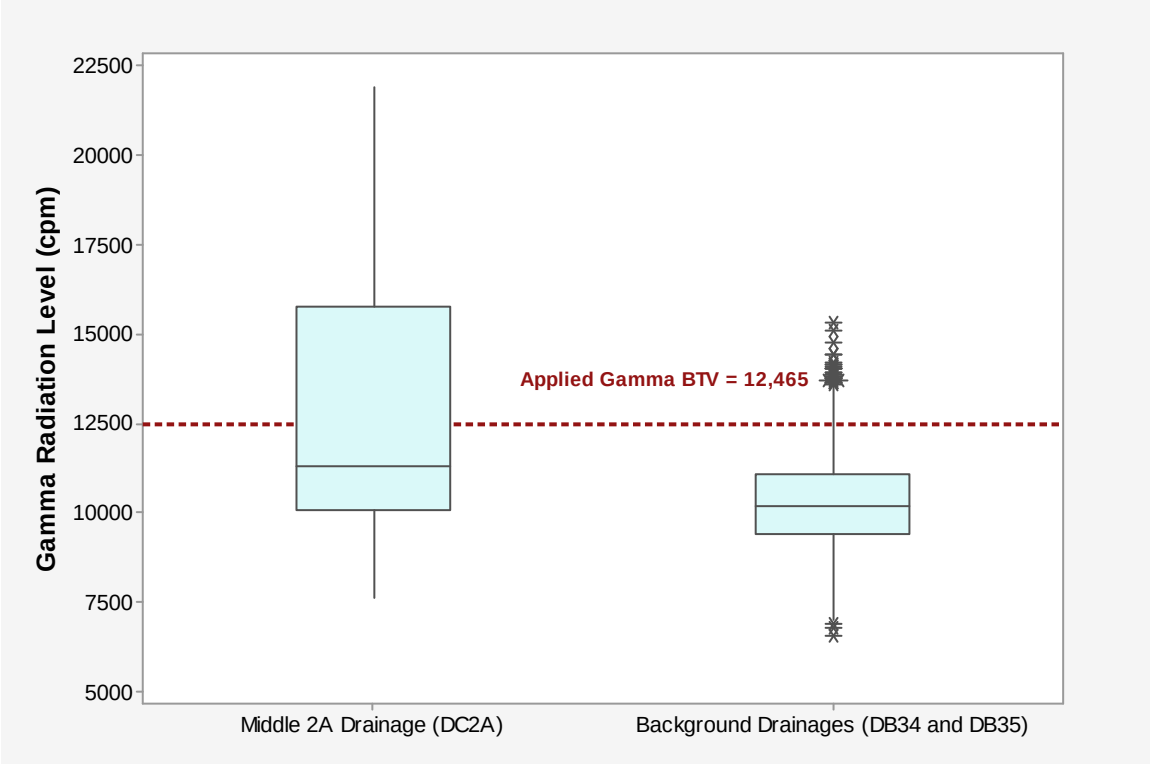


Figure J-29. Box Plot of Gamma Radiation Levels within the Middle 2A Drainage and Background Drainages

5.5.2.3 Potential Contribution from AUMs

Based on the radium-226, uranium, and vanadium sediment sample results exceeding twice their respective BTVs, Mesa IV Mine No. 1 appears to contribute to elevated concentrations of mine contaminants in the Middle 2A drainage; non-Tronox mines located upgradient on the Middle 2A drainage may also contribute to elevated concentrations of uranium and vanadium. Gamma measurements do not support this conclusion, as the maximum gamma measurement does not exceed twice the applied BTV, and the median gamma survey measurement is below the applied BTV for the drainage; therefore, additional investigation may be warranted to correlate gamma and metals results.

5.5.3 Middle 2B

Mesa II 1/2 Mine, Mesa II 1/2, Mine 4, and Mesa III Mine are located near the furthest upgradient portions of the Middle 2B drainage, which merges with the Middle 2C drainage and then flows into Middle 2 drainage. Non-AUM Target T32 (M2-01) is located to the south of the downgradient portion of Middle 2B drainage.

A total of 10 sediment samples were collected from the Middle 2B drainage in June 2018, including one judgmental sample (DC2B-SD8A) collected because of elevated gamma readings. In addition, one opportunistic sediment sample was collected downgradient of the Mesa III Mine survey area in September 2018. Sediment samples were analyzed for the suite of metals and radionuclides presented in Table J-9 and Table J-10. A gamma survey was performed along an approximately 0.5-mile reach of the Middle 2B drainage on June 22, 2018. The results of sediment sampling for primary analytes and the gamma survey are described in the following subsections and presented within the Middle 2B drainage results figures in Attachment J3 (Figure DC-I, Figures DC2B-1 and DC2B-2).

5.5.3.1 Sediment Sampling Results

Sediment results for primary analytes collected at 10 locations are compared with BTVs from BSA-34 and BSA-35 and presented in Table J-34. Results for molybdenum, radium-226, uranium, and vanadium exceeded the BTV in all of the samples collected. Results for arsenic and selenium exceeded the BTV in four and five samples, respectively, with the maximum concentration just over twice the BTV.

The maximum concentration for all primary analytes was exhibited in the sample collected within the drainage passing through Waste Pile M32 at Mesa III Mine at M32-SD1. The BTVs were exceeded by 22 times, 72 times, 173 times, and 17 times for molybdenum, radium-226, uranium, and vanadium, respectively. The radium-226 concentration from this location was the highest detected concentration off all samples collected within the drainage investigation, and the uranium concentration was the second highest detected concentration (exhibiting the same concentration as the sample collected below a waste pile at Mesa I Mine 12 in Middle 3E drainage).

Within the drainage itself, the maximum concentrations for selenium, uranium, and vanadium were in the middle portion of the drainage at location DC2B-SD7 below the confluence of the drainages coming from Mesa II 1/2 Mine and Mesa II 1/2 Mine 4, and from Mesa III Mine; the results exceeded the BTV by 2, 138, and 9 times, respectively. The highest concentration of uranium exceeded the BTV by 50 times at location DC2B-SD9, below Mesa III Mine. Molybdenum exhibited the maximum concentration in sample DC2B-SD3, located downgradient of non-AUM Target T32 (M2-01), with a result exceeding the BTV by 16 times.

Table J-34. Sediment Results for Primary Analytes in the Middle 2B Drainage

Field Sample ID	Drainage Channel ID	Sample Date	Arsenic		Lead		Molybdenum		Radium-226			Selenium		Thorium		Uranium		Vanadium	
			Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Activity (pCi/g)	TPU	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q
DC2B-SD2-01-062218	Middle 2B	6/22/2018	1.5		2.8		0.39		7.74	0.98		0.55	J	1.4		10		32	
DC2B-SD3-01-062218	Middle 2B	6/22/2018	2.2		3.1		3.10		4.04	0.6		0.66	J	1.4		5.2		24	
DC2B-SD4-01-062218	Middle 2B	6/22/2018	1.5		2.7		0.39		8.4	1.1		0.52	J	1.4		5.2		21	
DC2B-SD5-01-062218	Middle 2B	6/22/2018	2.4		3.3		2.60		10.4	1.4		0.83	J	1.6		23		56	
DC2B-SD6-01-062218	Middle 2B	6/22/2018	1.8		3.0		0.46		17.5	2.2		0.84	J	1.9		14		66	
DC2B-SD7-01-062218	Middle 2B	6/22/2018	4.9		5.5		2.80		47.1	5.6	J-	2.0		2.3		80		140	
DC2B-SD8-01-062218	Middle 2B	6/22/2018	2.5		3.7		1.10		18	2.2		1.6		1.7		69		60	
DC2B-SD8A-01-062218	Middle 2B	6/22/2018	2.5		3.5		1.50		26.4	3.2		0.78	J	1.6		14		47	
DC2B-SD9-01-062218	Middle 2B	6/22/2018	1.7		3.0		0.96	J	58.6	7	J	0.72	J	1.5		10	J	53	J
M32-SD1-01-092918	Middle 2B	9/29/2018	**5.6**		**5.7**		**4.20**		**84.3**	10	J-	**2.3**		**2.8**		**100**		**260**	
Number of Measurements			10		10		10		10			10		10		10		10	
Number of Detects			10		10		10		10			10		10		10		10	
Number of Nondetects			0		0		0		0			0		0		0		0	
Minimum (mg/kg)			1.5		2.7		0.39		4.04			0.52		1.4		5.2		21	
Maximum (mg/kg)			5.6		5.7		4.2		84.3			2.3		2.8		100		260	
Average (mg/kg)			2.7		3.6		1.8		28.2			1.1		1.8		33		76	
Median (mg/kg)			2.3		3.2		1.3		17.8			0.81		1.6		14		55	
Standard Deviation (mg/kg)			1.4		1.1		1.3		26.6			0.64		0.46		36		73	
90th Percentile (mg/kg)			5.0		5.5		3.2		61.2			2.0		2.4		82		152	
95th Percentile (mg/kg)			5.3		5.6		3.7		72.7			2.2		2.6		91		206	
99th Percentile (mg/kg)			5.5		5.7		4.1		82.0			2.3		2.8		98		249	
Relative Standard Deviation			0.54		0.30		0.76		0.94			0.59		0.26		1.1		0.96	
BTV (mg/kg)			2.4		8.0		0.19		1.2			0.80		3.5		0.58		15	
Maximum/BTV (unitless)			2.3		0.71		22		73			2.9		0.80		174		17	

Notes:
The maximum concentration is presented in **bold**.
Shaded **red** indicates that the result exceeds the applied BTV.

BTV	Background threshold value
ID	Identification
J	Estimated value
J-	Estimated value, may be biased low.
mg/kg	Milligrams per kilogram
pCi/g	Picocuries per gram
Q	Qualifier
TPU	Total propagated uncertainty

5.5.3.2 Gamma Radiation Survey Results

In general, the radiation levels within the Middle 2B drainage exceeded the applied gamma BTV with an upper range of measurements between eight and nine times the applied gamma BTV for the combined BSA-34 and BSA-35 data set of 12,465 cpm. Table J-35 provides summary statistics for the gamma radiation measurements within Middle 2B. Ninety-six percent of measurements exceeded the applied gamma BTV. Figure J-30 displays gamma radiation survey data collected within the drainage compared to the background drainage gamma survey results. The spread of gamma radiation levels within the drainage encompasses the range of background gamma measurements up to a maximum gamma count rate measurement of 106,275 cpm, a measurement greater than 10 times the applied gamma BTV. A box plot showing the quartiles of the data sets is provided in Figure J-31. The box plot displays the median of the drainage radiation levels above the background data set median and above applied gamma BTV.

The Mesa II Mine complex, found at the upstream end of the Middle 2B drainage, appears to be contributing materials to the drainage with elevated gamma readings. A majority of the drainage measures three to four times the applied gamma BTV.

Table J-35. Summary of Gamma Radiation Survey Results for the Middle 2B Drainage

Summary Statistic	Units	Gamma Radiation Survey Results
Applied Gamma BTV	cpm	12,465
Measurements	#	6,601
Minimum	cpm	7,722
Maximum	cpm	106,275
Average	cpm	39,652
Median	cpm	37,674
Standard Deviation	cpm	15,348
90th Percentile	cpm	61,346
95th Percentile	cpm	67,656
99th Percentile	cpm	78,133
Measurements Above Gamma BTV	#	6,361
Measurements Above Gamma BTV	%	96

Notes:
BTV Background threshold value
cpm Counts per minute

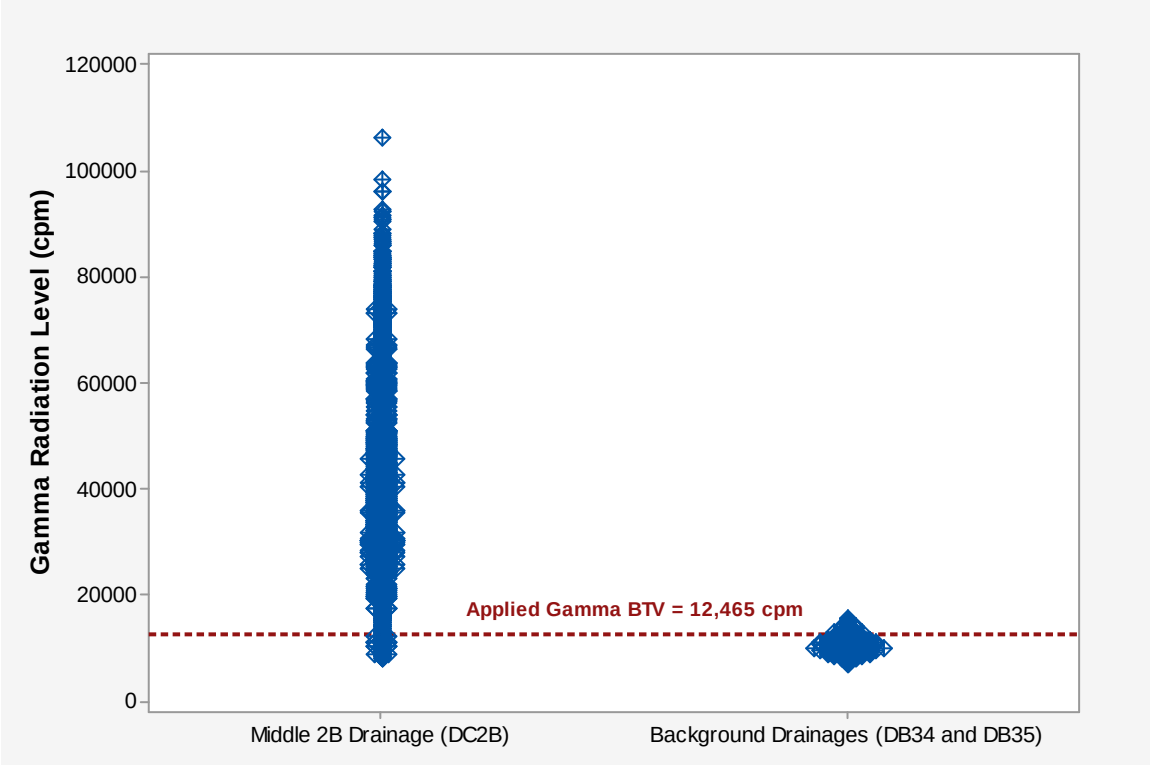


Figure J-30. Individual Value Plot of Gamma Radiation Levels within the Middle 2B Drainage and Background Drainages

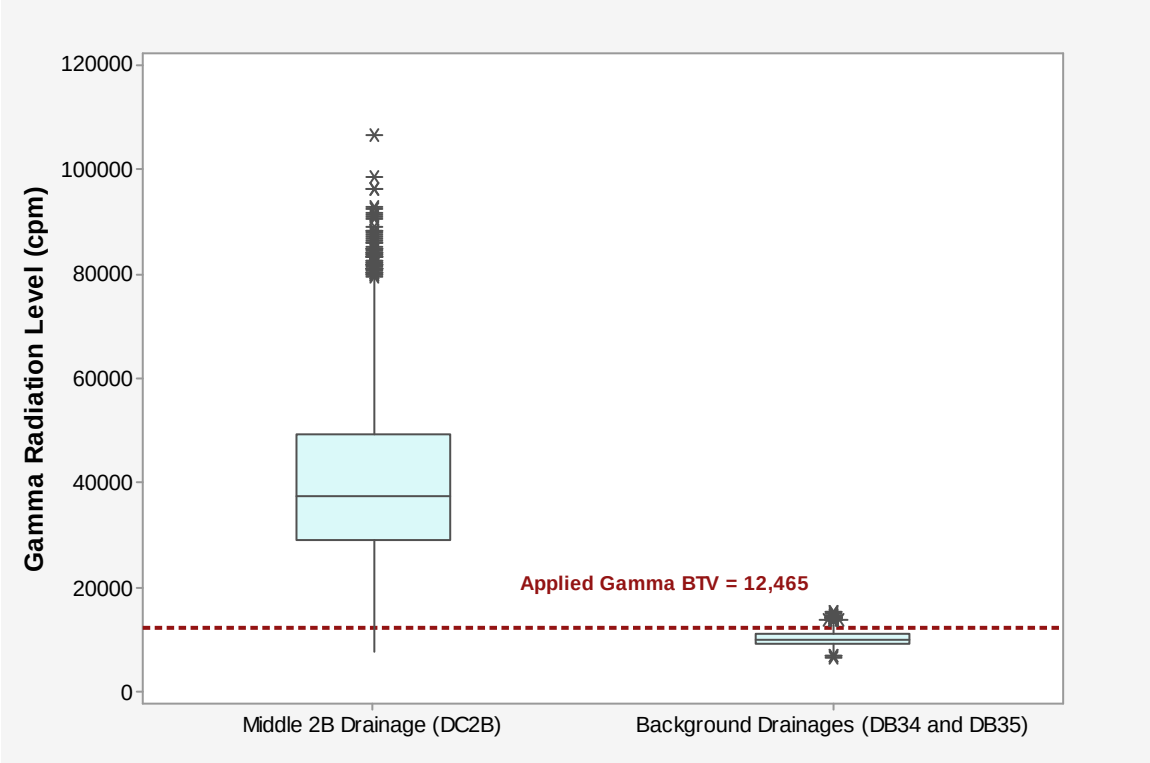


Figure J-31. Box Plot of Gamma Radiation Levels within the Middle 2B Drainage and Background Drainages

5.5.3.3 Potential Contribution from AUMs and Targets

Based on the arsenic, molybdenum, radium-226, selenium, uranium, and vanadium sediment sample results exceeding twice their respective BTVs, Mesa II 1/2 Mine, Mesa II 1/2, Mine 4, Mesa III Mine, and potentially non-AUM Target T32 (M2-01) appear to contribute to elevated concentrations of mine contaminants in the Middle 2B drainage. The radium-226 concentration from this location was the highest detected concentration of all samples collected within the drainage investigation, and the uranium concentration was the second highest detected concentration (exhibiting the same concentration as the sample collected below a waste pile at Mesa I Mine 12 in the Middle 3E drainage). Gamma measurements support the conclusion that the Middle 2B drainage may be impacted by the upgradient mines; the maximum concentration exceeds twice the applied BTV, and the median concentration exceeds the applied BTV. Additional investigation may be warranted to further identify the lateral and vertical extents of contamination.

5.6 MIDDLE 3 DRAINAGES

Middle 3 drains the southeastern portion of the Lukachukai Mountains Region. The Middle 3 drainage flows south to north across the Cove Valley, and receives inputs from upgradient drainages Middle 3A through 3G before merging with Middle 1 and Middle 2 into Cove Wash Middle. The direction of surface water flow is generally from south to north within the Middle 3 drainages, following the general trend of the downward slope of the mountains.

5.6.1 Middle 3

The upgradient portion of Middle 3 receives inputs from drainages Middle 3A, Middle 3B (via Middle 3A), Middle 3C (via Middle 3A), and Middle 3E. The Mesa I Mine Complex is located to the east of the lower portion of the Middle 3E drainage and the upper portion of the Middle 3 drainage, with Mesa I Mine 11 and 12 potentially contributing directly to the Middle 3 drainage. Surface water from Mesa II flows into Middle 3 drainage from the west above the confluence with Middle 3G. Middle 3 drainage continues past the confluence with Middle 3G; however, the portion of Middle 3 drainage downgradient of Middle 3G was not investigated during the RSE investigation.

A total of 20 surface sediment samples were collected from the Middle 3 drainage in June 2018, including one judgmental sample (DC3-SD18A) collected from below a 6-inch drop. Sediment samples were analyzed for the suite of metals and radionuclides presented in Table J-9 and Table J-10. A gamma survey was performed along an approximately 1.1-mile reach of the Middle 3 drainage on June 23, 2018. The results of sediment sampling for primary analytes and the gamma survey are described in the following subsections and presented within the Middle 3 drainage results figures in Attachment J3 (Figure DC3-I, Figures DC3-1 through DC3-5).

Surface water samples were also collected from the Middle 3 drainage; results are presented in Section 5.10.

5.6.1.1 Sediment Sampling Results

Sediment results for primary analytes collected at 20 locations are compared with BTVs from BSA-34 and BSA-35, and presented in Table J-36. All but two of the results for radium-226 and uranium exceeded the BTV – the maximum concentrations exceeded the BTV by 10 and 15 times, respectively. Results for arsenic, molybdenum, selenium, and vanadium also exceeded the BTV in three to six of the 19 samples. Lead and thorium did not exceed the BTV in any samples. The highest concentrations of most primary analytes are in samples DC3-SD4, DC3-SD5, and DC3-SD6, located in the downgradient portion of the drainage immediately below Mesa II Pit. The highest concentrations of radium-226 and selenium were found further upgradient in samples DC3-SD12 and DC3-SD13, located downgradient of the Mesa I Mine complex.

Table J-36. Sediment Results for Primary Analytes in the Middle 3 Drainage

Field Sample ID	Drainage Channel ID	Sample Date	Arsenic		Lead		Molybdenum		Radium-226			Selenium		Thorium		Uranium		Vanadium	
			Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Activity (pCi/g)	TPU	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q
DC3-SD1-01-062318	Middle 3	6/23/2018	1.1		3.3		0.12	J	2.33	0.38		<1.2	U	0.9		3.3		14	
DC3-SD2-01-062318	Middle 3	6/23/2018	1.3		3.0		0.17	J	1.84	0.35		0.45	J	1.1		2.9		13	
DC3-SD3-01-062318	Middle 3	6/23/2018	1.8		4.1		0.19	J	2.82	0.45	J-	0.42	J	1.6		3.7		14	
DC3-SD4-01-062318	Middle 3	6/23/2018	**5.9**		3.1		**1.70**		3.09	0.44	J-	0.55	J	1.5		2.2		16	
DC3-SD5-01-062318	Middle 3	6/23/2018	3.0		**7.0**		0.69		4.3	0.64		0.95	J	**3.0**		5.2		**22**	
DC3-SD6-01-062318	Middle 3	6/23/2018	2.5		5.7		0.79		3.14	0.5	J+	1.20	J	2.3		**9.0**		20	
DC3-SD7-01-062318	Middle 3	6/23/2018	0.8		1.9		0.08	J	0.85	0.23	LT	<1.2	U	1.1		1.0		7.2	
DC3-SD8-01-062318	Middle 3	6/23/2018	1.9		5.5		0.23		5.04	0.68	J-	0.42	J	1.4		1.7		21	
DC3-SD9-01-062318	Middle 3	6/23/2018	1.6		2.8		0.16	J	3.28	0.45		0.42	J	1.5		2.1		13	
DC3-SD10-01-062318	Middle 3	6/23/2018	1.2		2.7		0.14	J	2.1	0.32		<1.1	U	1.1		0.9	J	9.2	
DC3-SD10-01-082118	Middle 3	8/21/2018	1.0		2.1		0.09	J	1.89	0.35		<1.2	U	1.1		1.3		9.2	
DC3-SD11-01-062318	Middle 3	6/23/2018	1.2		2.2		0.13	J	8.3	1.1		<1.2	U	1.0		2.2		13	
DC3-SD12-01-062318	Middle 3	6/23/2018	1.1		2.7		0.11	J	**11.9**	1.6		<1.2	U	1.1		5.4		17	
DC3-SD13-01-062318	Middle 3	6/23/2018	1.6		2.7		0.13	J	7.52	0.96	J-	**1.70**		1.4		1.6		13	
DC3-SD14-01-062318	Middle 3	6/23/2018	1.4		3.7		0.20	J	3.06	0.47		0.38	J	1.4		1.6		11	
DC3-SD15-01-062318	Middle 3	6/23/2018	1.5		2.4		0.12	J	3.48	0.53		0.39	J	1.3		1.6		14	
DC3-SD16-01-062318	Middle 3	6/23/2018	0.8		2.0		0.09	J	0.92	0.26	LT	<1.1	U	0.8		0.3		2.7	
DC3-SD17-01-062318	Middle 3	6/23/2018	1.4		2.3		0.12	J	1.38	0.26		0.39	J	1.0		1.5		16	
DC3-SD18-01-062318	Middle 3	6/23/2018	1.3		2.8		0.12	J	1.21	0.26		<1.2	U	1.3		1.6		12	
DC3-SD18A-01-082118	Middle 3	8/21/2018	1.2		2.2		0.13	J	2.75	0.43	J	<1.2	U	1.4	J	0.57	J	9.7	J
Number of Measurements			20		20		20		20			20		20		20		20	
Number of Detects			20		20		20		20			11		20		20		20	
Number of Nondetects			0		0		0		0			9		0		0		0	
Minimum (mg/kg)			0.8		1.9		0.08		0.85			0.38		0.82		0.30		2.7	
Maximum (mg/kg)			5.9		7.0		1.7		11.9			1.7		3.0		9		22	
Average (mg/kg)			1.7		3.2		0.28		3.56			0.7		1.4		2.5		13	
Median (mg/kg)			1.4		2.8		0.13		2.94			0.42		1.3		1.7		13	
Standard Deviation (mg/kg)			1.1		1.4		0.39		2.78			0.44		0.50		2.1		5	
90th Percentile (mg/kg)			2.6		5.5		0.70		7.60			1.2		1.7		5.2		20	
95th Percentile (mg/kg)			3.1		5.8		0.8		8.5			1.5		2.3		6		21	
99th Percentile (mg/kg)			5		6.8		1.5		11.2			1.7		2.9		8		22	
Relative Standard Deviation			0.7		0.43		1.4		0.78			0.66		0.37		0.83		0.35	
BTV (mg/kg)			2.4		8.0		0.19		1.2			0.80		3.5		0.58		15	
Maximum/BTV (unitless)			2.5		0.88		8.9		10			2.1		0.86		16		1.5	

Notes:

The maximum concentration is presented in **bold**.
Shaded **red** indicates that the result exceeds the applied BTV.

<	The analyte was analyzed for, but was not detected. The reporting limit is shown in the result column.
BTV	Background threshold value
ID	Identification
J	Estimated value
J-	Estimated value, may be biased low.
J+	Estimated value, may be biased high.
LT	Result less than requested minimum detectable concentration, but greater than the sample-specific detectable concentration.
mg/kg	Milligrams per kilogram
pCi/g	Picocuries per gram
Q	Qualifier
TPU	Total propagated uncertainty
U	Not detected. The associated value is the reporting limit.

5.6.1.2 Gamma Radiation Survey Results

In general, the radiation levels within the Middle 3 drainage exceed the applied gamma BTV with an upper range of measurements greater than 10 times applied gamma BTV for the combined BSA-34 and BSA-35 data set of 12,465 cpm. Table J-37provides summary statistics for the gamma radiation measurements within Middle 3. Seventy-eight percent of measurements exceeded the applied gamma BTV. Figure J-32 displays gamma radiation survey data collected within the drainage compared to the background drainage gamma survey results. The spread of gamma radiation levels within the drainage encompasses the range of background gamma measurements up to a maximum gamma count rate measurement of 152,096 cpm, a measurement greater than 10 times the applied gamma BTV. A box plot showing the quartiles of the data sets is provided in Figure J-33. The box plot displays the median of the drainage radiation levels above the background data set median and above applied gamma BTV.

Elevated gamma measurements were observed at the upstream end of the Middle 3 drainage, immediately downgradient of Mesa I Mine 12. These elevated gamma measurements appear to be associated with the materials transported from Waste Pile M4 of Mesa I Mine 12.

Portions of the Middle 3 drainage gamma survey were not logged because of poor GPS signal resulting from the steep walled portions of the drainage.

Table J-37. Summary of Gamma Radiation Survey Results for the Middle 3 Drainage

Summary Statistic	Units	Gamma Radiation Survey Results
Applied Gamma BTV	cpm	12,465
Measurements	#	9,535
Minimum	cpm	7,620
Maximum	cpm	152,096
Average	cpm	18,433
Median	cpm	16,641
Standard Deviation	cpm	8,347
90th Percentile	cpm	27,896
95th Percentile	cpm	32,258
99th Percentile	cpm	46,312
Measurements Above Gamma BTV	#	7,396
Measurements Above Gamma BTV	%	78

Notes:
BTV Background threshold value
cpm Counts per minute

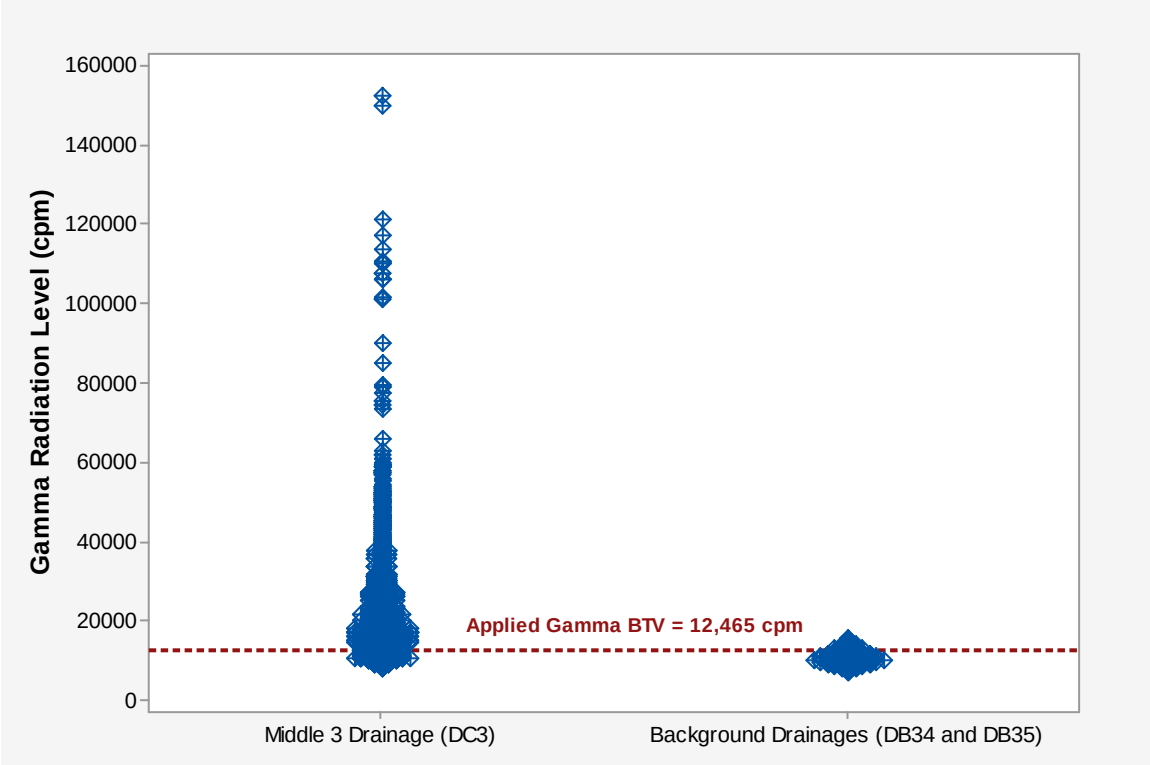


Figure J-32. Individual Value Plot of Gamma Radiation Levels within the Middle 3 Drainage and Background Drainages

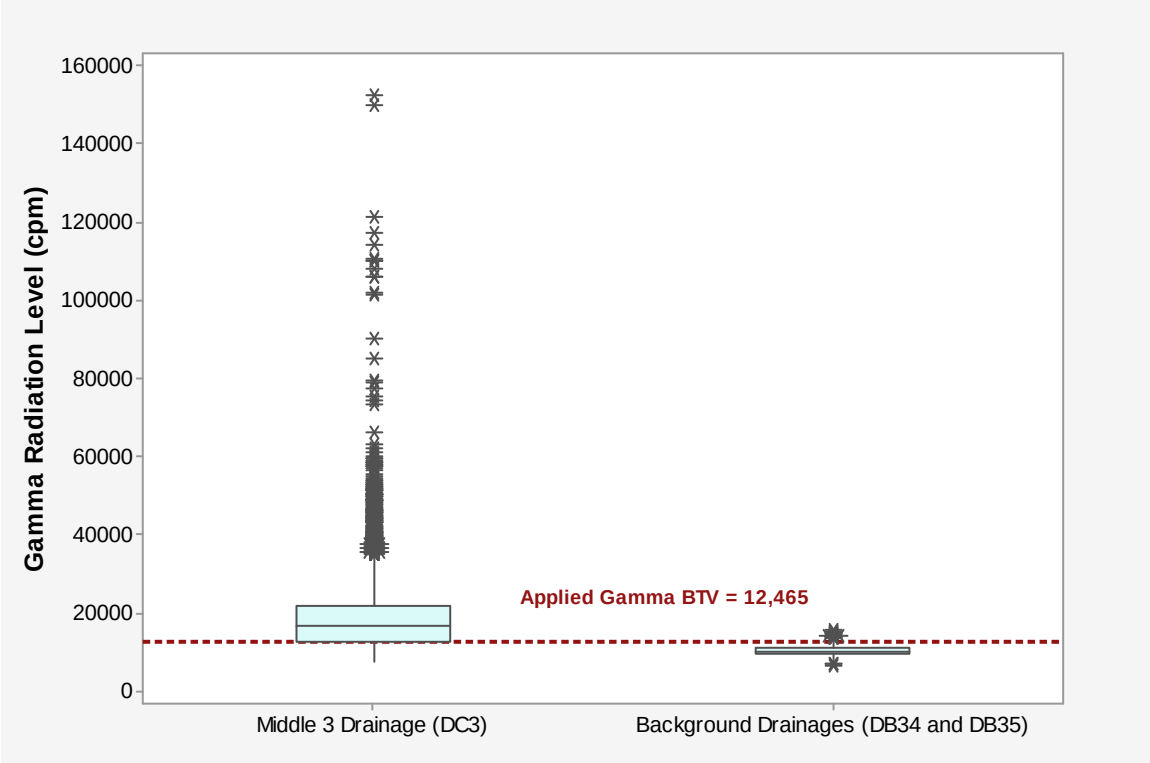


Figure J-33. Box Plot of Gamma Radiation Levels within the Middle 3 Drainage and Background Drainages

5.6.1.3 Potential Contribution from AUMs

Based on the arsenic, molybdenum, radium-226, selenium, and uranium sediment sample results exceeding twice their respective BTVs, multiple Tronox mines, including Mesa I Mine 11 and 12 and Mesa II Pit, as well as mines located on upgradient drainages Middle 3A and Middle 3E, appear to contribute to elevated concentrations of mine contaminants in the Middle 3 drainage. Gamma measurements support the conclusion that the Middle 3 drainage may be impacted by the upgradient mines; the maximum concentration exceeds twice the applied BTV, and the median concentration exceeds the applied BTV. Additional investigation may be warranted to further identify the lateral and vertical extents of contamination.

5.6.2 Middle 3A

Middle 3A drainage originates adjacent to non-Tronox Billy Topaha Mine, and flows north where three drainages merge with it, Middle 3C, Middle 3D and Middle 3B. Middle 3D merges with Middle 3A downgradient of the Middle 3C confluence and upgradient of the Middle 3B confluence. Henry Phillips Mine is located east of Middle 3A approximately halfway down the drainage, and Mesa II, Mine 4 is located west of Middle 3A at the downgradient portion of the drainage, before Middle 3A merges with Middle 3E, at which point it becomes Middle 3 drainage.

A total of 17 sediment samples were collected from the Middle 3A drainage in June 2018, and analyzed for the suite of metals and radionuclides presented in Tables J-9 and J-10. A gamma survey was performed along an approximately 1.2-mile reach of the Middle 3A drainage on June 18, 19, and 23, 2018. The results of sediment sampling for primary analytes and the gamma survey are described in the following subsections and presented within the Middle 3A drainage results figures in Attachment J3 (Figure DC3A-I, Figures DC3A -1 through DC3A-4).

5.6.2.1 Sediment Sampling Results

Sediment results for primary analytes collected at 17 locations are compared with BTVs from BSA-34 and BSA-35 and presented in Table J-38. Molybdenum, radium-226, and uranium exceeded their corresponding BTVs in eight, 11, and 14 samples, respectively. None of the results for the most upgradient sample collected at the confluence with Middle 3C drainage exceeded their respective BTVs. The maximum concentrations of these analytes were from the upgradient portion of the drainage just below the confluence of Middle 3C drainage from Mesa I 3/4 Incline Mine, and exceeded their BTVs by 4, 9, and 12 times. At these same locations, arsenic concentrations exceeded the BTV.

Selenium slightly exceeded the BTV in one sample in the downgradient portion of the drainage (DC3A-SD5) just downgradient of Henry Phillips Mine, and vanadium exceeded the BTV in four samples in various portions of the drainage.

Concentrations of contaminants tend to gradually decline downgradient, however, there are temporary increases in sample DC3A-SD10, immediately downgradient of the Middle 3D drainage originating from Mesa I 1/2, West Mine, and sample DC3A-SD5, immediately downgradient of Henry Phillips Mine.

Table J-38. Sediment Results for Primary Analytes in the Middle 3A Drainage

Field Sample ID	Drainage Channel ID	Sample Date	Arsenic		Lead		Molybdenum		Radium-226			Selenium		Thorium		Uranium		Vanadium	
			Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Activity (pCi/g)	TPU	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q
DC3A-SD1-01-062318	Middle 3A	6/23/2018	2.0		3.1		0.20	J	1.9	0.28	J-	0.38	J	1.5		1.3		9.7	
DC3A-SD2-01-062318	Middle 3A	6/23/2018	1.3		2.4		0.15	J	1.7	0.32		<1.0	U	1.2		1.0		7.1	
DC3A-SD3-01-062318	Middle 3A	6/23/2018	1.2		2.1		0.12	J	0.7	0.21	LT	<0.97	U	1.2		1.1		8.4	
DC3A-SD4-01-062318	Middle 3A	6/23/2018	1.7		2.8		0.19	J	1.8	0.33		0.38	J	1.6		1.4		9.2	
DC3A-SD5-01-062318	Middle 3A	6/23/2018	1.8		3.5		0.32		9.0	1.2		**0.82**	J	1.5		2.8		29	
DC3A-SD6-01-062318	Middle 3A	6/23/2018	1.1		2.2		0.17	J	1.3	0.25		0.36	J	1.2		1.3		6.4	
DC3A-SD7-01-062318	Middle 3A	6/23/2018	1.3		2.5		0.18	J	4.0	0.57	J-	0.51	J	1.3		2.2		12	
DC3A-SD8-01-062318	Middle 3A	6/23/2018	1.5		3.9		0.23		1.0	0.25	LT	0.38	J	1.3		1.4		6.2	
DC3A-SD9-01-061818	Middle 3A	6/18/2018	1.6		2.3		0.29		2.5	0.41		0.75	J	1.3		3.5		14	
DC3A-SD10-01-061818	Middle 3A	6/18/2018	2.1		3.7		0.23		2.2	0.37		0.68	J	1.5		5.7		16	
DC3A-SD11-01-061818	Middle 3A	6/18/2018	1.2		1.8		0.07	J	0.8	0.22	LT	<0.98	U	1.2		0.5		4.6	
DC3A-SD12-01-061818	Middle 3A	6/18/2018	1.4		1.6		0.09	J	0.7	0.21	J-	<1.0	U	1.0		0.4		4.8	
DC3A-SD13-01-061818	Middle 3A	6/18/2018	4.4		4.0		0.46		**10.6**	1.3	J-	0.61	J	**1.9**		5.8		39	
DC3A-SD14-01-061818	Middle 3A	6/18/2018	1.6		2.9		0.12	J	1.1	0.25		0.35	J	1.4		0.8	J	7.4	
DC3A-SD15-01-061818	Middle 3A	6/18/2018	**6.3**		**5.1**		0.25		1.9	0.28		0.46	J	1.6		**6.8**		**68**	
DC3A-SD16-01-061818	Middle 3A	6/18/2018	3.4		2.5		**0.71**		1.3	0.28	J-	<1.0	U	1.4		0.7		6.3	
DC3A-SD17-01-061818	Middle 3A	6/18/2018	1.3		1.7		0.09	J	0.76	0.21	J-	<0.98	U	1.1		0.4		5.3	
Number of Measurements			17		17		17		17			17		17		17		17	
Number of Detects			17		17		17		17			11		17		17		17	
Number of Nondetects			0		0		0		0			6		0		0		0	
Minimum (mg/kg)			1.1		1.6		0.07		0.71			0.35		1.0		0.38		4.6	
Maximum (mg/kg)			6.3		5.1		0.71		10.6			0.82		1.9		6.8		68	
Average (mg/kg)			2.1		2.8		0.23		2.54			0.52		1.4		2.2		15	
Median (mg/kg)			1.6		2.5		0.19		1.69			0.46		1.3		1.3		8.4	
Standard Deviation (mg/kg)			1.39		0.9		0.16		2.87			0.17		0.22		2.1		16	
90th Percentile (mg/kg)			3.8		3.9		0.38		5.99			0.75		1.6		5.7		33	
95th Percentile (mg/kg)			4.8		4.2		0.51		9.32			0.79		1.7		6.0		45	
99th Percentile (mg/kg)			6.0		4.9		0.67		10.3			0.81		1.9		6.6		63	
Relative Standard Deviation			0.67		0.34		0.69		1.13			0.33		0.16		0.95		1.11	
BTV (mg/kg)			2.4		8.0		0.19		1.2			0.80		3.5		0.58		15	
Maximum/BTV (unitless)			2.6		0.64		3.7		9.2			1.0		0.54		12		4.5	

Notes:
The maximum concentration is presented in **bold**.
Shaded **red** indicates that the result exceeds the applied BTV.

<	The analyte was analyzed for, but was not detected. The reporting limit is shown in the result column.
BTV	Background threshold value
ID	Identification
J	Estimated value
J-	Estimated value, may be biased low.
LT	Result less than requested minimum detectable concentration, but greater than the sample-specific detectable concentration.
mg/kg	Milligrams per kilogram
pCi/g	Picocuries per gram
Q	Qualifier
TPU	Total propagated uncertainty
U	Not detected. The associated value is the reporting limit.

5.6.2.2 Gamma Radiation Survey Results

In general, the radiation levels within the Middle 3A drainage exceeded the applied gamma BTV with an upper range of measurements between three and four times the applied gamma BTV for the combined BSA-34 and BSA-35 data set of 12,465 cpm. Table J-39 provides summary statistics for the gamma radiation measurements within Middle 3A. Sixty percent of measurements exceeded the applied gamma BTV. Figure J-34 displays gamma radiation survey data collected within the drainage compared to the background drainage gamma survey results. The spread of gamma radiation levels within the drainage encompasses the range of background gamma measurements up to a maximum gamma count rate measurement of 48,783 cpm. A box plot showing the quartiles of the data sets is provided in Figure J-35. The box plot displays the median of the drainage radiation levels above the background data set median and above the applied gamma BTV.

Much of the drainage measures two to three times the applied gamma BTV, with localized areas of gamma measurements exhibiting measurements of three to four times the BTV. No apparent waste piles lie in direct contact with the Middle 3A drainage until its terminus at Mesa I Mine 12.

Table J-39. Summary of Gamma Radiation Survey Results for the Middle 3A Drainage

Summary Statistic	Units	Gamma Radiation Survey Results
Applied Gamma BTV	cpm	12,465
Measurements	#	12,333
Minimum	cpm	7,457
Maximum	cpm	48,783
Average	cpm	14,090
Median	cpm	13,099
Standard Deviation	cpm	4,093
90th Percentile	cpm	19,151
95th Percentile	cpm	22,376
99th Percentile	cpm	28,965
Measurements Above Gamma BTV	#	7,401
Measurements Above Gamma BTV	%	60

Notes:
BTV Background threshold value
cpm Counts per minute

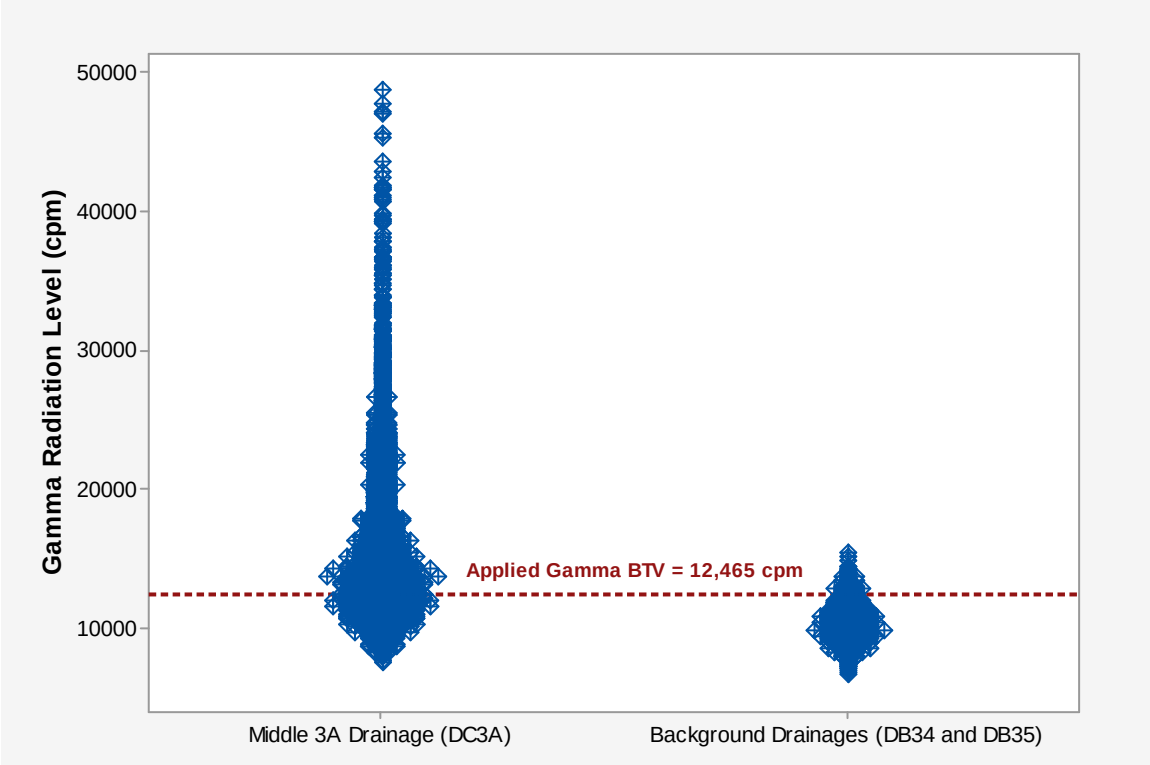


Figure J-34. Individual Value Plot of Gamma Radiation Levels within the Middle 3A Drainage and Background Drainages

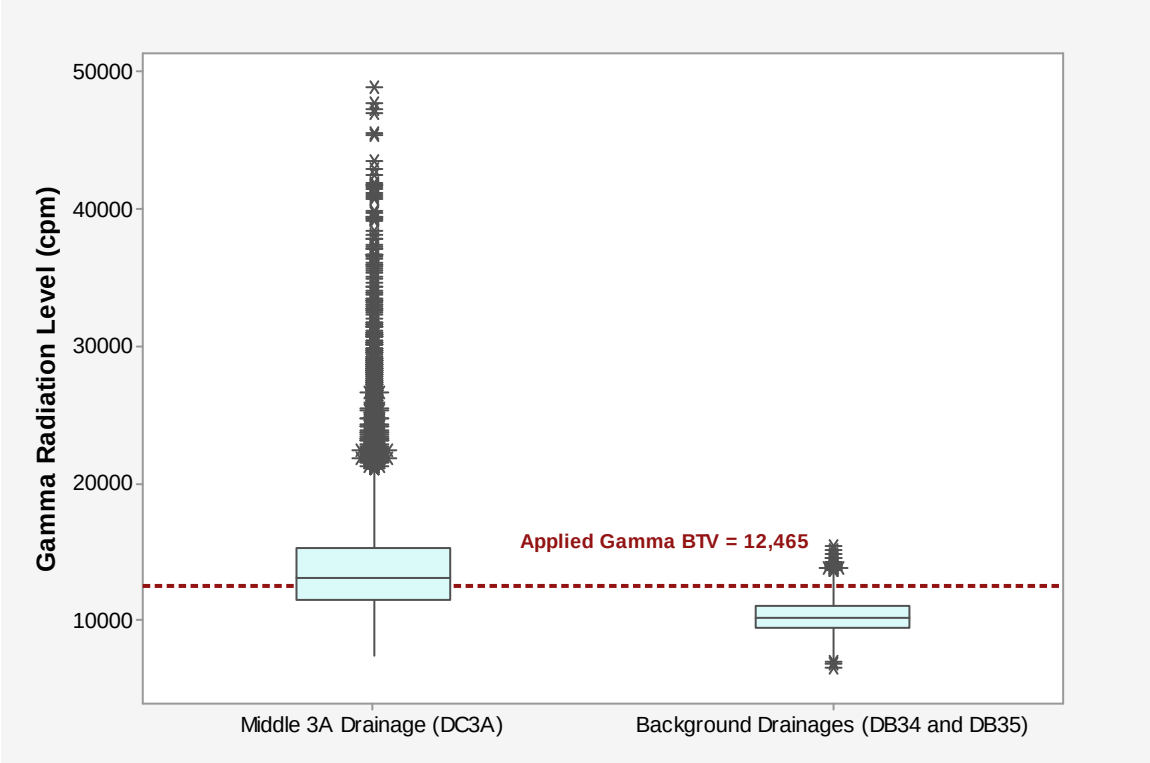


Figure J-35. Box Plot of Gamma Radiation Levels within the Middle 3A Drainage and Background Drainages

5.6.2.3 Potential Contribution from AUMs

Based on the arsenic, molybdenum, radium-226, uranium, and vanadium sediment sample results exceeding twice their respective BTVs, Mesa I 3/4 Incline Mine, Mesa I 1/2, West Mine, and Henry Phillips Mine appear to contribute to elevated concentrations of mine contaminants in the Middle 3A drainage. The Mesa II Mine Complex may also contribute to elevated concentrations in the drainage, however it is not apparent based on the patterns of the primary analytes. Gamma measurements support the conclusion that the Middle 3A drainage may be impacted by the upgradient mines; the maximum concentration exceeds twice the applied BTV, and the median concentration exceeds the applied BTV. Additional investigation may be warranted to further identify the lateral and vertical extents of contamination.

5.6.3 Middle 3B

The Middle 3B drainage originates near the Mesa II Mine Complex, consisting of Mesa II, Mine Nos. 1 & 2, P-21; Mesa I 3/4, Mine No. 2, P150; and Mesa II, Mine No. 1, P-150. The upper portion of the drainage flows right through Burial Cell 39 associated with Mesa II, Mine Nos. 1 & 2, P-21. Waste Pile M28 associated with Mesa II, Mine No. 1, P-150 is eroding into the Middle 3B drainage. The Middle 3B drainage flows into the Middle 3A drainage.

Six sediment samples were collected from the Middle 3B drainage in June 2018. In addition, two opportunistic sediment samples associated with Mesa II, Mine No. 1, P-150 were collected downgradient of the waste piles entering the drainage in September 2018. Sediment samples were analyzed for the suite of metals and radionuclides presented in Table J-9 and Table J-10. A gamma survey was performed along an approximately 0.4 mile reach of the Middle 3B drainage on June 18 and June 19, 2018. The results of sediment sampling results for primary analytes and the gamma survey are described in the following subsections and presented within the Middle 3B drainage results figures in Attachment J3 (Figure DC-I, Figures DC-1 and DC3B-2).

5.6.3.1 Sediment Sampling Results

Sediment results for primary analytes collected at six locations are compared with BTVs from BSA-34 and BSA-35 and presented in Table J-40. Results for arsenic, molybdenum, radium-226, selenium, uranium, and vanadium exceeded their corresponding BTVs. All samples for radium-226, and uranium, and all but one sample for molybdenum exceeded the BTV. Selenium only exceeded the BTVs in the samples collected below the Mesa II, Mine No. 1, P-150 waste pile. Lead and thorium did not exceed their BTVs in any samples.

For all analytes with exceedances except arsenic, the maximum concentrations were in the samples associated with the Mesa II, Mine No. 1, P-150 waste pile; the maximum molybdenum, radium-226, and uranium results exceeded the BTV by six times, 11 times, and 18 times, respectively. However, the most upgradient sample located downgradient of Mesa II, Mine Nos. 1 & 2, P-21 and Mesa I 3/4, Mine No. 2, P150 exceed BTVs for molybdenum, radium-226, and uranium, by factors of one, two, and four, respectively, indicating contribution of contamination from the upgradient mines.

For the results within the drainage, molybdenum, radium-226, and uranium results exceeded the BTV by three times, 6 times, and 12 times, respectively.

Table J-40. Sediment Results for Primary Analytes in the Middle 3B Drainage

Field Sample ID	Drainage Channel ID	Sample Date	Arsenic		Lead		Molybdenum		Radium-226			Selenium		Thorium		Uranium		Vanadium	
			Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Activity (pCi/g)	TPU	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q
DC3B-SD1-01-061918	Middle 3B	6/19/2018	1.8		3.8		0.53		2.4	0.41		0.62	J	1.7		5.7		13	
DC3B-SD2-01-061918	Middle 3B	6/19/2018	2.3		4.2		0.34		7.1	0.96		0.70	J	2.2		7.1		26	
DC3B-SD3-01-061918	Middle 3B	6/19/2018	2.7		3.8		0.18	J	3.9	0.58	J-	0.59	J	2.1		1.5		9.6	
DC3B-SD4-01-061918	Middle 3B	6/19/2018	3.1		3.2		0.27		3.6	0.54	J-	0.45	J	1.6		1.0		8.9	
M28-SD2-01-092618	Middle 3B	9/26/2018	2.8		3.9		**1.10**		5.4	0.76		**1.70**		2.4		**10**		24	
DC3B-SD5-01-061918	Middle 3B	6/19/2018	**4.4**	J	**4.6**		0.43		4.7	0.67	J	0.50	J	**2.8**		4.1		**31**	J
M28-SD1-01-092618	Middle 3B	9/26/2018	3.1		4.1		0.61		**12.3**	1.6		0.94	J	2.4		**10**		**31**	
DC3B-SD6-01-061918	Middle 3B	6/19/2018	2.1		3.3		0.22		2.3	0.38		0.45	J	2.0		2.1		11	
Number of Measurements			8		8		8		8			8		8		8		8	
Number of Detects			8		8		8		8			8		8		8		8	
Number of Nondetects			0		0		0		0			0		0		0		0	
Minimum (mg/kg)			1.8		3.2		0.2		2.3			0.5		1.6		1.0		8.9	
Maximum (mg/kg)			4.4		4.6		1.1		12.3			1.7		2.8		10.0		31.0	
Average (mg/kg)			2.8		3.9		0.5		5.2			0.7		2.2		5.2		19.3	
Median (mg/kg)			2.8		3.9		0.4		4.3			0.6		2.2		4.9		18.5	
Standard Deviation (mg/kg)			0.80		0.46		0.30		3.3			0.42		0.39		3.63		9.65	
90th Percentile (mg/kg)			3.5		4.3		0.8		8.7			1.2		2.5		10.0		31.0	
95th Percentile (mg/kg)			3.9		4.5		0.9		10.5			1.4		2.7		10.0		31.0	
99th Percentile (mg/kg)			4.3		4.6		1.1		11.9			1.6		2.8		10.0		31.0	
Relative Standard Deviation			0.29		0.12		0.65		0.63			0.56		0.18		0.70		0.50	
BTV (mg/kg)			2.4		8.0		0.19		1.2			0.80		3.5		0.58		15	
Maximum/BTV (unitless)			1.8		0.58		5.8		11			2.1		0.80		17		2.0	

Notes:
The maximum concentration is presented in **bold**.
Shaded **red** indicates that the result exceeds the applied BTV.
BTV Background threshold value
ID Identification
J Estimated value
J- Estimated value, may be biased low.
mg/kg Milligrams per kilogram
pCi/g Picocuries per gram
Q Qualifier
TPU Total propagated uncertainty

5.6.3.2 Gamma Radiation Survey Results

In general, the radiation levels within the Middle 3B drainage exceed the applied gamma BTV with an upper range of measurements greater than 10 times applied gamma BTV for the combined BSA-34 and BSA-35 data set of 12,465 cpm. Table J-41 provides summary statistics for the gamma radiation measurements within Middle 3B. Ninety-two percent of measurements exceeded the applied gamma BTV. Figure J-36 displays gamma radiation survey data collected within the drainage compared to the background drainage gamma survey results. The spread of gamma radiation levels within the drainage encompasses the range of background gamma measurements up to a maximum gamma count rate measurement of 148,952 cpm, a measurement greater than 10 times the applied gamma BTV. A box plot showing the quartiles of the data sets is provided in Figure J-37. The box plot displays the median of the drainage radiation levels above the background data set median and above applied gamma BTV.

The maximum gamma radiation level of 148,952 cpm was observed immediately downgradient of Waste Pile M28 (Mesa II, Mine No. 1 P-150) which sits near the drainage and appears to be contributing materials with elevated gamma readings directly into the Middle 3B. Gamma readings demonstrate a decreasing trend in the downstream direction away from the waste piles of M27 and M28.

Table J-41. Summary of Gamma Radiation Survey Results for the Middle 3B Drainage

Summary Statistic	Units	Gamma Radiation Survey Results
Applied Gamma BTV	cpm	12,465
Measurements	#	2,905
Minimum	cpm	8,659
Maximum	cpm	148,952
Average	cpm	27,750
Median	cpm	26,630
Standard Deviation	cpm	11,919
90th Percentile	cpm	39,931
95th Percentile	cpm	46,840
99th Percentile	cpm	65,268
Measurements Above Gamma BTV	#	2,669
Measurements Above Gamma BTV	%	92

Notes:
BTV Background threshold value
cpm Counts per minute

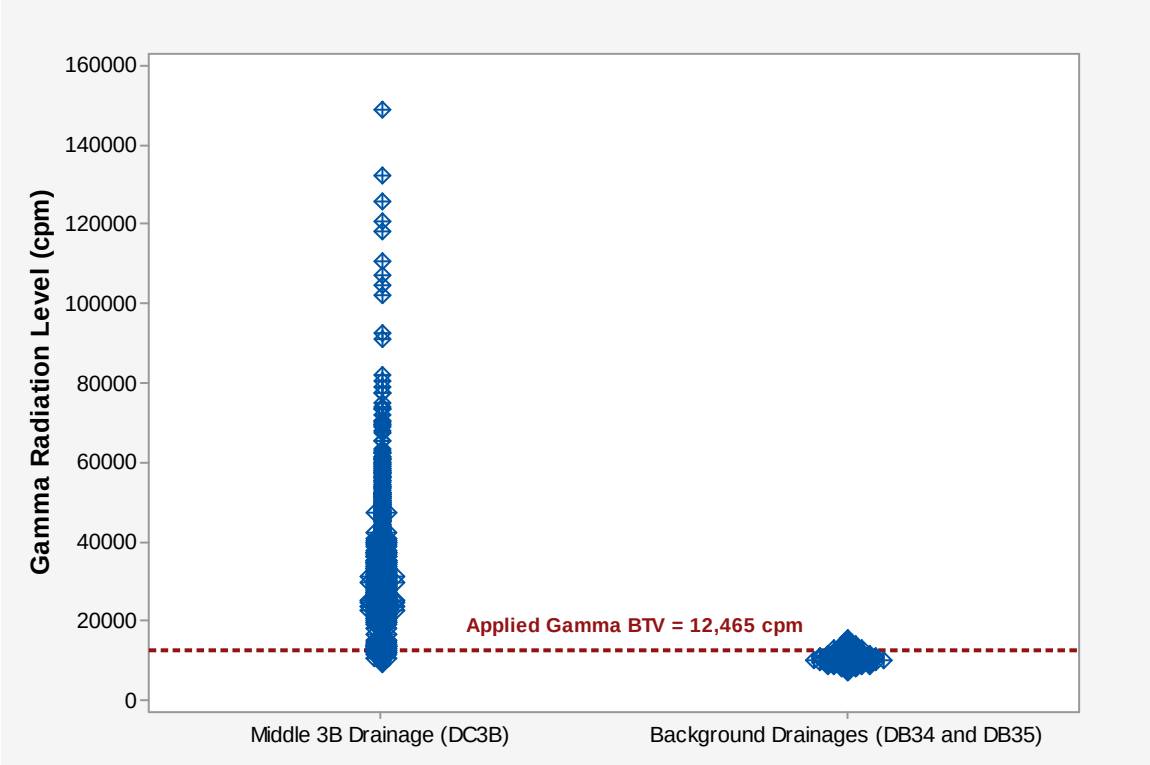


Figure J-36. Individual Value Plot of Gamma Radiation Levels within the Middle 3B Drainage and Background Drainages

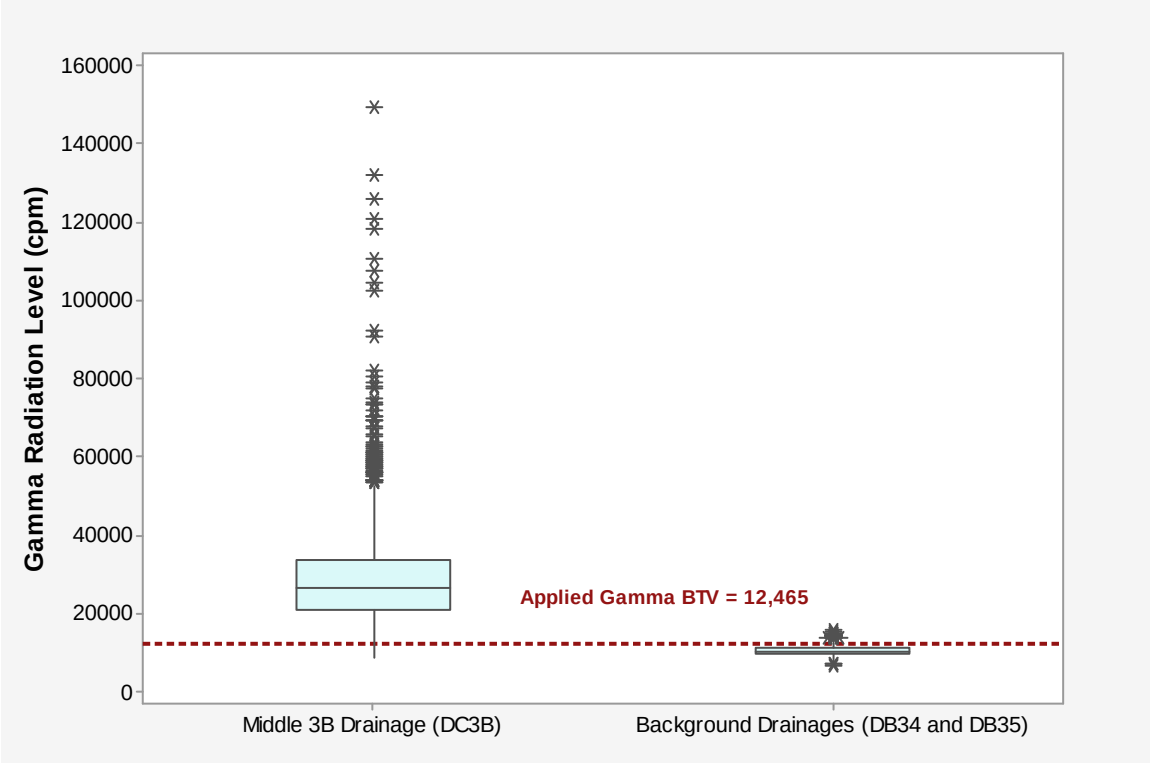


Figure J-37. Box Plot of Gamma Radiation Levels within the Middle 3B Drainage and Background Drainages

5.6.3.3 Potential Contribution from AUMs

Based on the molybdenum, radium-226, and uranium sediment sample results exceeding twice their respective BTVs, the Mesa II Complex mines appear to contribute to elevated concentrations of mine contaminants in the Middle 3B drainage. Gamma measurements support the conclusion that the Middle 3B drainage may be impacted by the upgradient mines; the maximum concentration exceeds twice the applied BTV, and the median concentration exceeds the applied BTV. Additional investigation may be warranted to further identify the lateral and vertical extents of contamination.

5.6.4 Middle 3C

Middle 3C drainage originates adjacent to Mesa I 3/4 Incline Mine, and flows into Middle 3A drainage. Six sediment samples were collected from the Middle 3C drainage in June 2018, including one judgmental sample (DC3C-SD3A) collected because of elevated gamma readings. In addition, one opportunistic sediment sample associated with Mesa I 3/4 Incline Mine survey area was collected downgradient of Waste Pile 31b where it enters the drainage in September 2018. Sediment samples were analyzed for the suite of metals and radionuclides presented in Table J-9 and Table J-10. A gamma survey was performed along an approximately 0.3 mile reach of the Middle 3C drainage on June 23, 2018. The results of sediment sampling for primary analytes and the gamma survey are described in the following subsections and presented within the Middle 3C drainage results figures in Attachment J3 (Figure DC3C-I, Figures DC3C-1 and DC3C-2).

5.6.4.1 Sediment Sampling Results

Sediment results for primary analytes collected at six locations are compared with BTVs from BSA-34 and BSA-35 and presented in Table J-42. All primary analytes exceeded their corresponding BTVs in the opportunistic sample collected at the Mesa I 3/4 Incline waste pile; the maximum concentration of all primary analytes occurred at this location.

Arsenic, molybdenum, radium-226, and uranium also exceeded the BTV in at least one sample collected within the drainage. Of this subset, only the maximum concentrations for radium-226 and uranium had results exceeding the BTV by more than two times, with radium-226 exceeding by almost four times in the most downgradient sample, and uranium exceeding by three times in the middle portion of the drainage.

Table J-42. Sediment Results for Primary Analytes in the Middle 3C Drainage

Field Sample ID	Drainage Channel ID	Sample Date	Arsenic		Lead		Molybdenum		Radium-226			Selenium		Thorium		Uranium		Vanadium	
			Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Activity (pCi/g)	TPU	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q
DC3C-SD1-01-061818	Middle 3C	6/18/2018	2.5		2.7		0.19	J	4.5	0.62	J-	0.41	J	1.2		1.3		10	
DC3C-SD2-01-061818	Middle 3C	6/18/2018	1.7		2.7		0.13	J	1.2	0.21	J-	<1.0	U	1.3		0.6		6.2	
DC3C-SD3-01-061818	Middle 3C	6/18/2018	2.5		3.3		0.24		1.5	0.25		0.50	J	1.9		1.8		9.7	
DC3C-SD3A-01-061818	Middle 3C	6/18/2018	1.7		1.9		0.12	J	0.91	0.22	J-	<0.95	U	1.3		0.5		4.9	
DC3C-SD4-01-061818	Middle 3C	6/18/2018	1.6		2.7		0.11	J	1.5	0.3		0.37	J	1.5		1.6		8.7	
DC3C-SD5-01-061818	Middle 3C	6/18/2018	2.0		2.2		0.11	J	1.4	0.25	J-	0.36	J	1.3		1.0		6.1	
M25-SD1-01-092818	Middle 3C	9/28/2018	**14**		**9.9**		**0.80**		**6.5**	0.87		**0.94**	J	**5.3**		**10**		**25**	
Number of Measurements			7		7		7		7			7		7		7		7	
Number of Detects			7		7		7		7			5		7		7		7	
Number of Nondetects			0		0		0		0			2		0		0		0	
Minimum (mg/kg)			1.6		1.9		0.11		0.91			0.36		1.2		0.48		4.9	
Maximum (mg/kg)			14.0		9.9		0.80		6.51			0.94		5.3		10.0		25	
Average (mg/kg)			3.7		3.6		0.24		2.49			0.52		2.0		2.4		10	
Median (mg/kg)			2.0		2.7		0.13		1.49			0.41		1.3		1.3		8.7	
Standard Deviation (mg/kg)			4.55		2.8		0.25		2.14			0.24		1.49		3.39		7	
90th Percentile (mg/kg)			7.1		5.9		0.46		5.30			0.76		3.3		5.1		16	
95th Percentile (mg/kg)			10.6		7.9		0.63		5.90			0.85		4.3		7.5		21	
99th Percentile (mg/kg)			13.3		9.5		0.77		6.39			0.92		5.1		9.5		24	
Relative Standard Deviation			1.23		0.77		1.03		0.86			0.47		0.75		1.41		0.68	
BTV (mg/kg)			2.4		8.0		0.19		1.2			0.80		3.5		0.58		15	
Maximum/BTV (unitless)			5.8		1.2		4.2		5.6			1.2		1.5		17		1.6	

Notes:
The maximum concentration is presented in **bold**.

<	Less than
BTV	Background threshold value
ID	Identification
J	Estimated
J-	Estimated - biased low
LT	Result less than requested minimum detectable concentration, but greater than the sample-specific detectable concentration.
mg/kg	Milligrams per kilogram
Q	Qualifier
TPU	Total propagated uncertainty
U	Not detected. The associated value is the reporting limit.
UJ	Estimated - not detected

5.6.4.2 Gamma Radiation Survey Results

In general, the radiation levels within the Middle 3C drainage exceeded the applied gamma BTV with an upper range of measurements between six and seven times applied gamma BTV for the combined BSA-34 and BSA-35 data set of 12,465 cpm. Table J-43 provides summary statistics for the gamma radiation measurements within Middle 3C. Ninety-one percent of measurements exceeded the applied gamma BTV. Figure J-38 displays gamma radiation survey data collected within the drainage compared to the background drainage gamma survey results. The spread of gamma radiation levels within the drainage encompasses the range of background gamma measurements up to a maximum gamma count rate measurement of 82,392 cpm. A box plot showing the quartiles of the data sets is provided in Figure J-39. The box plot displays the median of the drainage radiation levels above the background data set median and above applied gamma BTV.

The maximum gamma radiation level 82,392 cpm was observed approximately 1,300 feet downstream from the drainage origin near Mesa I 3/4 Incline. While much of the drainage exhibits gamma readings in the range of one to three times the applied gamma BTV, the maximum reading appears in a discrete localized area of elevated gamma measurements that are not associated with a nearby mine feature.

Table J-43. Summary of Gamma Radiation Survey Results for the Middle 3C Drainage

Summary Statistic	Units	Gamma Radiation Survey Results
Applied Gamma BTV	cpm	12,465
Measurements	#	4,159
Minimum	cpm	7,140
Maximum	cpm	82,392
Average	cpm	16,570
Median	cpm	15,581
Standard Deviation	cpm	5,475
90th Percentile	cpm	24,222
95th Percentile	cpm	27,257
99th Percentile	cpm	32,629
Measurements Above Gamma BTV	#	3,188
Measurements Above Gamma BTV	%	77

Notes:
BTV Background threshold value
cpm Counts per minute

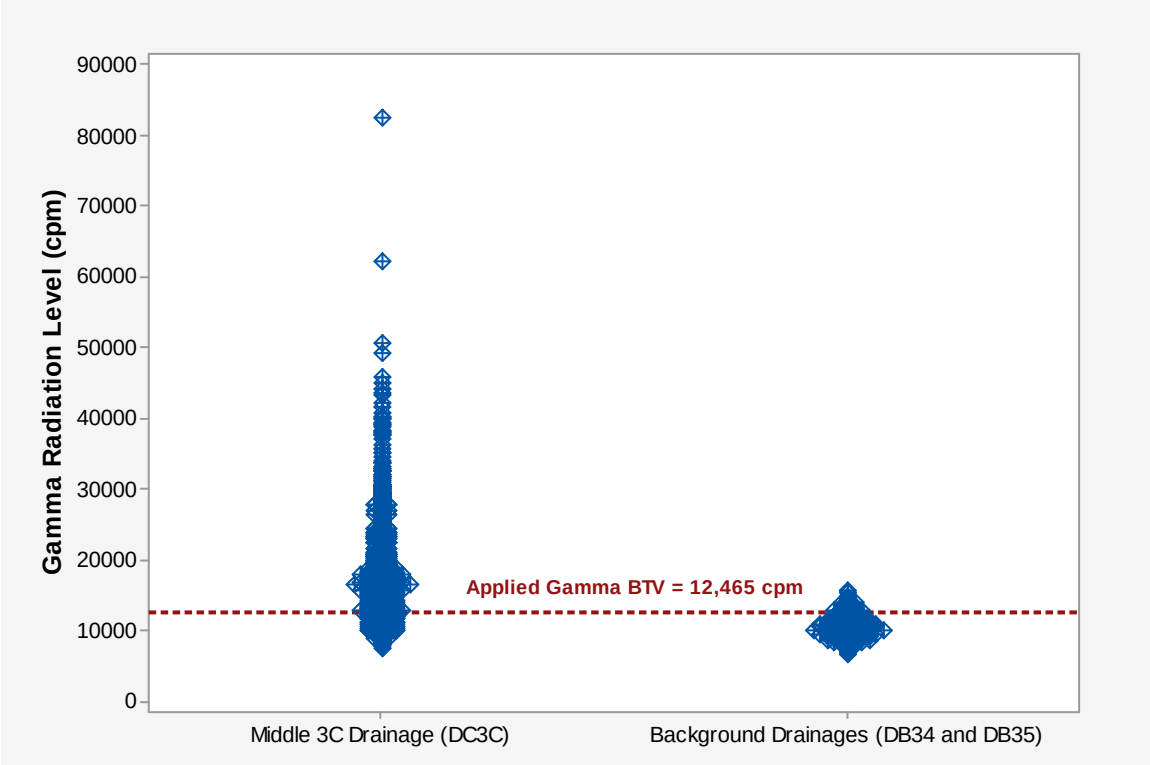


Figure J-38. Individual Value Plot of Gamma Radiation Levels within the Middle 3C Drainage and Background Drainages

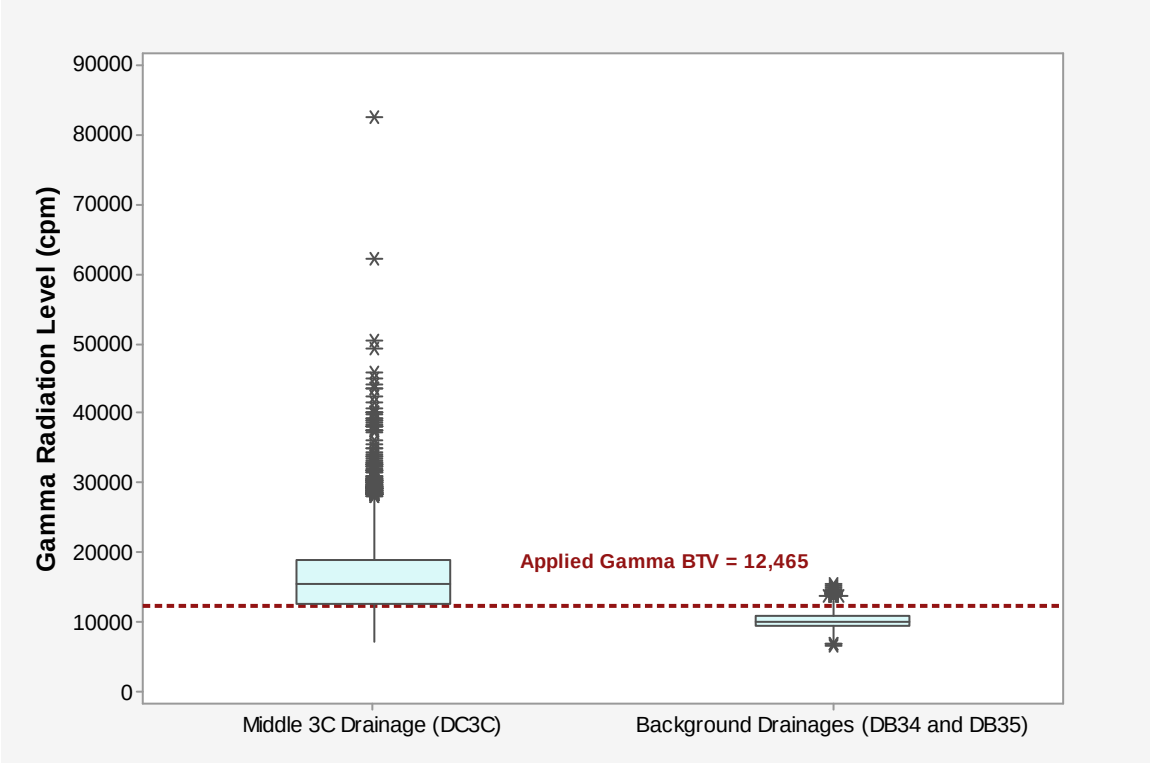


Figure J-39. Box Plot of Gamma Radiation Levels within the Middle 3C Drainage and Background Drainages

5.6.4.3 Potential Contribution from AUMs

Based on the arsenic, molybdenum, radium-226, and uranium sediment sample results exceeding twice their respective BTVs, Mesa I 3/4 Incline Mine appears to contribute to elevated concentrations of mine contaminants in the Middle 3C drainage. Gamma measurements support the conclusion that the Middle 3C drainage may be impacted by the upgradient mines; the maximum concentration exceeds twice the applied BTV, and the median concentration exceeds the applied BTV. Additional investigation may be warranted to further identify the lateral and vertical extents of contamination.

5.6.5 Middle 3D

The Middle 3D drainage originates slightly upgradient of Mesa I 1/2, West Mine. Surface water flows down a waterfall between Mesa I 1/2 West Mine and the most upgradient area surveyed. Middle 3D connects with Middle 3A at its terminus.

A total of three sediment samples were collected from the Middle 3D drainage in June 2018; one of those samples was a judgmental sample added because of the detection of elevated gamma readings. Sediment samples were analyzed for the suite of metals and radionuclides presented in Table J-9 and Table J-10. A gamma survey was performed along an approximately 500-foot reach of the Middle 3D drainage on June 19, 2018. The results of sediment sampling for primary analytes and the gamma survey are described in the following subsections and presented within the Middle 3D drainage results figures in Attachment J3 (Figure DC3D-I and Figure DC3D-1).

5.6.5.1 Sediment Sampling Results

Sediment results for primary analytes collected at three locations are compared with BTVs from BSA-34 and BSA-35 and presented in Table J-44. Results for radium-226 and uranium exceeded the BTV in the two most downgradient samples. The maximum concentrations exceeded the BTV by just over two times the BTV. None of the BTVs for the other primary analytes was exceeded in any samples.

Table J-44. Sediment Results for Primary Analytes in the Middle 3D Drainage

Field Sample ID	Drainage Channel ID	Sample Date	Arsenic		Lead		Molybdenum		Radium-226			Selenium		Thorium		Uranium		Vanadium	
			Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Activity (pCi/g)	TPU	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q
DC3D-SD1-01-061918	Middle 3D	6/19/2018	**1.7**		3.9		**0.14**	J	2.69	0.44	J-	**0.55**	J	2.4		0.6		8.7	
DC3D-SD1A-01-061918	Middle 3D	6/19/2018	1.4		**4.2**		0.07	J	**2.83**	0.45	J-	0.50	J	**2.5**		**1.2**		**13**	
DC3D-SD2-01-061918	Middle 3D	6/19/2018	0.8		2.7		0.06	J	0.76	0.21	LT	0.36	J	1.6		0.4		5.4	
Number of Measurements			3		3		3		3			3		3		3		3	
Number of Detects			3		3		3		3			3		3		3		3	
Number of Nondetects			0		0		0		0			0		0		0		0	
Minimum (mg/kg)			0.8		2.7		0.06		0.76			0.36		1.6		0.38		5.4	
Maximum (mg/kg)			1.7		4.2		0.14		2.83			0.55		2.5		1.2		13	
Average (mg/kg)			1.3		3.6		0.09		2.09			0.47		2.2		0.7		9	
Median (mg/kg)			1.4		3.9		0.07		2.69			0.50		2.4		0.6		8.7	
Standard Deviation (mg/kg)			0.46		0.8		0.04		1.16			0.10		0.49		0.42		4	
90th Percentile (mg/kg)			1.6		4.1		0.13		2.80			0.54		2.5		1.1		12	
95th Percentile (mg/kg)			1.7		4.2		0.13		2.82			0.55		2.5		1.1		13	
99th Percentile (mg/kg)			1.7		4.2		0.14		2.83			0.55		2.5		1.2		13	
Relative Standard Deviation			0.35		0.22		0.45		0.55			0.21		0.23		0.57		0.42	
BTV (mg/kg)			2.4		8.0		0.19		1.2			0.80		3.5		0.58		15	
Maximum/BTV (unitless)			0.71		0.53		0.74		2.4			0.69		0.71		2.1		0.86	

Notes:
The maximum concentration is presented in **bold**.
Shaded **red** indicates that the result exceeds the applied BTV.
BTV Background threshold value
ID Identification
J Estimated value
J- Estimated value, may be biased low.
LT Result less than requested minimum detectable concentration, but greater than the sample-specific detectable concentration.
mg/kg Milligrams per kilogram
pCi/g Picocuries per gram
Q Qualifier
TPU Total propagated uncertainty

5.6.5.2 Gamma Radiation Survey Results

A 300-foot portion of the Middle 3D drainage immediately downgradient of the Mesa I 1/2 West Mine was inaccessible due the presence of a cliff (waterfall) within the drainage. Gamma radiation levels within the drainage encompassed the range of the combined BSA-34 and BSA-35 background data set up to a maximum gamma measurement of 33,742 cpm. Table J-45 provides summary statistics for the gamma radiation measurements within the drainage. Fifty-one percent of the gamma measurements exceeded the applied gamma BTV. Figure J-40 displays gamma radiation survey data collected within the drainage compared to the background drainage gamma survey results. A box plot showing the quartiles of the data sets is provided in Figure J-41. The box plot displays the median of the drainage radiation levels above the background data set median and above applied gamma BTV.

Table J-45. Summary of Gamma Radiation Survey Results for the Middle 3D Drainage

Summary Statistic	Units	Gamma Radiation Survey Results
Applied Gamma BTV	cpm	12,465
Measurements	#	447
Minimum	cpm	8,392
Maximum	cpm	33,742
Average	cpm	16,402
Median	cpm	12,706
Standard Deviation	cpm	7,139
90th Percentile	cpm	28,228
95th Percentile	cpm	30,733
99th Percentile	cpm	33,116
Measurements Above Gamma BTV	#	230
Measurements Above Gamma BTV	%	51

Notes:
BTV Background threshold value
cpm Counts per minute

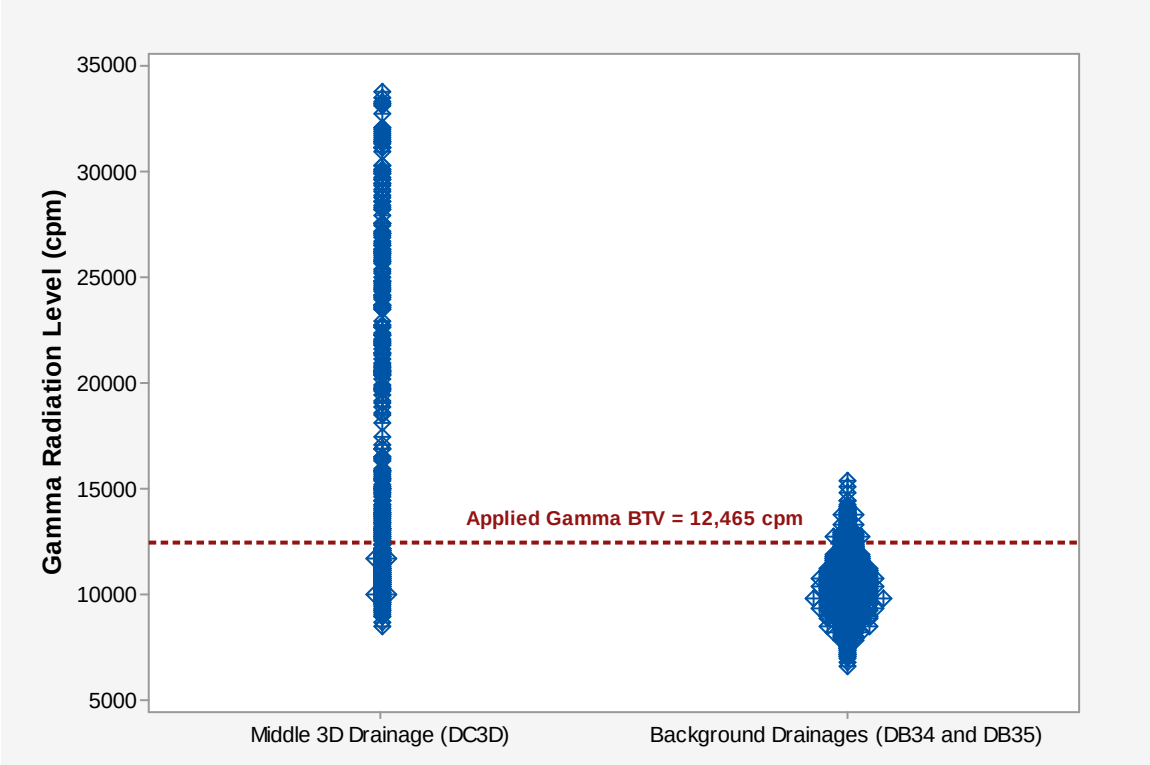


Figure J-40. Individual Value Plot of Gamma Radiation Levels within the Middle 3D Drainage and Background Drainages

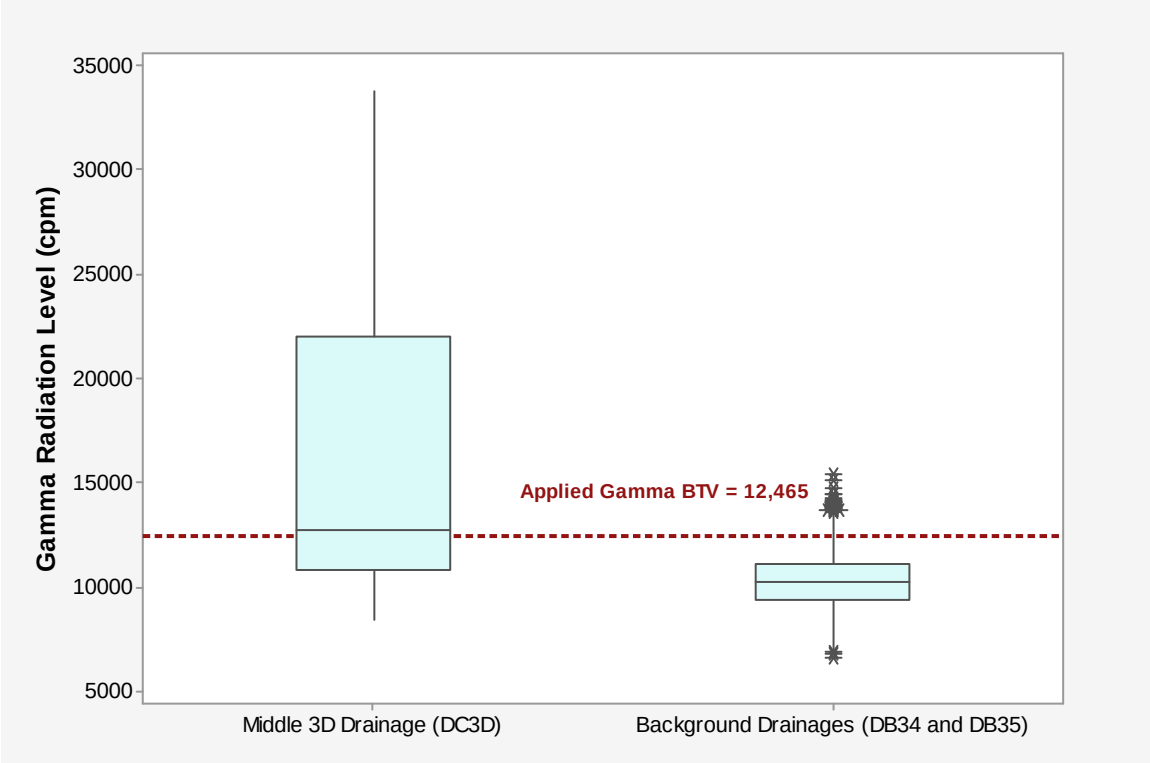


Figure J-41. Box Plot of Gamma Radiation Levels within the Middle 3D Drainage and Background Drainages

5.6.5.3 Potential Contribution from AUMs

Based on the radium-226 and uranium sample results slightly exceeding twice their respective BTVs, Mesa I 1/2 West Mine appears to contribute to elevated concentrations of radium-226 and uranium in the Middle 3D drainage. Gamma measurements support the conclusion that the Middle 3D drainage may be impacted by the upgradient mines; the maximum concentration exceeds twice the applied BTV, and the median concentration exceeds the applied BTV. Additional investigation may be warranted to further identify the lateral and vertical extents of contamination.

5.6.6 Middle 3E

Middle 3E originates at Mesa I 1/4 Mine at the far southeast portion of the RSE sampling investigation area. Mesa I 1/2 Mine is located to the west of the drainage approximately halfway down the length of the drainage. Mesa I Mine 14 and Mesa I Mine 12 are located on the eastern side of the drainage just above the confluence with Middle 3A tributary. In addition, Target T35 (M1-05) is located within the downgradient portion of the Middle 3E drainage just below local drainages from Mesa I Mine 14 and is not associated with any particular physical feature, and Target 36 (M1-06) is co-located with a waste pile downhill of Mesa I Mine 14. Target T16 (M1-04) is located within the Middle 3E drainage just below Waste Pile M5 associated with Mesa I Mine 12. Middle 3E connects with Middle 3A immediately downgradient of Waste Pile M5, where the drainage becomes Middle 3.

A total of 20 sediment samples were collected from the Middle 3E drainage in June and August 2018; one of those samples was a judgmental sample added at the location of a waterfall; a sample was collected at that location on two dates. In addition, opportunistic sediment samples associated with Mesa I Mine 12 (1 sample), Mesa I Mine 14 (3 samples), and Mesa I 1/2 Mine (2 samples) were collected downgradient of waste piles entering the drainages. Sediment samples were analyzed for the suite of metals and radionuclides presented in Table J-9 and Table J-10. A gamma survey was performed along an approximately 0.8-mile reach of the Middle 3E drainage on June 23 and August 17, 2018. The results of sediment sampling for primary analytes and the gamma survey are described in the following subsections and presented within the Middle 3E drainage results figures in Attachment J3 (Figure DC3E-I, Figures DC3E-1 through DC3E-4).

Surface water samples were also collected from Middle 3 drainage; results are presented in Section 5.10.

5.6.6.1 Sediment Sampling Results

Sediment results for primary analytes collected at 20 locations are compared with BTVs from BSA-34 and BSA-35 and presented in Table J-46. Of the samples collected directly in the drainage, molybdenum, radium-226, selenium, and uranium exceeded the BTV. The majority of exceedances were in the downgradient samples (locations DC3E-SD1 through DC3E-SD8), downgradient of Mesa I 1/2 Mine, Mesa I Mine 14, and Mesa I Mine 12.

Radium-226 concentrations exceed the BTV downstream from Waste Pile M10A and M10B associated with Mesa I 1/2 Mine. The opportunistic sediment sample collected within Waste Pile M10B exhibited the highest concentration of molybdenum of the entire sample set for Middle 3E, and the second highest concentration of radium-226, which exceeded the BTV by 48 times. Both samples collected below the M10 Mine waste piles had elevated concentrations of radium-226, selenium, uranium, and vanadium – the concentrations of radium-226, uranium, and vanadium were 24, 80, and 8 times the BTVs, respectively.

The BTVs for radium-226, uranium, and vanadium collected within the northern field-mapped drainage below Mesa I Mine 14 were exceeded; maximum concentrations exceeded the BTV by three, five, and two times, respectively. The results for the sample collected within the southern field-mapped drainage below Mesa I Mine 14 did not exceed BTVs. The third opportunistic sample associated with Mesa I Mine 14 was collected below a drainage originating from the northern part of the mine. The location is also just downgradient of Target T36 (M1-06). Results in this sample exceeded BTVs by less than two times for molybdenum and selenium, 24 times for radium-226, 30 times for uranium, and 4 times for vanadium.

Location DC3E-SD3 is within Target T35 (M1-05). Results in this sample exceeded BTVs by 3 times for radium-226, 6 times for uranium, and less than 2 times for vanadium; all other primary analytes exhibited results below corresponding BTVs.

The opportunistic sediment sample collected below Waste Pile M5 associated with Mesa I Mine 12, and within Target T16 (M1-04) exhibited the highest concentration of radium-226, selenium, uranium, and vanadium, with concentrations 56, 9, 174, and 24 times greater than the BTVs, respectively. The detected concentration of uranium was the second highest concentration detected in all of the drainage investigation (exhibiting the same concentration as the sample collected within a drainage flowing through a waste pile at Mesa III Mine in Middle 2B drainage). Gamma readings in this area also indicate that the upgradient waste pile, sediments within this area of the drainage, and sediments downgradient are heavily impacted by Waste Pile M5.

Table J-46. Sediment Results for Primary Analytes in the Middle 3E Drainage

Field Sample ID	Drainage Channel ID	Sample Date	Arsenic		Lead		Molybdenum		Radium-226			Selenium		Thorium		Uranium		Vanadium	
			Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Activity (pCi/g)	TPU	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q
DC3E-SD1-01-062318	Middle 3E	6/23/2018	1.5		3.3		0.15	J	3.1	0.48		0.41	J	1.7		3.2		19	
DC3E-SD1-01-082118	Middle 3E	8/21/2018	2.3		3.8		0.44		7.7	1	J-	0.43	J	1.5		3.5		40	
DC3E-SD2-01-062318	Middle 3E	6/23/2018	1.7		4.0		0.13	J	5.4	0.74		0.66	J	2.3		11		32	
DC3E-SD3-01-062318	Middle 3E*	6/23/2018	1.4		3.6		0.11	J	3.5	0.55		0.75	J	1.9		3.2		19	
DC3E-SD4-01-062318	Middle 3E	6/23/2018	1.8		3.3		0.14	J	6.6	0.87		0.49	J	1.6		11		33	
M7-SD1-01-062318	Middle 3E*	6/23/2018	2.1		5.2		0.25		27.4	3.3	J-	1.00		2.0		17		54	
DC3E-SD5-01-062318	Middle 3E	6/23/2018	0.9		2.4		0.10	J	1.6	0.29		<1.3	U	1.5		2.1		12	
DC3E-SD5A-01-062318	Middle 3E	6/23/2018	1.4		3.8		0.12	J	2.9	0.45		0.56	J	2.1		2.9		33	
DC3E-SD5A-01-082118	Middle 3E	8/21/2018	0.8		2.0		0.07	J	0.7	0.22	LT	<1.1	U	1.2		0.5		6.6	
M7-SD2-01-081418	Middle 3E	8/14/2018	0.8		1.5		0.06	J	<0.36	0.2	U	<0.92	U	1.0		0.3		2.1	
M7-SD3-01-081418	Middle 3E	8/14/2018	1.2		3.7		0.09	J	3.2	0.5		<0.97	U	1.8		3.1		31	
DC3E-SD6-01-081718	Middle 3E	8/17/2018	1.4		5.5		0.13	J	13.5	1.7		0.67	J	2.3		7.3		32	
M10-SD2-01-081718	Middle 3E	8/17/2018	1.5		5.1		0.17	J	27.7	3.3		0.91	J	1.9		49		120	
DC3E-SD7-01-081718	Middle 3E	8/17/2018	1.3		3.2		0.23	J	9.2	1.2		0.43	J	1.6		11		29	
DC3E-SD8-01-081718	Middle 3E	8/17/2018	0.9		2.2		0.07	J	2.5	0.39		<1.2	U	1.4	J+	1.4	J	14	J
M10-SD1-01-081718	Middle 3E	8/17/2018	2.0		5.4		**0.67**		55.4	6.6		3.80		2.0		47		160	
DC3E-SD9-01-081718	Middle 3E	8/17/2018	1.4		3.2		0.12	J	0.6	0.21	LT	0.44	J	2.3		0.6		7.8	
DC3E-SD10-01-081718	Middle 3E	8/17/2018	0.9		2.2		0.07	J	<0.32	0.19	UJ	<1.2	U	1.5		0.4		5.8	
DC3E-SD10-01-093018	Middle 3E	9/30/2018	1.5		2.4		0.12	J	0.5	0.2	LT	0.36	J	1.5		0.3		7.8	
DC3E-SD11-01-081718	Middle 3E	8/17/2018	1.2		3.5		0.07	J	0.8	0.2	LT	0.55	J	1.9		0.8		8.5	
DC3E-SD12-01-081718	Middle 3E	8/17/2018	1.2		2.5		0.11	J	0.6	0.17	LT	<1.1	U	2.1		0.3		6.2	
DC3E-SD13-01-081718	Middle 3E	8/17/2018	0.9		2.3		0.08	J	<0.52	0.26	U	<1.2	U	1.6		0.5		6.6	
DC3E-SD14-01-081718	Middle 3E	8/17/2018	0.6		2.4		0.06	J	0.5	0.18	LT	<1	U	1.4		0.4		7.2	
DC3E-SD14-01-093018	Middle 3E	9/30/2018	1.1		1.7		0.09	J	0.5	0.15	LT	0.33	J	1.3		0.5		6.6	
DC3E-SD15-01-081718	Middle 3E	8/17/2018	1.6		3.0		0.11	J	0.5	0.21	LT	0.50	J	**3.4**		0.5		11	
M5-SD1-01-062318	Middle 3E*	6/23/2018	**2.8**		**7.7**		0.39		**64.4**	7.6		**7.00**		1.8		**100**		**360**	
Number of Measurements			26		26		26		26			26		26		26		26	
Number of Detects			26		26		26		23			17		26		26		26	
Number of Nondetects			0		0		0		3			9		0		0		0	
Minimum (mg/kg)			0.6		1.5		0.06		0.50			0.33		1.0		0.27		2.1	
Maximum (mg/kg)			2.8		7.7		0.67		64.4			7.00		3.4		100		360	
Average (mg/kg)			1.4		3.4		0.16		10.39			1.13		1.8		10.7		41	
Median (mg/kg)			1.4		3.3		0.12		3.11			0.55		1.8		2.5		16.5	
Standard Deviation (mg/kg)			0.51		1.4		0.14		17.45			1.71		0.48		22.3		74	
90th Percentile (mg/kg)			2.1		5.3		0.32		27.64			2.12		2.3		32.0		87	
95th Percentile (mg/kg)			2.3		5.5		0.43		52.63			4.44		2.3		48.5		150	
99th Percentile (mg/kg)			2.7		7.2		0.61		62.4			6.49		3.1		87.3		310	
Relative Standard Deviation			0.36		0.42		0.88		1.68			1.51		0.27		2.09		1.82	
BTV (mg/kg)			2.4		8.0		0.19		1.2			0.80		3.5		0.58		15	
Maximum/BTV (unitless)			1.2		1.0		3.5		56			8.8		1.0		174		24	

Table J-46. Sediment Results for Primary Analytes in the Middle 3E Drainage

Notes:
The maximum concentration is presented in **bold**.
Shaded **red** indicates that the result exceeds the applied BTV.

*	
<	The analyte was analyzed for, but was not detected. The reporting limit is shown in the result column.
BTV	Background threshold value
ID	Identification
J	Estimated value
J-	Estimated value, may be biased low.
J+	Estimated value, may be biased high.
LT	Result less than requested minimum detectable concentration, but greater than the sample-specific detectable concentration.
M3	The requested minimum detected concentration was not met, but the reported activity is greater than the reported minimum
mg/kg	Milligrams per kilogram
pCi/g	Picocuries per gram
Q	Qualifier
TPU	Total propagated uncertainty
U	Not detected. The associated value is the reporting limit.
UJ	Not considered detected. The associated value is the reported concentration, which is estimated.

5.6.6.2 Gamma Radiation Survey Results

In general, the radiation levels within the Middle 3E drainage exceeded the applied gamma BTV with the upper range of measurements between seven and eight times the applied gamma BTV for the combined BSA-34 and BSA-35 data set of 12,465 cpm. Table J-47 provides summary statistics for the gamma radiation measurements within Middle 3E. Forty-seven percent of the gamma measurements exceeded the applied gamma BTV. Figure J-42 displays gamma radiation survey data collected within the drainage compared to the background drainage gamma survey results. The spread of gamma radiation levels within the drainage encompasses the range of background gamma measurements up to a maximum gamma count rate measurement of 90,858 cpm, a measurement greater than seven times the applied gamma BTV. A box plot showing the quartiles of the data sets is provided in Figure J-43. The box plot displays the median of the drainage radiation levels above the background data set median and above applied gamma BTV. Waste Pile M9, which is located at the upstream end of the Middle 3E drainage, exhibits gamma count rate measurements in excess of 40,000 cpm and likely contributes sediments to the Middle 3E drainage. Additionally, elevated gamma measurements occur directly below Waste Pile 10A and Waste Pile M5, both of which lie in direct contact with the Middle 3E drainage.

At some locations, the canyon walls obscured the GPS signal; portions of the gamma survey conducted in Middle 3E are not displayed because of the loss of GPS coverage.

Table J-47. Summary of Gamma Radiation Survey Results for the Middle 3E Drainage

Summary Statistic	Units	Gamma Radiation Survey Results
Applied Gamma BTV	cpm	12,465
Measurements	#	4,246
Minimum	cpm	8,602
Maximum	cpm	90,858
Average	cpm	14,275
Median	cpm	12,210
Standard Deviation	cpm	6,083
90th Percentile	cpm	19,832
95th Percentile	cpm	24,274
99th Percentile	cpm	42,272
Measurements Above Gamma BTV	#	1,979
Measurements Above Gamma BTV	%	47

Notes:
BTV Background threshold value
cpm Counts per minute

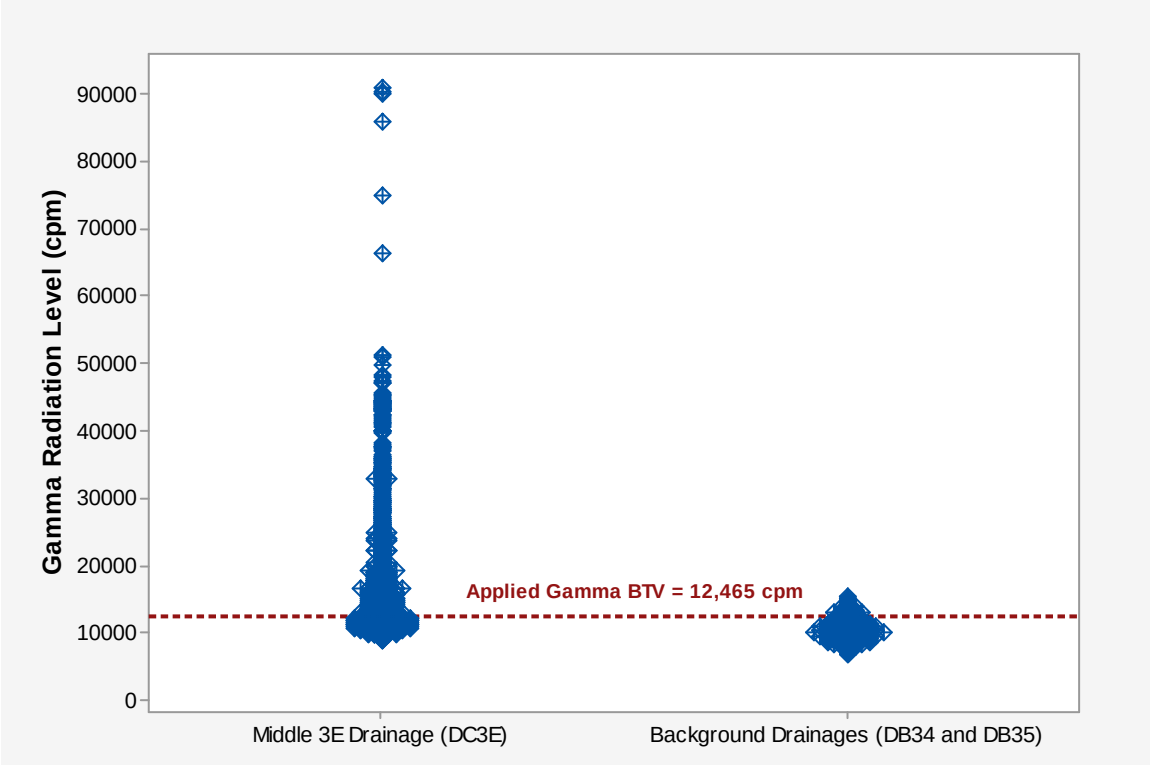


Figure J-42. Individual Value Plot of Gamma Radiation Levels within the Middle 3E Drainage and Background Drainages

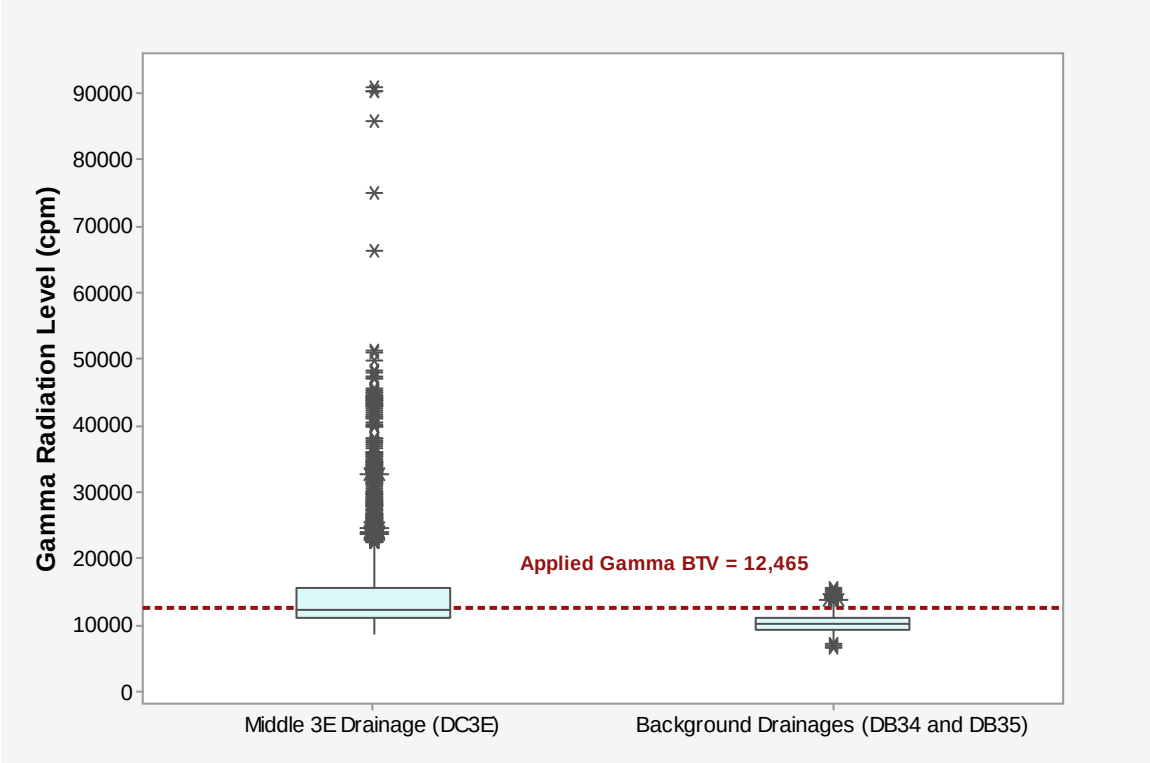


Figure J-43. Box Plot of Gamma Radiation Levels within the Middle 3E Drainage and Background Drainages

5.6.6.3 Potential Contribution from AUMs and Targets

Based on the molybdenum, radium-226, selenium, uranium, and vanadium sediment sample results exceeding twice their respective BTVs, the waste piles associated with Mesa I Mine 12, Mesa I Mine 14, and Mesa I 1/2 Mine appear to be contributing contaminated soil to the drainages, with the highest contribution coming from Mesa I Mine 12. Mesa I 1/4 Mine does not appear to contribute to elevated concentrations in the upper portion of the Middle 3E drainage, according to the patterns of detected contaminant concentrations in the upgradient portion of the drainage. The median gamma measurement is lower than the applied BTV, however, the maximum concentration, detected in the Mesa I Mine 12 waste pile, greatly exceeds the applied gamma BTV.

Targets T16 (M1-04), T35 (M1-05), and T36 (M1-06) are located along the Middle 3E drainage. Target T16 (M1-04) is located within the Middle 3E drainage just below Waste Pile M5 associated with Mesa I Mine 12. Target T35 (M1-05) is located in the drainage just below local drainages from Mesa I Mine 14, though not associated with any physical feature. Target 36 (M1-06) is co-located with a waste pile downhill of Mesa I Mine 14. Opportunistic samples were collected within or downgradient of each Target. Sediment sample results for all three samples exceeded twice the applied BTV for radium-26 and uranium at all three locations, and selenium and vanadium at a subset of the locations.

Within Target T16 (M1-04), the detected concentration of uranium was the second highest concentration detected in all of the drainage investigation (exhibiting the same concentration as the sample collected within a drainage flowing through a waste pile at Mesa III Mine in Middle 2B drainage). Gamma measurements around the Target also indicate that the upgradient waste pile, sediments within this area of the drainage, and sediments downgradient in the Middle 3 drainage are heavily impacted by Waste Pile M5 in Mesa I Mine 12. Target T16 (M1-04) was determined to be Waste Pile M5, which is considered to be TENORM with primary analytes and gamma activity exceeding BTVs, and will be addressed in the EE/CA.

Gamma measurements were not collected within the drainage at the locations of Target 35 (M1-05) or Target 36 (M1-06) because of poor GPS signal, but measurements along the sides of the drainage, and within a drainage leading from Mesa I Mine 14 indicate exceedances of twice the applied gamma BTV. Target T36 (M1-06) was determined to be a waste pile associated with Mesa I Mine 14, and is considered to be TENORM with primary analytes and gamma activity exceeding BTVs, and will be addressed in the EE/CA. Due to topographic position downslope of Mesa I Mine 14 ephemeral drainages, Target T35 (M1-05) has likely received eroding mine waste. Sediment sample results indicate that primary analytes and gamma activity exceed BTVs; therefore, Target T35 will be addressed in the EE/CA.

The upgradient portion of Middle 3E drainage is similar to background concentrations; however, the drainage below Mesa 1/2 Mine appears to be impacted by Tronox mines. Additional investigation may be warranted to further identify the lateral and vertical extents of contamination of mine contaminants and radiation in the portion of the Middle 3E drainage downgradient of Mesa I 1/2 Mine.

5.6.7 Middle 3F

The Middle 3F drainage originates slightly upgradient of Mesa I Mine 13, and flows directly through a large waste pile at that site. The drainage is below the east side of the Mesa I Mine Complex. Mesa I Mine 10 is located west of the most upgradient sampling point, and Mesa I Mine 15 is west of the drainage further downgradient. Middle 3F connects with Middle 3G at its terminus.

A total of 11 sediment samples were collected from the Middle 3F drainage in June 2018, including one judgmental sample collected because of elevated gamma readings. In addition, three opportunistic sediment samples associated with Mesa I Mine 13 were collected within the Middle 3E drainage flowing through the middle of the site boundary in September 2018. Sediment samples were analyzed for the suite of metals and radionuclides presented in Table J-9 and Table J-10. A gamma survey was performed along an approximately 0.6-mile reach of the Middle 3F drainage on June 23, 2018. The results of sediment sampling for primary analytes and the gamma survey are described in the following subsections and presented within the Middle 3F drainage results figures in Attachment J3 (Figure DC3F-I, Figures DC3F-1 through DC3F-4).

5.6.7.1 Sediment Sampling Results

Sediment results for primary analytes collected at 11 locations are compared with BTVs from BSA-34 and BSA-35 and presented in Table J-48. Results from all samples exceeded the BTV for radium-226 and uranium, and all but one result exceeded vanadium BTV. Arsenic, molybdenum, selenium, and thorium exceeded the BTV in either one or two samples directly associated with the drainage in the upgradient portion of the wash.

Concentrations of radium-226, selenium, uranium, and vanadium steadily increase in the sediment samples collected from upgradient to downgradient within Mesa I Mine 13, with the maximum concentrations exceeding their corresponding BTVs by 13, 2, 17, and 8 times. Most of the results for the Mesa I Mine 13 samples exceeded the BTV for the primary analytes (except thorium), which likely indicates that Mesa I Mine 13 contributes to elevated concentrations of contaminants in the drainage. The maximum concentrations of arsenic, radium-226, selenium, and vanadium were exhibited in sample M6-SD1, collected at the downgradient portion of the site boundary.

Sample results immediately downgradient of Waste Pile M8 associated with Mesa I Mine 15 (DC3F-SD7, DC3F-SD8, DCSF-SD-8A) exhibit elevated results for many primary analytes, particularly radium-226, uranium, and vanadium, which exceeded the BTVs by 5, 38, and 4 times, respectively. The furthest downgradient samples also exhibit elevated concentrations of the same three mine contaminants, and gamma readings in this area are also 3 to 10 times above BTVs.

Table J-48. Sediment Results for Primary Analytes in the Middle 3F Drainage

Field Sample ID	Drainage Channel ID	Sample Date	Arsenic		Lead		Molybdenum		Radium-226			Selenium		Thorium		Uranium		Vanadium	
			Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Activity (pCi/g)	TPU	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q
DC3F-SD1-01-062318	Middle 3F	6/23/2018	1.7		3.3		0.11	J	4.12	0.53	J-	0.60	J	2.1		3.2		72	
DC3F-SD2-01-062318	Middle 3F	6/23/2018	1.2		3.1		0.08	J	5.81	0.73		0.44	J	1.8		3.2		22	
DC3F-SD3-01-062318	Middle 3F	6/23/2018	2.2		3.2		0.12	J	3.38	0.52		0.59	J	1.7		2.7		17	
DC3F-SD4-01-062318	Middle 3F	6/23/2018	1.2		2.9		0.09	J	2.41	0.39		0.48	J	1.6		2.2		20	
DC3F-SD5-01-062318	Middle 3F	6/23/2018	1.2		2.9		0.09	J	2.54	0.43		0.44	J	1.4		4.7		21	
DC3F-SD6-01-062318	Middle 3F	6/23/2018	1.1		2.4		0.06	J	2.65	0.46		0.32	J	1.3		6.1		21	
DC3F-SD7-01-062318	Middle 3F	6/23/2018	**7.1**	J	3.5		**0.43**		6.01	0.79		0.37	J	1.9		4.0		31	
DC3F-SD8-01-062318	Middle 3F	6/23/2018	1.6		3.4		0.11	J	11.5	1.5		1.90		1.9		**22**		57	
DC3F-SD8A-01-062318	Middle 3F	6/23/2018	2.2		5.0		0.15	J	6.59	0.84	J-	0.77	J	**4.3**		12		80	
DC3F-SD9-01-062318	Middle 3F	6/23/2018	1.3		3.2		0.11	J	3.31	0.51		0.37	J	1.8	J	3.2	J	23	J
DC3F-SD10-01-062318	Middle 3F	6/23/2018	1.3		3.2		0.10	J	2.24	0.39		0.52	J	1.7		3.2		21	
M6-SD1-01-091618	Middle 3F	9/16/2018	2.9		**8.4**		0.20		**15.5**	2		**2.00**		3.1		**22**		**120**	
M6-SD2-01-091618	Middle 3F	9/16/2018	3.7		6.2		0.16	J	5.78	0.81		1.60		3.4		9.8		50	
M6-SD3-01-091618	Middle 3F	9/16/2018	7.0		7.1		**0.43**		2.57	0.43		1.30		3.5		3.0		10.0	
Number of Measurements			14		14		14		14			14		14		14		14	
Number of Detects			14		14		14		14			14		14		14		14	
Number of Nondetects			0		0		0		0			0		0		0		0	
Minimum (mg/kg)			1.1		2.4		0.06		2.24			0.32		1.3		2.20		10.0	
Maximum (mg/kg)			7.1		8.4		0.43		15.5			2.00		4.3		22.0		120	
Average (mg/kg)			2.6		4.1		0.16		5.32			0.84		2.3		7.2		40	
Median (mg/kg)			1.7		3.3		0.11		3.75			0.56		1.9		3.6		22.5	
Standard Deviation (mg/kg)			2.05		1.8		0.12		3.86			0.60		0.93		6.9		32	
90th Percentile (mg/kg)			6.0		6.8		0.36		10.03			1.81		3.5		19.0		78	
95th Percentile (mg/kg)			7.0		7.6		0.43		12.90			1.94		3.8		22.0		94	
99th Percentile (mg/kg)			7.1		8.2		0.43		15.0			1.99		4.2		22.0		115	
Relative Standard Deviation			0.80		0.44		0.75		0.73			0.72		0.41		0.95		0.78	
BTV (mg/kg)			2.4		8.0		0.19		1.2			0.80		3.5		0.58		15	
Maximum/BTV (unitless)			3.0		1.1		2.3		13			2.5		1.2		38		8	

Notes:
The maximum concentration is presented in **bold**.
Shaded **red** indicates that the result exceeds the applied BTV.

BTV	Background threshold value
ID	Identification
J	Estimated value
J-	Estimated value, may be biased low.
mg/kg	Milligrams per kilogram
pCi/g	Picocuries per gram
Q	Qualifier
TPU	Total propagated uncertainty

5.6.7.2 Gamma Radiation Survey Results

In general, the radiation levels within the Middle 3F drainage exceed the applied gamma BTV with an upper range of measurements greater than 10 times the applied gamma BTV for the combined BSA-34 and BSA-35 data set of 12,465 cpm. Table J-49 provides summary statistics for the gamma radiation measurements within the drainage. Ninety-one percent of measurements exceeded the applied gamma BTV. Figure J-44 displays gamma radiation survey data collected within the drainage compared to the background drainage gamma survey results. The spread of gamma radiation levels within the drainage encompasses the range of background gamma measurements up to a maximum gamma count rate measurement of 999,960 cpm. A box plot showing the quartiles of the data sets is provided in Figure J-45. The box plot displays the median of the drainage radiation levels above the background data set median and above applied gamma BTV.

Much of the drainage measures two to three times the applied gamma BTV, with localized areas of gamma measurements exhibiting measurements of three to four times the BTV drainage. The maximum gamma radiation level of 999,960 cpm was observed adjacent to and immediately downgradient of Waste Pile M8 (Mesa I Mine 15).

Table J-49. Summary of Gamma Radiation Survey Results for the Middle 3F Drainage

Summary Statistic	Units	Gamma Radiation Survey Results
Applied Gamma BTV	cpm	12,465
Measurements	#	9,461
Minimum	cpm	7,798
Maximum	cpm	999,960
Average	cpm	34,490
Median	cpm	22,466
Standard Deviation	cpm	50,597
90th Percentile	cpm	49,458
95th Percentile	cpm	122,701
99th Percentile	cpm	243,014
Measurements Above Gamma BTV	#	8,634
Measurements Above Gamma BTV	%	91

Notes:
BTV Background threshold value
cpm Counts per minute

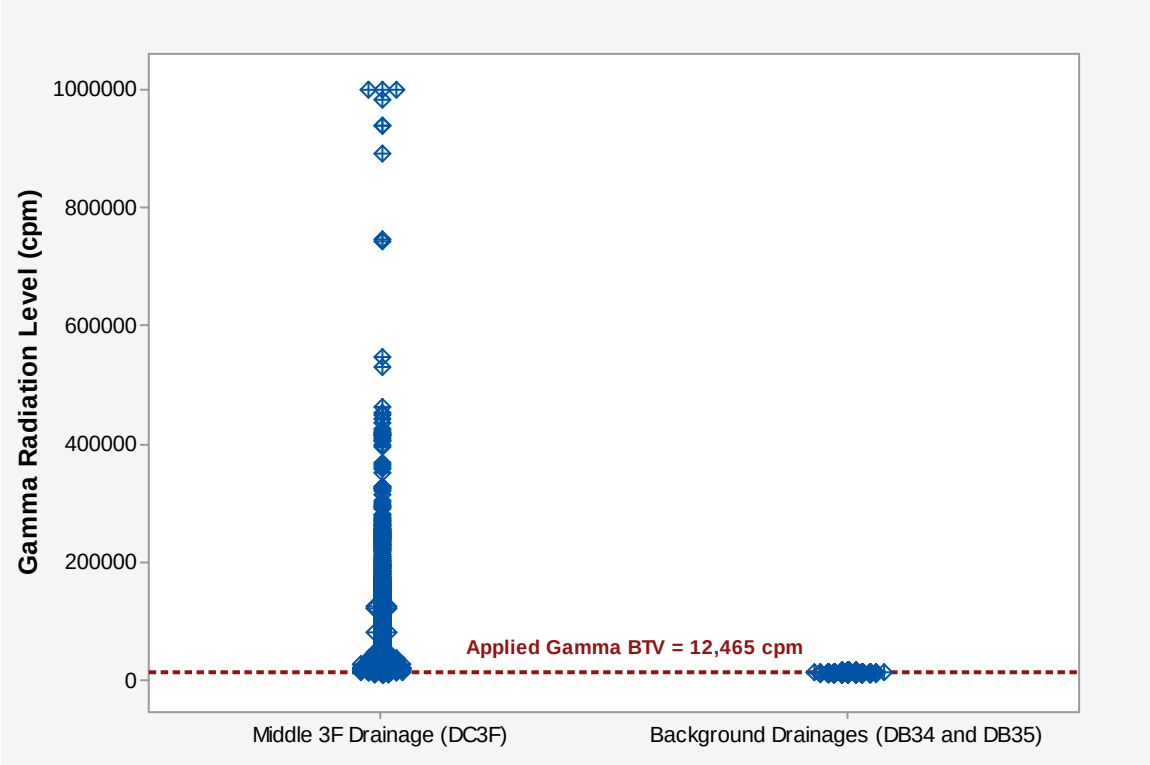


Figure J-44. Individual Value Plot of Gamma Radiation Levels within the Middle 3F Drainage and Background Drainages

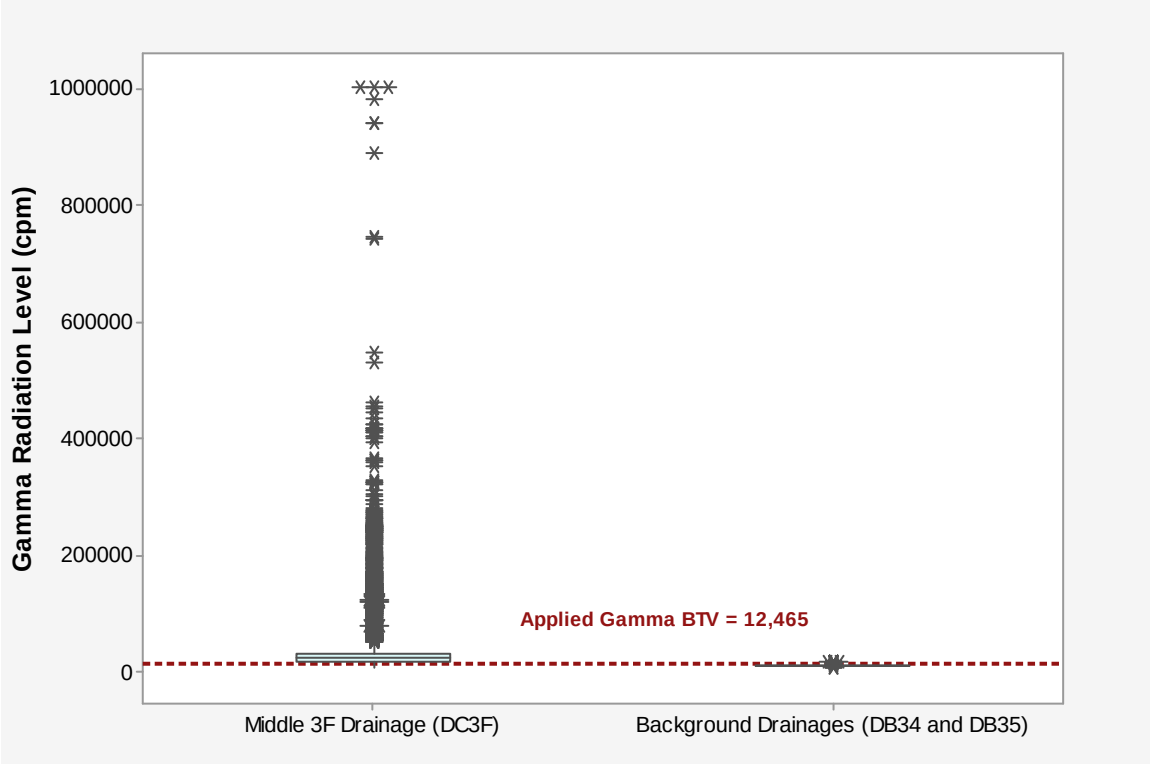


Figure J-45. Box Plot of Gamma Radiation Levels within the Middle 3F Drainage and Background Drainages

5.6.7.3 Potential Contribution from AUMs

Based on the arsenic, molybdenum, radium-226, selenium, uranium, and vanadium sediment sample results exceeding twice their respective BTVs, Mesa I Mine 13, Mesa I Mine 10, and Mesa I Mine 15 appear to be contributing contaminated soil to the Middle 3F drainage, with the highest contribution coming from the Mesa I Mine 13 Waste Pile M6, which is located directly in the drainage. Gamma measurements support the conclusion that the Middle 3F drainage may be impacted by the upgradient mines; the maximum concentration greatly exceeds twice the applied BTV, and the median concentration exceeds the applied BTV. The gamma count rate in this drainage is the highest recorded gamma count rate (999,960 cpm), observed adjacent to and immediately downgradient of Waste Pile M8 associated with Mesa I Mine 15. Additional investigation may be warranted to further identify the lateral and vertical extents of contamination.

5.6.8 Middle 3G

The Middle 3G drainage is the easternmost drainage evaluated during the RSE investigation. The only known upgradient mines are those upgradient of Middle 3F, which merges with Middle 3G halfway down the length of the drainage. There are no known Tronox or non-Tronox mines located upgradient of the confluence with Middle 3F, and also no known additional mines contributing directly to the portion downgradient of the confluence with Middle 3F. BSA-35 is located upgradient of the sampled portion of Middle 3G drainage. Middle 3G connects with Middle 3 at its terminus.

A total of six sediment samples were collected from the Middle 3G drainage in June 2018 and analyzed for the suite of metals and radionuclides presented in Table J-9 and Table J-10. A gamma survey was performed along an approximately 0.6-mile reach of the Middle 3G drainage on June 23, 2018. The results of sediment sampling for primary analytes and the gamma survey are described in the following subsections and presented within the Middle 3G drainage results figures in Attachment J3 (Figure DC3G-I, Figures DC3G-1 through DC3G-3). Although there are no sediment samples in the far upgradient portion of the drainage, the figures present available gamma results up to and beyond the upgradient background areas BSA-35.

5.6.8.1 Sediment Sampling Results

Sediment results for primary analytes collected at six locations are compared with BTVs from BSA-34 and BSA-35 and presented in Table J-50. Results for radium-226 exceeded the BTV in four of the six samples, and uranium exceeded the BTV in two samples. None of the results exceeded by more than twice the BTV. None of the BTVs for the other primary analytes was exceeded in any samples.

Table J-50. Sediment Results for Primary Analytes in the Middle 3G Drainage

Field Sample ID	Drainage Channel ID	Sample Date	Arsenic		Lead		Molybdenum		Radium-226			Selenium		Thorium		Uranium		Vanadium	
			Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Activity (pCi/g)	TPU	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q
DC3G-SD1-01-062318	Middle 3G	6/23/2018	**1.5**		4.6		**0.08**	J	1.35	0.28	J	0.55	J	**3.1**		0.8	J	13	J
DC3G-SD2-01-062318	Middle 3G	6/23/2018	1.3		4.2		**0.08**	J	1.62	0.31	J-	0.42	J	2.1		0.5		9.5	
DC3G-SD3-01-062318	Middle 3G	6/23/2018	1.3		4.4		**0.08**	J	1.02	0.24	J-	**0.58**	J	2.2		0.5		6.3	
DC3G-SD4-01-062318	Middle 3G	6/23/2018	1.2		**4.9**		0.06	J	1.54	0.24	J-	0.57	J	2.3		0.3		8.0	
DC3G-SD5-01-062318	Middle 3G	6/23/2018	1.4		4.5		0.06	J	**2.21**	0.32	J-	0.51	J	2.3		**1.0**	J	**14**	J
DC3G-SD6-01-062318	Middle 3G	6/23/2018	1.3		4.1		0.07	J	0.57	0.17	LT	0.51	J	1.9		0.5		6.6	
Number of Measurements			6		6		6		6			6		6		6		6	
Number of Detects			6		6		6		6			6		6		6		6	
Number of Nondetects			0		0		0		0			0		0		0		0	
Minimum (mg/kg)			1.2		4.1		0.06		0.57			0.42		1.9		0.33		6.3	
Maximum (mg/kg)			1.5		4.9		0.08		2.21			0.58		3.1		1.0		14	
Average (mg/kg)			1.3		4.5		0.07		1.39			0.52		2.3		0.6		10	
Median (mg/kg)			1.3		4.5		0.07		1.45			0.53		2.3		0.5		8.8	
Standard Deviation (mg/kg)			0.10		0.29		0.01		0.56			0.06		0.41		0.24		3.3	
90th Percentile (mg/kg)			1.5		4.8		0.08		1.92			0.58		2.7		0.9		14	
95th Percentile (mg/kg)			1.5		4.8		0.08		2.06			0.58		2.9		0.9		14	
99th Percentile (mg/kg)			1.5		4.9		0.08		2.18			0.58		3.1		1.0		14	
Relative Standard Deviation			0.08		0.06		0.13		0.40			0.11		0.18		0.40		0.34	
BTV (mg/kg)			2.4		8.0		0.19		1.2			0.80		3.5		0.58		15	
Maximum/BTV (unitless)			0.63		0.61		0.43		1.9			0.73		0.89		1.7		0.92	

Notes:
The maximum concentration is presented in **bold**.
Shaded **red** indicates that the result exceeds the applied BTV.
BTV Background threshold value
ID Identification
J Estimated value
J- Estimated value, may be biased low.
LT Result less than requested minimum detectable concentration, but greater than the sample-specific detectable concentration.
mg/kg Milligrams per kilogram
pCi/g Picocuries per gram
Q Qualifier
TPU Total propagated uncertainty

5.6.8.2 Gamma Radiation Survey Results

BSA-35 is located at the upstream end of the Middle 3G drainage and upstream of the confluence of the Middle 3G and Middle 3F. Gamma radiation levels are, in general, in the range of the combined BSA-34 and BSA-35 background data set. Downstream of the Middle 3F and Middle 3G confluence, the gamma radiation levels range from one to two times the BTV, with a localized area exceeding 10 times the applied gamma BTV. Table J-51 provides summary statistics for the gamma radiation measurements within the drainage. Fifty-five percent of the gamma measurements exceeded the applied gamma BTV. Figure J-46 displays gamma radiation survey data collected within the drainage compared to the background drainage gamma survey results. The spread of gamma radiation levels within the drainage encompasses the range of background gamma measurements up to a maximum gamma count rate measurement of 161,602 cpm, a measurement greater than 10 times the applied gamma BTV. A box plot showing the quartiles of the data sets is provided in Figure J-47. The box plot displays the median of the drainage radiation levels above the background data set median and above applied gamma BTV.

The maximum gamma radiation level of 161,602 cpm was observed approximately 150 feet downgradient of the Middle 3F and Middle 3G confluence.

Table J-51. Summary of Gamma Radiation Survey Results for the Middle 3G Drainage

Summary Statistic	Units	Gamma Radiation Survey Results
Applied Gamma BTV	cpm	12,465
Measurements	#	10,191
Minimum	cpm	5,913
Maximum	cpm	161,602
Average	cpm	13,778
Median	cpm	13,274
Standard Deviation	cpm	6,860
90th Percentile	cpm	17,976
95th Percentile	cpm	20,258
99th Percentile	cpm	32,074
Measurements Above Gamma BTV	#	5,594
Measurements Above Gamma BTV	%	55

Notes:
BTV Background threshold value
cpm Counts per minute

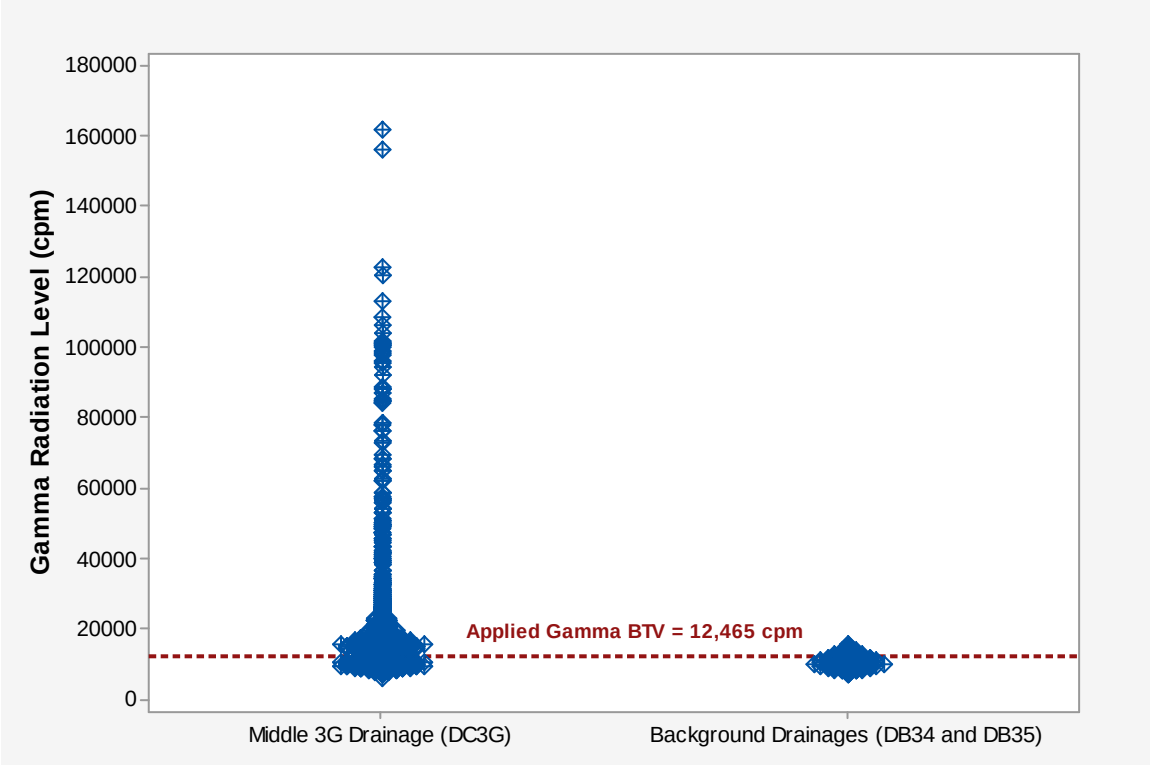


Figure J-46. Individual Value Plot of Gamma Radiation Levels within the Middle 3G Drainage and Background Drainages

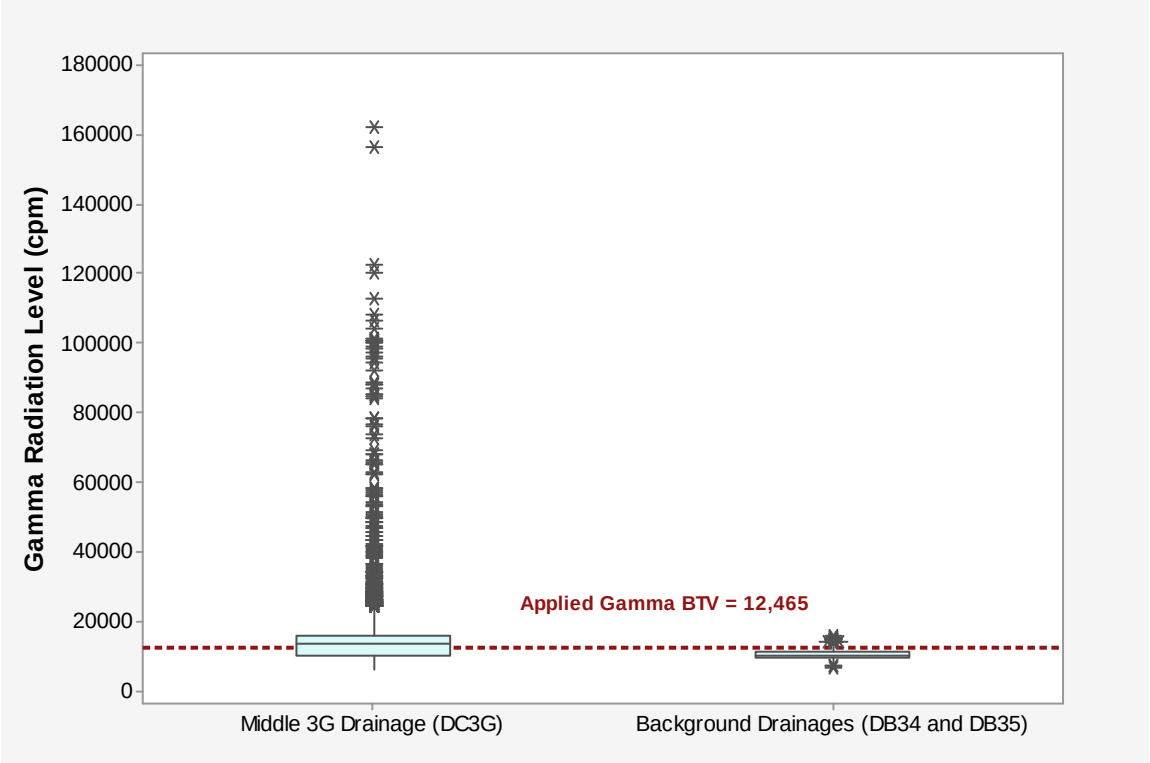


Figure J-47. Box Plot of Gamma Radiation Levels within the Middle 3G Drainage and Background Drainages

5.6.8.3 Potential Contribution from AUMs

Based on the sediment sample results for primary analytes not exceeding twice their respective BTVs, upgradient mines (via through surface water flow from Middle 3F drainage) do not appear to contribute to elevated concentrations of mine-related contaminants or gamma radiation in the Middle 3G drainage. Gamma measurements along the entirety of the drainage length contradict the conclusion, however, as the maximum gamma measurement greatly exceeds twice the applied gamma BTV, and the median value exceeds the applied BTV. Gamma measurements exceeding twice the applied BTV were recorded only in areas downgradient of the confluence with Middle 3F.

5.7 KNIFE EDGE DRAINAGE

The Knife Edge drainage is southwest of the Knife Edge Mesa Mine AUM site. The direction of surface water flow is generally from northeast to southwest, following the general trend of the downward slope of the mountains. The Knife Edge drainage originates approximately 1,000 feet downgradient of Knife Edge Mesa Mine. Non-AUM Target T34 (KE-02) is also located upgradient of the drainage. Non-AUM Target T33 (KE-01) drains to a drainage east of Knife Edge Mine; no sediment sampling or gamma surveys were conducted in this drainage; however, Target T33 (KE-01) was confirmed to be a waste pile via direct observation, and aerial photography shows what appears to be a waste pile on the bench below, that may flow into the drainage.

A total of 16 sediment samples were collected from the Knife Edge drainage in August 2018, and were analyzed for the suite of metals and radionuclides presented in Table J-9 and Table J-10. A gamma survey was performed along an approximately 0.6-mile reach of the Knife Edge drainage on June 23, 2018. The results of sediment sampling for primary analytes and the gamma survey are described in the following subsections and presented within the Knife Edge drainage results figures in Attachment J3 (Figure DM33-I, Figures DM33-1 and DM33-2).

5.7.1 Sediment Sampling Results

Sediment results for primary analytes collected at 16 locations are compared with BTVs from BSA-34 and BSA-35, and presented in Table J-52. Arsenic, radium-226, uranium, thorium, vanadium exceeded the BTV in at least one sample. However, with one exception (arsenic at an upgradient location with a results 2.3 times the BTV), all results were less than two times the corresponding BTVs.

Table J-52. Sediment Results for Primary Analytes in the Knife Edge Drainage

Field Sample ID	Drainage Channel ID	Sample Date	Arsenic		Lead		Molybdenum		Radium-226			Selenium		Thorium		Uranium		Vanadium	
			Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Activity (pCi/g)	TPU	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q
DM33-SD1-01-081818	Knife Edge	8/18/2018	1.5		5.3		0.09	J	0.84	0.22	J-	0.54	J	2.6		0.5		8.6	
DM33-SD2-01-081818	Knife Edge	8/18/2018	1.5		5.1		0.09	J	0.94	0.23	J-	0.49	J	2.3		0.4		7.0	
DM33-SD3-01-081818	Knife Edge	8/18/2018	1.9		6.6		0.09	J	0.86	0.22	LT	0.64	J	3.4		0.4		8.5	
DM33-SD4-01-081818	Knife Edge	8/18/2018	1.9		6.2		0.07	J	**1.23**	0.29		0.62	J	3.4		0.6	J	8.4	J
DM33-SD5-01-081818	Knife Edge	8/18/2018	2.9		5.5		0.13	J	0.58	0.2	J-	0.57	J	3.0		**0.7**		10	
DM33-SD6-01-081818	Knife Edge	8/18/2018	2.6		5.5		0.12	J	0.62	0.18	J-	0.59	J	2.7		0.5		9.8	
DM33-SD7-01-081818	Knife Edge	8/18/2018	3.4		7.0		0.08	J	0.84	0.26	LT	0.76	J	3.4		0.4		13	
DM33-SD8-01-081818	Knife Edge	8/18/2018	3.9		6.4		0.09	J	0.59	0.19	J-	0.68	J	3.9		0.5		15	
DM33-SD9-01-081818	Knife Edge	8/18/2018	3.4		**7.8**		0.09	J	0.99	0.22	LT	0.72	J	**4.1**		0.5		14	
DM33-SD10-01-081818	Knife Edge	8/18/2018	3.0		6.1		0.06	J	0.68	0.19	J-	0.66	J	3.7		0.4		13	
DM33-SD11-01-081818	Knife Edge	8/18/2018	3.3		7.1		0.08	J	0.63	0.16	J-	0.65	J	3.4		0.4		15	
DM33-SD12-01-081818	Knife Edge	8/18/2018	3.5		7.4		0.10	J	0.69	0.22	J-	0.73	J	3.9		0.4		14	
DM33-SD13-01-081818	Knife Edge	8/18/2018	2.9		6.2		0.08	J	0.49	0.17	J-	0.66	J	3.3		0.4		13	
DM33-SD14-01-081818	Knife Edge	8/18/2018	4.1		6.9		0.09	J	0.65	0.19	LT	0.79	J	3.9		0.4		**16**	
DM33-SD15-01-081818	Knife Edge	8/18/2018	**5.6**		6.4		**0.13**	J	0.58	0.22	J-	0.69	J	**4.1**		0.5		**16**	
DM33-SD16-01-081818	Knife Edge	8/18/2018	3.8		6.8		0.07	J	0.55	0.19	J-	**0.80**	J	3.9		0.4		**16**	
Number of Measurements			16		16		16		16			16		16		16		16	
Number of Detects			16		16		16		16			16		16		16		16	
Number of Nondetects			0		0		0		0			0		0		0		0	
Minimum (mg/kg)			1.5		5.1		0.06		0.49			0.49		2.3		0.36		7	
Maximum (mg/kg)			5.6		7.8		0.13		1.23			0.80		4.1		0.73		16	
Average (mg/kg)			3.1		6.4		0.09		0.74			0.66		3.4		0.46		12	
Median (mg/kg)			3.2		6.4		0.09		0.67			0.66		3.4		0.44		13	
Standard Deviation (mg/kg)			1.1		0.77		0.02		0.20			0.09		0.6		0.09		3.1	
90th Percentile (mg/kg)			4.0		7.3		0.13		0.97			0.78		4.0		0.56		16	
95th Percentile (mg/kg)			4.5		7.5		0.13		1.05			0.79		4.1		0.64		16	
99th Percentile (mg/kg)			5.4		7.7		0.13		1.19			0.80		4.1		0.71		16	
Relative Standard Deviation			0.35		0.12		0.23		0.27			0.13		0.16		0.20		0.25	
BTV (mg/kg)			2.4		8.0		0.19		1.2			0.80		3.5		0.58		15	
Maximum/BTV (unitless)			2.3		1.0		0.68		1.1			1.0		1.2		1.3		1.1	

Notes:
The maximum concentration is presented in **bold**.
Shaded **red** indicates that the result exceeds the applied BTV.
BTV Background threshold value
ID Identification
J Estimated value
J- Estimated value, may be biased low.
LT Result less than requested minimum detectable concentration, but greater than the sample-specific detectable concentration.
mg/kg Milligrams per kilogram
pCi/g Picocuries per gram
Q Qualifier
TPU Total propagated uncertainty

5.7.2 Gamma Radiation Survey Results

In general, the radiation levels within the Knife Edge drainage are within the range of the combined BSA-34 and BSA-35 background data set. Table J-53 provides summary statistics for the gamma radiation measurements within the drainage. Two percent of measurements exceeded the applied gamma BTV. Figure J-48displays gamma radiation survey data collected within the drainage compared to the background drainage gamma survey results. The spread of gamma radiation levels within the drainage encompasses the range of background gamma measurements up to a maximum gamma count rate measurement of 13,670 cpm. A box plot showing the quartiles of the data sets is provided in Figure J-49. The box plot displays the median of the drainage radiation levels above the background data set median but below the applied gamma BTV.

Gamma measurements within the Knife Edge drainage appear to indicate that remaining waste at the Knife Edge AUM site has a limited impact on the downstream drainage.

Table J-53. Summary of Gamma Radiation Survey Results for the Knife Edge Drainage

Summary Statistic	Units	Gamma Radiation Survey Results
Applied Gamma BTV	cpm	12,465
Measurements	#	7,044
Minimum	cpm	8,281
Maximum	cpm	13,670
Average	cpm	10,532
Median	cpm	10,513
Standard Deviation	cpm	695
90th Percentile	cpm	11,347
95th Percentile	cpm	11,675
99th Percentile	cpm	12,745
Measurements Above Gamma BTV	#	114
Measurements Above Gamma BTV	%	2

Notes:
BTV Background threshold value
cpm Counts per minute

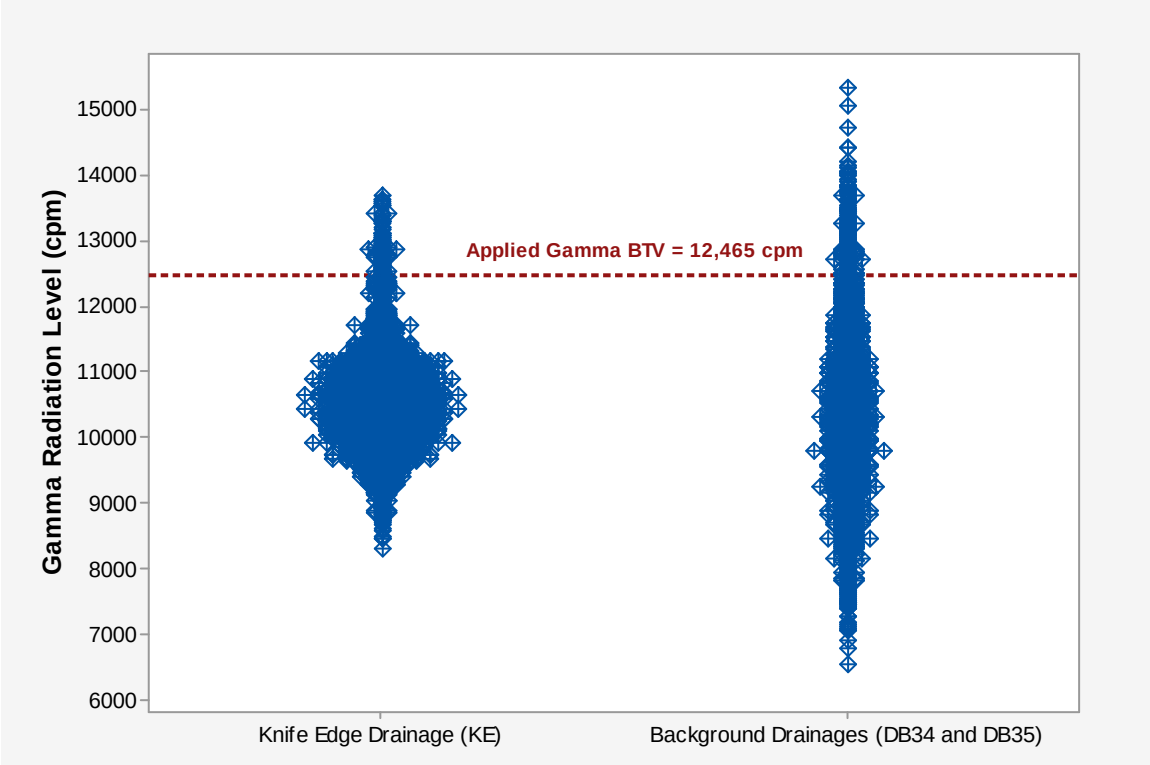


Figure J-48. Individual Value Plot of Gamma Radiation Levels within the Knife Edge Drainage and Background Drainages

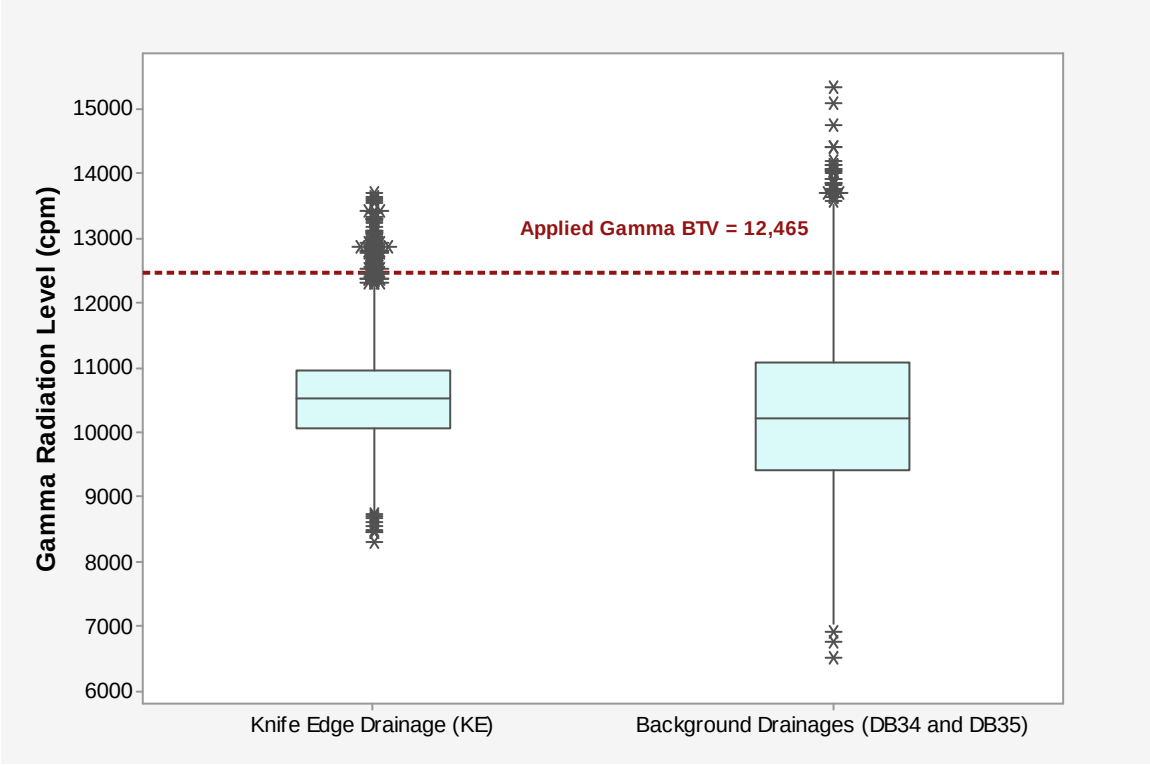


Figure J-49. Box Plot of Gamma Radiation Levels within the Knife Edge Drainage and Background Drainages

5.7.3 Potential Contribution from AUMs and Targets

Based on the sediment sample results for primary analytes and the maximum gamma survey measurement not exceeding twice the applied BTVs, Knife Edge Mesa Mine and the Non-AUM Target T34 (KE-02) do not appear to contribute to elevated concentrations of mine contaminants in the Knife Edge drainage.

The drainage east of Knife Edge drainage was identified to have a waste pile associated with Target T33 (KE-01), with runoff potentially flowing into it. This east side drainage was not sampled, and sediment concentrations and gamma measurements remain a data gap.

5.8 BLACK MESA DRAINAGE

The Black Mesa drainage is within the southeastern portion of the Lukachukai Mountains Region, directly downslope of the Flag and Black Mesas. The Black Mesa drainage surface flow originates from the Flag Mesa mines Flag No. 1, and Black Mesa mines Black No. 1 Mine, Black No. 2 Mine, and Black No. 2 Mine (West).

A total of 15 sediment samples were collected from the Black Mesa drainage in August 2018. Sediment samples were analyzed for the suite of metals and radionuclides presented in Table J-9 and Table J-10. A gamma survey was performed along an approximately 0.6-mile reach of the Black Mesa drainage on June 23, 2018. The results of sediment sampling results for primary analytes and the gamma survey are described in the following subsections and presented within the Black Mesa drainage results figures in Attachment J3 (Figure DM35-I, Figures DM35-1 through DM35-4).

5.8.1 Sediment Sampling Results

Sediment results for primary analytes collected at 15 locations are compared with BTVs from BSA-34 and BSA-35 and presented in Table J-54. Radium-226 and uranium exceeded the BTV in all samples, with the maximum concentration exceeding the BTV by two and 57 times. Arsenic, molybdenum, and vanadium results exceeded the corresponding BTVs in four (arsenic) and five (molybdenum, vanadium) samples.

The highest concentrations of uranium and vanadium were at the furthest upgradient location DM35-SD21 – these concentrations were greatly elevated above the second highest concentrations, which were found at location DM35-SD10 in the downgradient portion of the drainage. The maximum concentrations of arsenic, molybdenum, and radium-226 were also at location DM35-SD10.

Table J-54. Sediment Results for Primary Analytes in the Black Mesa Drainage

Field Sample ID	Drainage Channel ID	Sample Date	Arsenic		Lead		Molybdenum		Radium-226			Selenium		Thorium		Uranium		Vanadium	
			Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Activity (pCi/g)	TPU	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q
DM35-SD7-01-082018	Black Mesa	8/20/2018	1.8		2.7		0.20		2.3	0.4		0.51	J	1.6		2.9		15	
DM35-SD8-01-082018	Black Mesa	8/20/2018	1.2		2.3		0.12	J	2.0	0.35		<0.98	U	1.4		2.3		12	
DM35-SD9-01-082018	Black Mesa	8/20/2018	1.5		2.9		0.31		2.1	0.34	J-	0.36	J	1.7		2.8		12	
DM35-SD10-01-082018	Black Mesa	8/20/2018	**4.2**		3.1		**0.52**		**2.7**	0.37	J-	**0.73**	J	1.6		7.1		28	
DM35-SD11-01-082018	Black Mesa	8/20/2018	2.3		3.3		0.30		2.4	0.4	J-	0.35	J	1.6		2.6		12	
DM35-SD12-01-082018	Black Mesa	8/20/2018	2.2		2.9		0.16	J	1.7	0.32	J-	0.38	J	1.6		2.7		17	
DM35-SD13-01-082018	Black Mesa	8/20/2018	1.2		2.4		0.13	J	1.7	0.3		0.36	J	1.6		2.8		13	
DM35-SD14-01-082018	Black Mesa	8/20/2018	2.3		3.7		0.15	J	2.2	0.39		0.43	J	2.3		1.6		13	
DM35-SD15-01-082018	Black Mesa	8/20/2018	1.1		2.5		0.11	J	1.3	0.25	J-	0.33	J	1.4		1.6		8.6	
DM35-SD16-01-082018	Black Mesa	8/20/2018	1.6		2.9		0.16	J	1.6	0.29		0.34	J	1.7		3.7		16	
DM35-SD17-01-082018	Black Mesa	8/20/2018	2.7		**4.8**		0.15	J	2.3	0.32	J-	0.47	J	2.2		1.5		12	
DM35-SD18-01-082018	Black Mesa	8/20/2018	1.7		3.4		0.10	J	1.9	0.35	J-	0.42	J	**2.4**		1.0		9.0	
DM35-SD19-01-082018	Black Mesa	8/20/2018	2.5		3.3		0.13	J	1.3	0.21	J-	0.37	J	2.2		1.8		21	
DM35-SD20-01-081818	Black Mesa	8/18/2018	2.6		4.2		0.32		1.5	0.3	J-	0.49	J	2.1		2.1		15	
DM35-SD21-01-081818	Black Mesa	8/18/2018	1.6		4.0		0.12	J	1.3	0.25	J-	0.39	J	2.1		**33**		**80**	
Number of Measurements			15		15		15		15			15		15		15		15	
Number of Detects			15		15		15		15			14		15		15		15	
Number of Nondetects			0		0		0		0			1		0		0		0	
Minimum (mg/kg)			1.1		2.3		0.10		1.3			0.33		1.4		1.0		8.6	
Maximum (mg/kg)			4.2		4.8		0.52		2.7			0.73		2.4		33.0		80	
Average (mg/kg)			2.0		3.2		0.20		1.9			0.42		1.8		4.6		19	
Median (mg/kg)			1.8		3.1		0.15		1.9			0.39		1.7		2.6		13	
Standard Deviation (mg/kg)			0.80		0.71		0.12		0.45			0.10		0.34		8.0		18	
90th Percentile (mg/kg)			2.7		4.1		0.32		2.3			0.50		2.3		5.7		25	
95th Percentile (mg/kg)			3.2		4.4		0.38		2.5			0.59		2.3		15		44	
99th Percentile (mg/kg)			4.0		4.7		0.49		2.7			0.70		2.4		29		73	
Relative Standard Deviation			0.39		0.22		0.58		0.24			0.25		0.19		1.7		0.93	
BTV (mg/kg)			2.4		8.0		0.19		1.2			0.80		3.5		0.58		15	
Maximum/BTV (unitless)			1.8		0.60		2.7		2.4			0.91		0.69		57		5.3	

Notes:
The maximum concentration is presented in **bold**.
Shaded **red** indicates that the result exceeds the applied BTV.
BTV Background threshold value
ID Identification
J Estimated value
J- Estimated value, may be biased low.
LT Result less than requested minimum detectable concentration, but greater than the sample-specific detectable concentration.
mg/kg Milligrams per kilogram
pCi/g Picocuries per gram
Q Qualifier
TPU Total propagated uncertainty
U Not detected. The associated value is the reporting limit.

5.8.2 Gamma Radiation Survey Results

In general, the radiation levels within the Black Mesa drainage are within the range of the combined BSA-34 and BSA-35 background data set. Table J-55 provides summary statistics for the gamma radiation measurements within the drainage. Fifty-four percent of measurements exceeded the applied gamma BTV. Figure J-50 displays gamma radiation survey data collected within the drainage compared to the background drainage gamma survey results. The spread of gamma radiation levels within the drainage encompasses the range of background gamma measurements up to a maximum gamma count rate measurement of 21,822 cpm, a measurement less than two times the applied gamma BTV. A box plot showing the quartiles of the data sets is provided in Figure J-51. The box plot displays the median of the drainage radiation levels above the background data set median and above applied gamma BTV.

Gamma measurements within the Black Mesa drainage appear to indicate that remaining waste at the Flag Mesa and Black Mesa AUM sites have limited impact on the downstream drainage.

Table J-55. Summary of Gamma Radiation Survey Results for the Black Mesa Drainage

Summary Statistic	Units	Gamma Radiation Survey Results
Applied Gamma BTV	cpm	12,465
Measurements	#	8,946
Minimum	cpm	8,437
Maximum	cpm	21,288
Average	cpm	12,493
Median	cpm	12,663
Standard Deviation	cpm	1,702
90th Percentile	cpm	14,544
95th Percentile	cpm	15,307
99th Percentile	cpm	16,617
Measurements Above Gamma BTV	#	4,875
Measurements Above Gamma BTV	%	54

Notes:
BTV Background threshold value
cpm Counts per minute

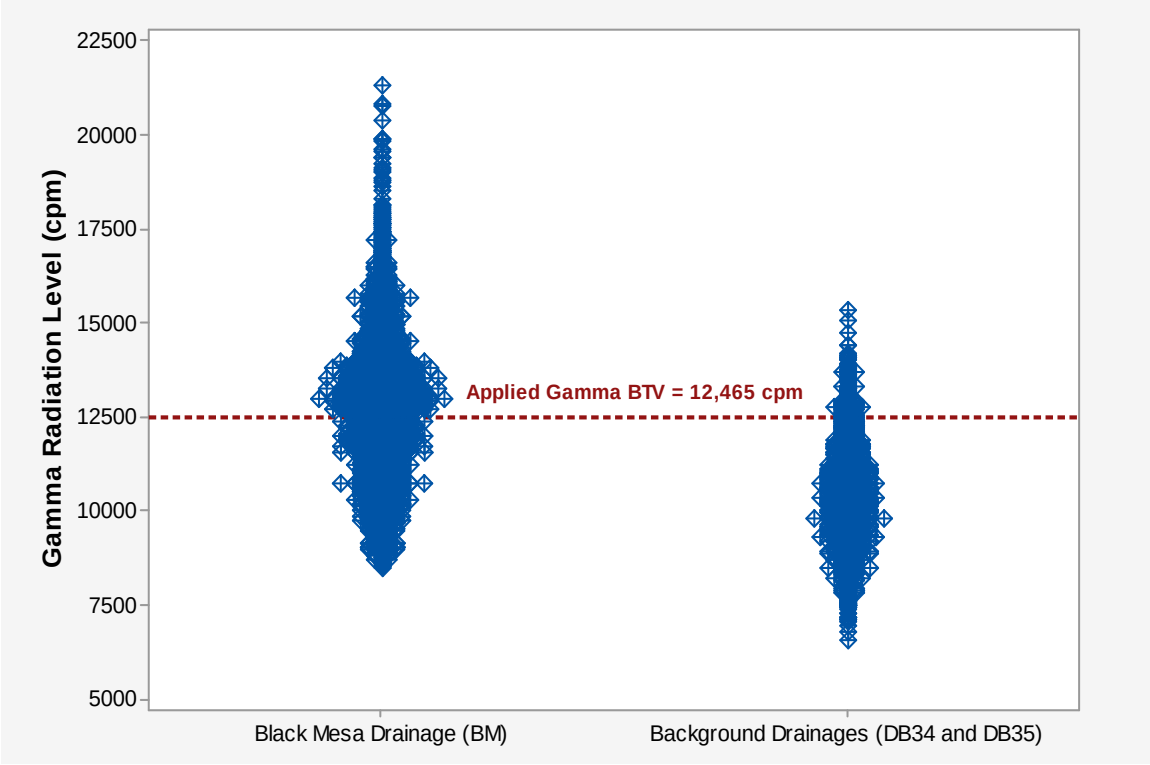


Figure J-50. Individual Value Plot of Gamma Radiation Levels within the Black Mesa Drainage and Background Drainages

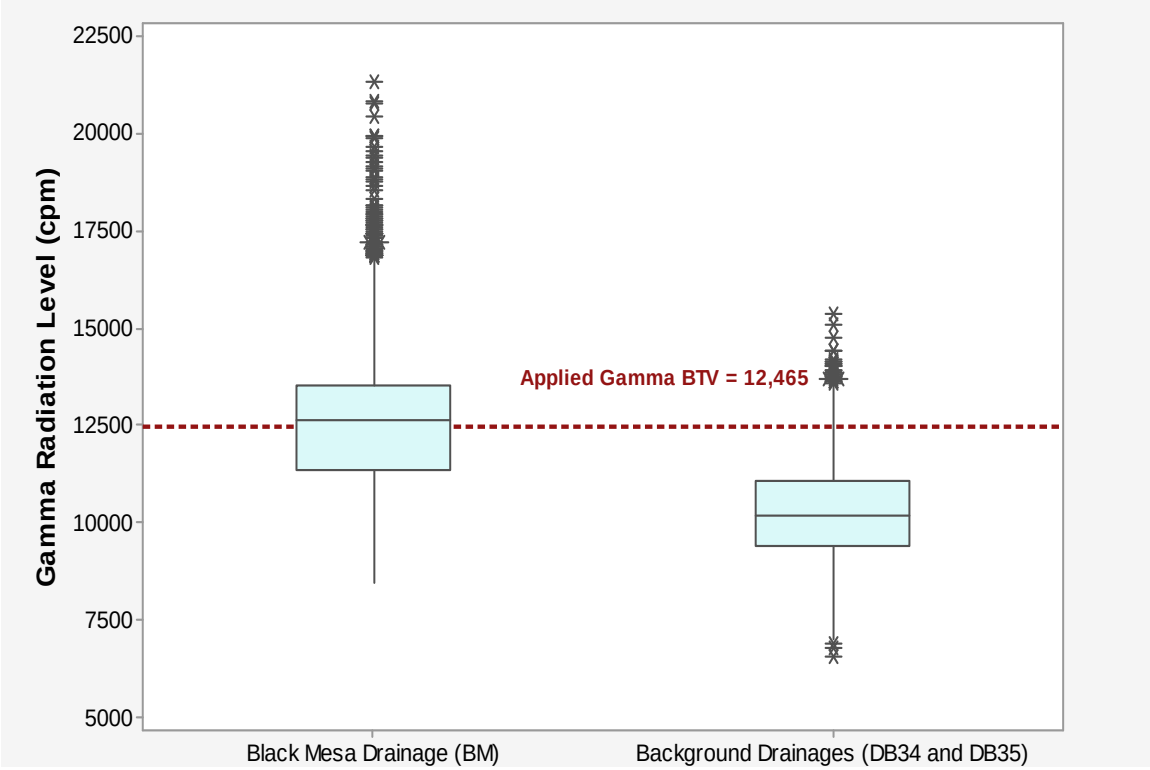


Figure J-51. Box Plot of Gamma Radiation Levels within the Black Mesa Drainage and Background Drainages

5.8.3 Potential Contribution from AUMs

Based on the molybdenum, radium-226, uranium, and vanadium sediment sample results exceeding twice their respective BTVs, the Flag Mesa and Black Mesa Mines appear to contribute to elevated concentrations of mine contaminants in the Black Mesa drainage. Gamma measurements do not support this conclusion, as the maximum gamma measurement does not exceed twice the applied BTV, and the median gamma survey measurement is below the applied BTV for the drainage; therefore, additional investigation may be warranted to correlate gamma and metals results. Concentrations of primary analytes and gamma measurements in the Black Mesa drainage are relatively low when compared to concentrations detected in the rest of the Lukachukai Mountains drainages.

5.9 TOMMY JAMES DRAINAGE

The Tommy James drainage surface flow originates from Tommy James Mine and Step Mesa Mine. The direction of surface water flow is generally from northeast to southwest within the Lukachukai Mountains Region, following the general trend of the downward slope of the mountains.

A total of 11 sediment samples were collected from the Tommy James drainage in August 2018, and analyzed for the suite of metals and radionuclides presented in Table J-9 and Table J-10. A gamma survey was performed along an approximately 0.6-mile reach of the Tommy James drainage on June 23, 2018. The results of sediment sampling for primary analytes and the gamma survey are described in the following subsections and presented within the Tommy James drainage results figures in Attachment J3 (Figure DM39-I, Figures DM39-1 through DM39-5).

5.9.1 Sediment Sampling Results

Sediment results for primary analytes collected at 11 locations are compared with BTVs from BSA-34 and BSA-35, and presented in Table J-56. Molybdenum and uranium exceeded the BTV in four and six samples, with maximum concentrations at downgradient location DM39-SD8 exceeding the BTV by four and three times, respectively. The same sample exhibited concentrations of arsenic and radium-226 exceeding the BTV slightly. None of the other results for arsenic, lead, radium-226, selenium, thorium, or vanadium exceeded the BTVs.

Table J-56. Sediment Results for Primary Analytes in the Tommy James Drainage

Field Sample ID	Drainage Channel ID	Sample Date	Arsenic		Lead		Molybdenum		Radium-226			Selenium		Thorium		Uranium		Vanadium	
			Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Activity (pCi/g)	TPU	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q	Result (mg/kg)	Q
DM39-SD7-01-081618	Tommy James	8/16/2018	1.8		2.4		0.21		0.99	0.25	LT	<0.95	U	2.2		1.1		6.1	
DM39-SD8-01-081618	Tommy James	8/16/2018	**3.4**		3.8		**0.76**		**1.31**	0.27		0.38	J	2.3		**1.9**		9.7	
DM39-SD9-01-081618	Tommy James	8/16/2018	1.4		3.1		0.64		0.52	0.2	J-	<0.99	U	1.4		0.6		5.8	
DM39-SD10-01-081618	Tommy James	8/16/2018	1.1		2.5		0.10	J	0.68	0.17	LT	0.33	J	2.0	J	0.5		4.4	
DM39-SD11-01-081618	Tommy James	8/16/2018	1.2		2.3		0.12	J	0.45	0.16	J-	0.37	J	1.9		0.5		5.1	
DM39-SD12-01-081618	Tommy James	8/16/2018	1.4		2.3		0.12	J	0.67	0.21	LT	0.32	J	1.8		0.9		6.5	
DM39-SD13-01-081618	Tommy James	8/16/2018	2.4		**4.9**		0.09	J	0.9	0.23	J-	**0.56**	J	**3.2**		0.5		**10**	
DM39-SD14-01-081618	Tommy James	8/16/2018	1.8		3.5		0.12	J	0.75	0.19	J-	0.50	J	2.6		0.6		7.9	
DM39-SD15-01-081618	Tommy James	8/16/2018	1.8		3.3		0.12	J	0.81	0.2	J-	0.43	J	2.4		1.3		9.0	
DM39-SD16-01-081618	Tommy James	8/16/2018	1.7		**4.9**	J	0.39		0.81	0.19	J-	**0.56**	J	2.9		0.4		8.0	
DM39-SD17-01-081618	Tommy James	8/16/2018	2.3		3.9		0.13	J	0.76	0.19	J-	0.36	J	2.6		0.4		8.7	
Number of Measurements			11		11		11		11			11		11		11		11	
Number of Detects			11		11		11		11			9		11		11		11	
Number of Nondetects			0		0		0		0			2		0		0		0	
Minimum (mg/kg)			1.1		2.3		0.09		0.5			0.32		1.4		0.4		4.4	
Maximum (mg/kg)			3.4		4.9		0.76		1.3			0.56		3.2		1.9		10	
Average (mg/kg)			1.8		3.4		0.25		0.8			0.42		2.3		0.8		7	
Median (mg/kg)			1.8		3.3		0.12		0.8			0.38		2.3		0.6		8	
Standard Deviation (mg/kg)			0.66		0.96		0.24		0.23			0.09		0.52		0.5		2	
90th Percentile (mg/kg)			2.4		4.9		0.64		1.0			0.56		2.9		1.3		10	
95th Percentile (mg/kg)			2.9		4.9		0.70		1.2			0.56		3.1		2		10	
99th Percentile (mg/kg)			3.3		4.9		0.75		1.3			0.56		3.2		2		10	
Relative Standard Deviation			0.36		0.29		0.93		0.30			0.22		0.23		0.6		0.26	
BTV (mg/kg)			2.4		8.0		0.19		1.2			0.80		3.5		0.58		15	
Maximum/BTV (unitless)			1.4		0.61		4.0		1.1			0.70		0.91		3.3		0.66	

Notes:
The maximum concentration is presented in **bold**.
Shaded **red** indicates that the result exceeds the applied BTV.

<	The analyte was analyzed for, but was not detected. The reporting limit is shown in the result column.
BTV	Background threshold value
ID	Identification
J	Estimated value
J-	Estimated value, may be biased low.
LT	Result less than requested minimum detectable concentration, but greater than the sample-specific detectable concentration.
mg/kg	Milligrams per kilogram
pCi/g	Picocuries per gram
Q	Qualifier
TPU	Total propagated uncertainty
U	Not detected. The associated value is the reporting limit.

5.9.2 Gamma Radiation Survey Results

In general, the radiation levels within the Tommy James drainage are within the range of the combined BSA-34 and BSA-35 background data set. Table J-57 provides summary statistics for the gamma radiation measurements within the drainage. Two percent of measurements exceeded the applied gamma BTV. Figure J-52 displays gamma radiation survey data collected within the drainage compared to the background drainage gamma survey results. The spread of gamma radiation levels within the drainage encompasses the range of background gamma measurements up to a maximum gamma count rate measurement of 14,525 cpm. A box plot showing the quartiles of the data sets is provided in Figure J-53. The box plot displays the median of the drainage radiation levels approximately equal to the background data set median and below the applied gamma BTV.

Table J-57. Summary of Gamma Radiation Survey Results for the Tommy James Drainage

Summary Statistic	Units	Gamma Radiation Survey Results
Applied Gamma BTV	cpm	12,465
Measurements	#	8,359
Minimum	cpm	7,102
Maximum	cpm	14,525
Average	cpm	10,133
Median	cpm	10,061
Standard Deviation	cpm	942
90th Percentile	cpm	11,357
95th Percentile	cpm	11,782
99th Percentile	cpm	12,630
Measurements Above Gamma BTV	#	133
Measurements Above Gamma BTV	%	2

Notes:
BTV Background threshold value
cpm Counts per minute

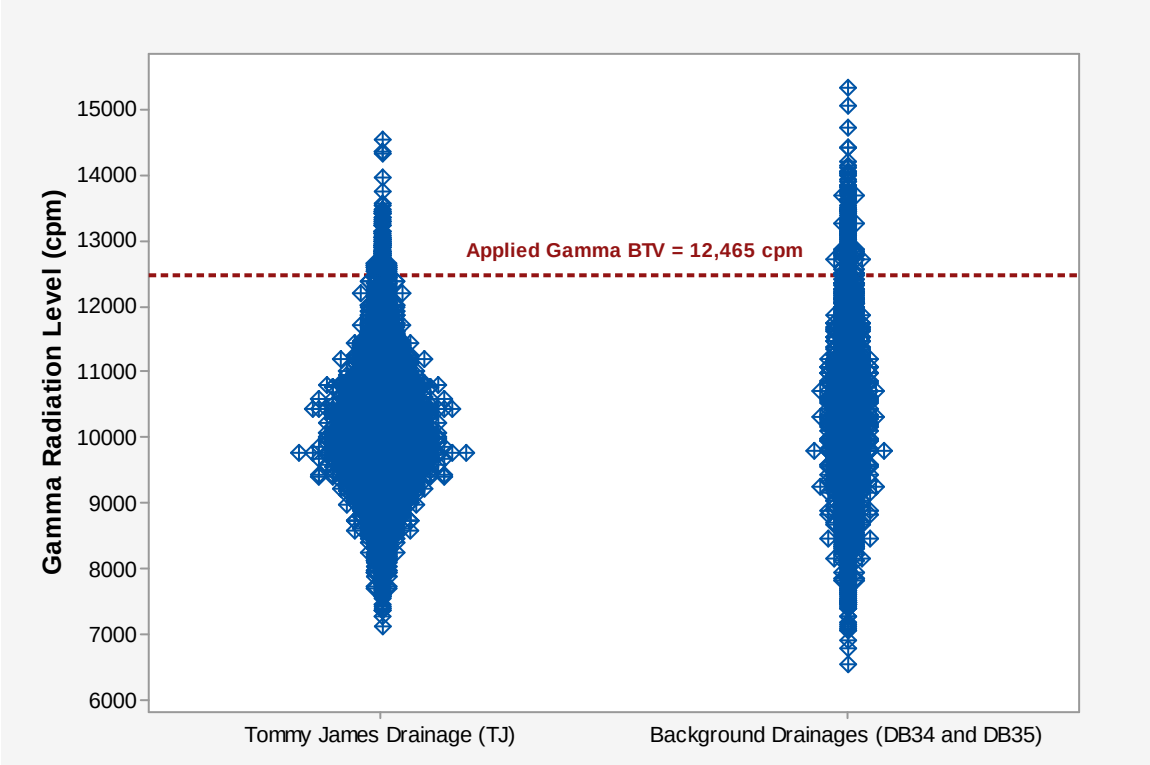


Figure J-52. Individual Value Plot of Gamma Radiation Levels within the Tommy James Drainage and Background Drainages

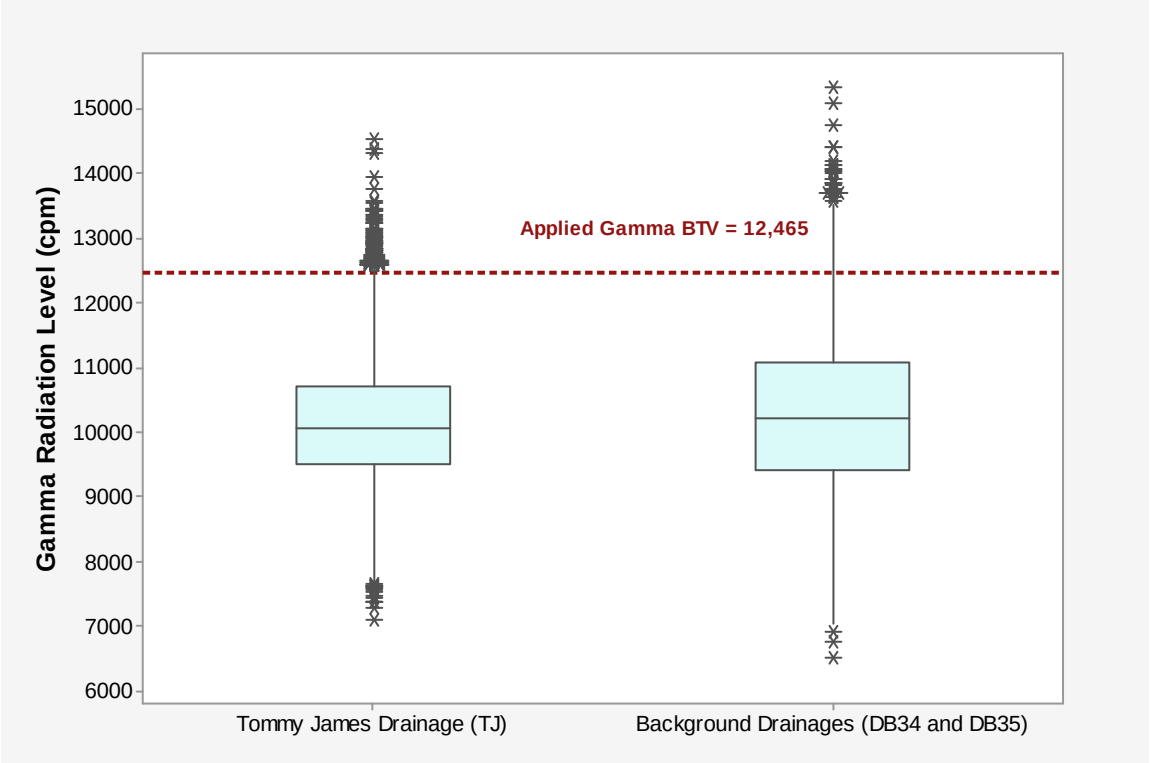


Figure J-53. Box Plot of Gamma Radiation Levels within the Tommy James Drainage and Background Drainages

5.9.3 Potential Contribution from AUMs

Based on the molybdenum and uranium sediment sample results exceeding twice their respective BTVs, the Tommy James and Step Mesa Mines appear to contribute to elevated concentrations of mine contaminants in the Tommy James drainage. Gamma measurements do not support this conclusion, as the maximum gamma measurement does not exceed twice the applied BTV, and the median gamma survey measurement is below the applied BTV for the drainage; therefore, additional investigation may be warranted to correlate gamma and metals results. Concentrations of primary analytes and gamma measurements in the Tommy James drainage are relatively low when compared to concentrations detected in the rest of the Lukachukai Mountains drainages.

5.10 SURFACE WATER IN MIDDLE 3 AND MIDDLE 3E DRAINAGES

On August 21, 2018, two surface water samples, one duplicate sample, and water quality parameters were collected from the Middle 3 drainage, and two surface water samples and water quality parameters were collected from the Middle 3E drainage. On September 30, 2018, two additional samples plus one duplicate were collected from the Middle 3E drainage; water quality parameters were not collected during the second sampling event because the water quality meter was not available because of a manufacturer shipping error.

In the below sections, the 2018 RSE surface water sample results are compared with the maximum CWWA background concentrations presented in Table J-6, and to previous CWWA sample results within the same drainages. The full set of results for total and dissolved metals, radionuclides, and laboratory and field-measured water quality parameters are presented in Tables J1-5 through J1-9 of Attachment J1.

5.10.1 Comparison of 2018 Surface Water Results to Maximum Background Surface Water and Groundwater Concentrations

Table J-58 and Table J-59 present Middle 3 and Middle 3E drainage surface water results for primary analytes compared to maximum CWWA background levels from Weston (2018). All 2018 RSE surface water results for primary analytes for samples collected in the Middle 3E drainage, which is upgradient of Middle 3 (See Figure J-11), were within the range of background values from the CWWA (Weston 2018).

All 2018 RSE molybdenum results for surface water samples collected in the Middle 3 drainage (downstream from the Middle 3A confluence) exceeded the maximum background concentrations by a factor of 2.6 from the CWWA (Weston 2018), and the most downgradient sample collected (DC3- SW10) exceeded the maximum background concentration by a factor of 1.2 for radium-226. All other primary analytes, including uranium, were within the range of background concentrations.

The 2018 RSE August and September sampling event results represent a snapshot in time during a low-flow event. Seasonal trends in water quality may exist because these drainages are ephemeral and springtime runoff intensity and duration is dependent on snowmelt. The CWWA found some evidence that surface water total uranium concentrations are higher during the low-flow season (Weston 2018).

Table J-58. Middle 3 Surface Water Results for Primary Analytes Compared To Maximum Background Levels from the Cove Wash Watershed Report

Field Sample ID	Drainage Channel	Sample Date	Arsenic		Lead		Molybdenum		Radium-226			Selenium		Thorium		Uranium		Vanadium	
			µg/L	Q	µg/L	Q	µg/L	Q	Activity (pCi/L)	TPU	Q	µg/L	Q	µg/L	Q	µg/L	Q	µg/L	Q
DC3-SW10-01-082118	Middle 3	8/21/2019	5.1		0.24	J-	**8.6**		**2.5**	0.80		1.3	J	0.21		69		9.8	
DC3-SW10-02-082118[1]	Middle 3	8/21/2019	4.9		0.13	J-	**7.9**		1.4	0.58		0.97	J	<0.20	U	64		9.0	
DC3-SW18A-01-082118	Middle 3	8/21/2019	4.8		0.45	J-	**8.3**		2.0	0.67		1.9	J	0.37		72		10	
Number of Measurements			3		3		3		3			3		3		3		3	
Number of Detects			3		3		3		3			3		2		3		3	
Number of Nondetects			0		0		0		0			0		1		0		0	
Minimum (µg/L or pCi/L)			4.8		0.13		7.9		1.4			0.97		0.21		64		9.0	
Maximum (µg/L or pCi/L)			5.1		0.45		8.6		2.5			1.9		0.37		72		10	
Average (µg/L or pCi/L)			4.9		0.27		8.3		2.0			1.4		0.29		68		9.6	
Median (µg/L or pCi/L)			4.9		0.24		8.3		2.0			1.3		0.29		69		9.8	
Standard Deviation (µg/L or pCi/L)			0.15		0.16		0.4		0.51			0.47		0.11		4.0		0.53	
90th Percentile (µg/L or pCi/L)			5.1		0.41		8.5		2.4			1.8		0.35		71		10	
95th Percentile (µg/L or pCi/L)			5.1		0.43		8.6		2.4			1.8		0.36		72		10	
99th Percentile (µg/L or pCi/L)			5.1		0.45		8.6		2.5			1.9		0.34		72		10	
Relative Standard Deviation (µg/L or pCi/L)			31		595		42		0.26			339		390		59		55	
Maximum Background Concentration (µg/L or pCi/L)[2]			18		7.4		3.3		2.1 [3]			15		NA		180		130	
Maximum Concentration/Maximum Background Concentration (unitless)			0.28		0.06		2.6		1.2			0.13		NA		0.40		0.08	

Notes:
Results exceeding the maximum background concentration are presented in **bold** font.

1	Duplicate sample
2	Background concentrations are from Weston (2018).
3	Background concentration is for Radium-226 and Radium-228 combined.
<	The analyte was analyzed for, but was not detected. The reporting limit is shown in the result column.
µg/L	Micrograms per liter
ID	Identification
J	Estimated value
J-	Estimated value, may be biased low.
LT	Result less than requested minimum detectable concentration, but greater than the sample-specific detectable concentration.
NA	No background value is available for thorium.
pCi/L	Picocuries per liter
Q	Qualifier
U	Not detected. The associated value is the reporting limit.
UJ	Not considered detected. The associated value is the reported concentration, which is estimated.

Table J-59. Middle 3E Surface Water Results for Primary Analytes Compared To Maximum Background Levels from the Cove Wash Watershed Report

Field Sample ID	Drainage Channel ID	Sample Date	Arsenic		Lead		Molybdenum		Radium-226			Selenium		Thorium		Uranium		Vanadium	
			µg/L	Q	µg/L	Q	µg/L	Q	Activity (pCi/L)	TPU	Q	µg/L	Q	µg/L	Q	µg/L	Q	µg/L	Q
DC3E-SW1-01-082118	Middle 3E	8/21/2018	4.3		0.51	J-	<2.0	U	1.6	0.64		1.2	J	0.35		23	J	9.6	4.3
DC3E-SW5A-01-082118	Middle 3E	8/21/2018	5.2		2.0	J-	<2.0	U	1.5	0.55		1.8	J	0.80		16		14	5.2
DC3E-SW10-01-093018	Middle 3E	9/30/2018	3.00		<2.0	U	<2.0	U	<0.33	0.33	U	1.7	J	0.03	J	20		6.8	3.0
DC3E-SW10-02-093018[1]	Middle 3E	9/30/2018	3.2		<2.0	U	<2.0	U	<0.29	0.24	U	2.3	J	0.02	J	20		6.8	3.2
DC3E-SW14-01-093018	Middle 3E	9/30/2018	3.1		<2.0	U	<2.0	U	0.47	0.31	LT	0.95	J	0.15	J	12		5.9	3.1
Number of Measurements			5		5		5		5			5		5		5		5	
Number of Detects			5		2		0		3			5		5		5		5	
Number of Nondetects			0		3		5		2			0		0		0		0	
Minimum (µg/L or pCi/L)			3.000		0.51		--		0.47			0.95		0.02		12		5.9	
Maximum (µg/L or pCi/L)			5.2		2.0		--		1.6			2.3		0.80		23		14	
Average (µg/L or pCi/L)			3.8		1.3		--		1.2			1.6		0.27		18		8.6	
Median (µg/L or pCi/L)			3.2		1.3		--		1.5			1.7		0.15		20		6.8	
Standard Deviation (µg/L or pCi/L)			0.96		1.1		--		0.6			0.53		0.32		4.3		3.3	
90th Percentile (µg/L or pCi/L)			4.8		1.9		--		1.6			2.1		0.62		22		12	
95th Percentile (µg/L or pCi/L)			5.0		1.9		--		1.6			2.2		0.71		22		13	
99th Percentile (µg/L or pCi/L)			5.2		2.0		--		1.6			2.3		0.78		23		14	
Relative Standard Deviation (µg/L or pCi/L)			256		840		--		0.53			333		1203		234		384	
Maximum Background Concentration (µg/L or pCi/L)[2]			18		7.4		3.3		2.1 [3]			15		NA		180		130	
Maximum Concentration/Maximum Background Concentration (unitless)			0.29		0.27		--		0.8			0.15		NA		0.13		0.11	

Notes:

1	Duplicate sample
2	Background concentration is from Weston (2018).
3	Background concentration is for Radium-226 and Radium-228 combined.
--	Statistic or calculation invalid; all results were nondetects.
<	The analyte was analyzed for, but was not detected. The reporting limit is shown in the result column.
µg/L	Micrograms per liter
ID	Identification
J	Estimated value
J-	Estimated value, may be biased low
LT	Result less than requested minimum detectable concentration, but greater than the sample-specific detectable concentration.
NA	No background value is available for thorium.
pCi/L	Picocuries per liter
Q	Qualifier
U	Not detected. The associated value is the reporting limit.
UJ	Not considered detected. The associated value is the reported concentration, which is estimated.

5.10.2 Comparison of 2018 Surface Water Results to Previous Sample Results from 2015, 2016, and 2017 CWWA Results

As mentioned in Section 5.0, the CWWA determined that the following analytes exceeded screening levels (USEPA MCLs for drinking water or NNEPA NNSWQS) and background ranges, and were deemed to be associated with AUMs within the Cove Wash watershed: total aluminum, total arsenic, total barium, total beryllium, total lead, total mercury, total molybdenum, total combined radium (evaluated in this report as radium-226 and radium-228 separately), total selenium, total thallium, total uranium, total vanadium, dissolved cadmium, dissolved copper and gross alpha radiation. The below discussion identifies the potentially contributing AUMs to each 2018 RSE surface water sample, and presents the relationship of the 2018 RSE surface water sampling locations to the CWWA surface water sampling locations. An evaluation of the 2018 RSE surface water analytes compared with the previous sample results from the CWWA from 2015, 2016, and 2017 follows.

Surface water was collected from six locations from Middle 3 and Middle 3E drainage reaches during the 2018 RSE. Three CWWA sampling locations (CW-13, CW-14, and CW-90) were collected along the same reaches, as shown on Figure J-11. The 2018 RSE surface water sample locations DC3-SW14, DC3E-SW10, DC3E-SW5A, and DC3-SW1 are in the Middle 3E drainage (Figure J-11). These samples are representative of water quality in four locations along this drainage and closest in proximity to CWWA sample location CW-14. The Middle 3A drainages merges with Middle 3E drainage just below CCWA sample location CW-14, and at the confluence they combine to form the Middle 3 drainage. CWWA sample location CW-13 is located just downstream from this confluence and the 2018 RSE sample location DC3-SW18A is co-located with this location. The 2018 RSE location DC3-SW10 is the furthest downgradient surface water location. It is located upstream of CWWA location CW-90.

Table J-60 presents the relationship of the 2018 RSE investigation sampling locations to potentially contributing Tronox AUMs and Weston (2018) surface water sampling locations.

Table J-60. Relationship of 2018 RSE Investigation Surface Water Sampling Locations to Tronox AUMs and Weston (2018) Surface Water Sampling Locations

Field Sample ID	Drainage Channel ID	Tronox Mine Inputs	Location Relative to Weston Sample Location
DC3E-SW14	Middle 3E	Mesa I 1/4 Mine	Furthest upgradient from CW-14
DC3E-SW10[1]	Middle 3E	Mesa I 1/4 Mine	Upgradient from CW-14
DC3E-SW5A	Middle 3E	Mesa I 1/4 Mine Mesa I 1/2 Mine	Closest upgradient location from CW-14
DC3E-SW1	Middle 3E	Mesa I 1/4 Mine Mesa I 1/2 Mine Mesa I Mine 14 Mine	Downgradient of CW-14[2]
DC3-SW18A	Middle 3 (at confluence of Middle 3E and Middle 3A)	Middle 3A and Middle 3E Mines Mesa I Mine Complex Mesa I Camp	At CW-13
DC3-SW10[1]	Middle 3	Middle 3A and Middle 3E Mines Mesa I Mine Complex Mesa I Camp	Upstream from CW-90[2]

Notes:
[1] A duplicate sample was collected at this location.
[2] May receive contribution from Mesa II Pit (DC3-SW10 is upgradient of Mesa II Pit).

Table J-61 summarizes the surface water results for of the Middle 3E drainage samples for the identified analytes of concern. Location CW-14 was sampled during both high- and low-flow levels; all the Tetra Tech samples (DC3E-SW1, DC3E-SW 5A, DC3E-SW10, and DC3E-SW14) were sampled during a low-flow event. Table J-62 summarizes the surface water results for the Middle 3 drainage samples for the identified analytes of concern. The CW-13 location was sampled at high- and low-flow levels and the Tetra Tech sample (DC3-SW18A) location was sampled during a low-flow event. Table J-63 summarizes surface water results for the lower Middle 3 drainage samples for the identified analytes of concern. The CW-90 location was sampled at high- and low-flow levels and the Tetra Tech sample (DC3-SW10A and DC3-SW10B – duplicate) location was sampled during a low-flow event. The three tables present results for spatially proximate samples, and high-flow and low-flow runoff events are identified. A brief analysis of the surface water analyte concentration comparisons follows.

For total barium, total beryllium, total mercury, radium-226, total thallium, dissolved cadmium, dissolved copper, gross alpha, no trend was apparent between results from samples collected during the 2015, 2016, and 2017 events, and results from the 2018 RSE investigation. Observations of trends for the remaining analytes follow:

- Total aluminum results for samples collected in the Middle 3E drainage upgradient of the confluence of Middle 3A and 3E, and at the confluence, were higher during the 2018 low-flow event; however, the results for samples collected downgradient of the confluence were higher during the 2017 high-flow event.

- Total arsenic results for samples collected in the Middle 3E drainage upgradient of the confluence of Middle 3A and 3E were higher during the 2015 low-flow event; however, the results for the downgradient sets of samples exhibited no trend.
- Total lead and selenium results for samples collected in the Middle 3E drainage upgradient of the confluence of Middle 3A and 3E and at the confluence were similar for all sampling events; however, sample results for samples collected downgradient of the confluence were higher during the 2017 high-flow event.
- Total molybdenum results for samples collected in the Middle 3E drainage upgradient of the confluence of Middle 3A and 3E and at the confluence were similar for all sampling events; however, sample results for samples collected downgradient of the confluence were higher during the 2018 low-flow event.
- Radium-228 results for samples collected in the Middle 3E drainage upgradient of the confluence of Middle 3A and 3E were higher during the 2018 low-flow event; however, the results for the downgradient sets of samples exhibited no trend.
- Total uranium results for samples collected in the Middle 3E drainage upgradient of the confluence of Middle 3A and 3E exhibited no trend; the results for samples results collected at the confluence exhibited higher concentrations during the 2018 low-flow event; and the results for samples collected downgradient of the confluence were higher during the 2018 low-flow event. Uranium concentrations generally increased moving downstream.
- Although no trends for gross alpha were observed over time among spatially proximate samples, gross alpha concentrations generally increased from upgradient to downgradient.
- Total vanadium results for samples collected in the Middle 3E drainage upgradient of the confluence of Middle 3A and 3E exhibited no trend, and the results for samples collected at the confluence and downgradient of the confluence exhibit higher concentrations during the 2015 low-flow event.

Table J-61. Comparison of 2018 RSE Investigation and the 2015 and 2016 Cove Wash Watershed Assessment Surface Water Concentrations for Analytes Typically Associated with AUMs in the Middle 3E Drainage

Analyte	Units	CWWA Location Sample ID Flow Event Type			2018 RSE Investigation Location Sample ID Flow Event Type					Observations
		CW-14	CW-14	CW-14	DC3E-SW1	DC3E-SW5A	DC3E-SW10	DC3E-SW10	DC3E-SW14	
		CW-SW-14, CW-SW-14F	CW-SW-14, CW-SW-14F	CW-SW-14, CW-SW-14F	DC3E-SW1-01-082118	DC3E-SW5A-01-082118	DC3E-SW10-01-093018	DC3E-SW10-02-093018[1]	DC3E-SW14-01-093018	
		6/18/2015	5/2/2016	6/23/2016	8/21/2018	8/21/2018	9/30/2018	9/30/2018	9/30/2018	
		Low	High	Low	Low	Low	Low	Low	Low	
Total Aluminum	µg/L	-	310	140 J	1300 J	**4100**	<100 U	<100 U	590 J	2018 low-flow event higher
Total Arsenic	µg/L	**9.4 J**	3.9 U	3.9 U	4.3	5.2	3	3.2	3.1	2015 low-flow event higher
Total Barium	µg/L	460	380	430	330 J	420	**480**	**480**	430	No trend
Total Beryllium	µg/L	0.51 U	0.48 U	0.48 U	0.07 J	0.23 J	<0.5 U	<0.5 U	<0.5 U	No trend
Total Lead	µg/L	2.2 U	2.2 U	2.2 U	0.51 J-	**2 J-**	<2 U	<2 U	<2 U	No trend[2]
Total Mercury	µg/L	0.06 U	0.06 U	0.06 UJ	<0.2 U	<0.2 U	<0.2 U	<0.2 U	<0.2 U	No trend (all ND)
Total Molybdenum	µg/L	2.9 U	0.38 U	0.38 U	<2 U	<2 U	<2 U	<2 U	<2 U	No trend (all ND)
Radium-226	Activity (pCi/L)	**1.8**	0.53 J	0.93 J	1.6	1.53	<0.33 U	<0.29 U	0.47 LT	No trend
Radium-228	Activity (pCi/L)	0.55 U	-0.12 U	0.39 U	<0.48 U	<1.4 UJ	**0.92 LT**	0.87 LT	<0.68 U	2018 low-flow event higher
Total Selenium	µg/L	4.6 U	4.5 U	4.5 U	1.2 J	1.8 J	1.7 J	**2.3 J**	0.95 J	No trend[2]
Total Thallium	µg/L	6.2 U	5.4 U	5.4 U	<0.1 UJ	**0.01 J-**	<0.1 UJ	<0.1 UJ	<0.1 UJ	No trend[2]
Total Uranium	µg/L	**24**	17	23	23 J	16	20	20	12	No trend
Total Vanadium	µg/L	**18**	7.7	7.3 J	9.6 J	14	6.8	6.8	5.9	No trend
Dissolved Cadmium	µg/L	0.76 U	0.77 U	0.77 U	<2 U	<2 U	<2 U	<2 U	<2 U	No trend (all ND)
Dissolved Copper	µg/L	2.2 U	1.9 U	1.9 U	<20 U	**0.51 J**	<20 U	<20 U	<20 U	No trend[2]
Gross Alpha	Activity (pCi/L)	13.7	7.2	15.7	12.6	**18.7**	8.8	8.9	8	No trend

Notes:
The maximum detected result is in **bold** text.

1	Duplicate sample
2	No trend is evident because results are not directly comparable. Analyte was detected for the first time in 2018, but at lower limits than were achievable in the 2015 and 2016 events.
-	Not analyzed
<	The analyte was analyzed for, but was not detected. The reporting limit is shown in the result column.
µg/L	Micrograms per liter
AUM	Abandoned uranium mine
ID	Identification
J	Estimated value
J-	Estimated value, may be biased low.
LT	Result less than requested minimum detectable concentration, but greater than the sample-specific detectable concentration.
M3	The requested minimum detected concentration was not met, but the reported activity is greater than the reported minimum.
ND	Nondetect
pCi/L	Picocuries per liter
RSE	Removal site evaluation
U	Not detected. The associated value is the reporting limit.
UJ	Not considered detected. The associated value is the reported concentration, which is estimated.

Table J-62. Comparison of 2018 RSE Investigation and the 2015 and 2016 Cove Wash Watershed Assessment Surface Water Concentrations for Analytes Typically Associated with AUMs in the Lower Middle 3 Drainage

Analyte	Units	CWWA Location Sample ID Flow Event Type			RSE Investigation Location Sample ID Flow Event Type	Observations
		CW-13	CW-13	CW-13	DC3-SW18A	
		CW-SW-13, CW-SW-13F	CW-SW-13, CW-SW-13F	CW-SW-13, CW-SW-13F	DC3-SW18A-01-082118	
		6/18/2015	5/2/2016	6/23/2016	8/21/2018	
		Low	High	Low	Low	
Total Aluminum	µg/L	-	310	160 J	**1300**	2018 low-flow event higher
Total Arsenic	µg/L	5.4 U	3.9 U	3.9 U	**4.8**	No trend[2]
Total Barium	µg/L	**430**	360	390	300	No trend
Total Beryllium	µg/L	0.51 U	0.48 U	0.48 U	<0.5 U	No trend (All ND)
Total Lead	µg/L	2.2 U	2.2 U	2.2 U	**0.45 J-**	No trend[2]
Total Mercury	µg/L	0.06 U	0.06 U	0.06 UJ	<0.2 U	No trend (All ND)
Total Molybdenum	µg/L	6.5 J	2.9	6.4	**8.3**	No trend
Radium-226	Activity (pCi/L)	**3.07**	0.93 J	1.57	2	No trend
Radium-228	Activity (pCi/L)	0.54 U	-0.06 U	0.45 U	<0.84 U	No trend (All ND)
Total Selenium	µg/L	4.6 U	4.5 U	4.5 U	**1.9 J**	No trend[2]
Total Thallium	µg/L	6.2 U	5.4 U	5.4 U	<0.1 UJ	No trend (All ND)
Total Uranium	µg/L	57	38	67	**72**	2018 low-flow event higher
Total Vanadium	µg/L	**21**	8.5	9.7 J	10	2015 low-flow event higher
Dissolved Cadmium	µg/L	0.76 U	0.77 U	0.77 U	<2 U	No trend (All ND)
Dissolved Copper	µg/L	2.2 U	1.9 U	1.9 U	<20 U	No trend (All ND)
Gross Alpha	Activity (pCi/L)	33	15.5	42.9	**46.8 M3**	No trend

Notes:
The maximum detected result is in **bold** text.

1	Duplicate sample
2	No trend is evident because results are not directly comparable. Analyte was detected for the first time in 2018, but at lower limits than were achievable in 2015 and 2016 events.
-	Not analyzed
<	The analyte was analyzed for, but was not detected. The reporting limit is shown in the result column.
µg/L	Micrograms per liter
AUM	Abandoned uranium mine
ID	Identification
J	Estimated value
J-	Estimated value, may be biased low.
LT	Result less than requested minimum detectable concentration, but greater than the sample-specific detectable concentration.
M3	The requested minimum detected concentration was not met, but the reported activity is greater than the reported minimum.
ND	Nondetect
pCi/L	Picocuries per liter
RSE	Removal site evaluation
U	Not detected. The associated value is the reporting limit.
UJ	Not considered detected. The associated value is the reported concentration, which is estimated.

Table J-63. Comparison of 2018 RSE Investigation and the 2015 and 2016 Cove Wash Watershed Assessment Surface Water Concentrations for Analytes Typically Associated with AUMs in the Middle 3E Drainage

Analyte	Units	CWWA Location Sample ID Flow Event Type	RSE Investigation Location Sample ID Flow Event Type		Observations
		CW-90	DC3-SW10	DC3-SW10	
		CW-SW-90-170426, CW-SW-90F-170426	DC3-SW10-01-082118	DC3-SW10-02-082118 [1]	
		4/26/2017	8/21/2018	8/21/2018	
		High	Low	Low	
Total Aluminum	µg/L	**3200**	570	580	2017 high flow event higher
Total Arsenic	µg/L	3 U	5.1	**4.9**	No trend
Total Barium	µg/L	**380**	240	230	No trend
Total Beryllium	µg/L	1.5 U	<0.5 U	<0.5 U	No trend (All ND)
Total Lead	µg/L	**1.8**	0.24 J-	0.13 J-	2017 high flow event higher
Total Mercury	µg/L	0.06 U	<0.2 U	<0.2 U	No trend (All ND)
Total Molybdenum	µg/L	3.1	**8.6**	7.9	2018 low flow event higher
Radium-226	Activity (pCi/L)	2.16	**2.46**	1.44	No trend
Radium-228	Activity (pCi/L)	0.47 U	<0.36 UJ	<0.56 UJ	No trend (All ND)
Total Selenium	µg/L	**4**	1.3 J	0.97 J	2017 high flow event higher
Total Thallium	µg/L	**3.2**	<0.1 UJ	<0.1 UJ	No trend (All ND)
Total Uranium	µg/L	43	**69**	64	2018 low flow event higher
Total Vanadium	µg/L	**18**	9.8	9	2015 low flow event higher
Dissolved Cadmium	µg/L	1.5 U	<2 U	<2 U	No trend (All ND)
Dissolved Copper	µg/L	3 U	<20 U	<20 U	No trend (All ND)
Gross Alpha	Activity (pCi/L)	**44.1**	34.1	36.6	No trend

Notes:
The maximum detected result is in **bold** text.

1	Duplicate sample
<	The analyte was analyzed for, but was not detected. The reporting limit is shown in the result column.
µg/L	Micrograms per liter
AUM	Abandoned uranium mine
ID	Identification
J	Estimated value
J-	Estimated value, may be biased low.
LT	Result less than requested minimum detectable concentration, but greater than the sample-specific detectable concentration.
ND	Nondetect
pCi/L	Picocuries per liter
RSE	Removal site evaluation
U	Not detected. The associated value is the reporting limit.
UJ	Not considered detected. The associated value is the reported concentration, which is estimated.

5.11 GEOCHEMICAL RESULTS

At Mesa IV Mine No. 2, an opportunistic sediment sample (M21-SD2-01-091218) was collected from an ephemeral drainage sample located between Waste Piles M21A and M21B and approximately 950 feet upslope of the Middle 2 drainage. The sediment sample contained total metals and radionuclides at concentrations higher than those observed in the Middle 2 drainage. To evaluate the potential leachability of the sediment containing mine waste, a split sample was submitted for geochemical analysis of leachable metals and radionuclides after synthetic precipitation leaching procedure (SPLP) and leachable metals after toxicity characteristic leaching procedure (TCLP), and evaluation of the acid generation potential of the sediment based on acid-base accounting (ABA). The laboratory analytical results for the geochemical soil samples are presented in Tables J1-10, J1-11, J1-12, and J1-13 of Attachment J1.

The majority of the SPLP results for the eight primary analytes were detects. However, leachable lead, molybdenum, and selenium were not detected in the SPLP leachate. The SPLP results for leachable arsenic, uranium, and vanadium concentrations were within the range of observed background concentrations for surface water and groundwater within the Cove Wash Watershed (Weston 2018). The SPLP results for leachable radium-226 exceeded the maximum background concentration observed within the Cove Wash watershed. Leachable thorium was detected but no range of background concentrations has been established for thorium.

The majority of the TCLP results were nondetects. Leachable arsenic, barium, and lead were detected in the TCLP leachate, but the results were below the permissible limits. The results indicate that the mine waste-impacted sediment sample met the TCLP requirements for disposal at a permitted landfill or a low-level radioactive waste disposal facility.

The ABA result was 74 tons of calcium carbonate equivalent per 1,000 tons of material (ppt $CaCO_3$). Samples with negative ABA values are considered acid producing while samples with positive ABA values are considered non-acid producing. The results indicate that the sediment sample is not acid producing.

The sediment leachate and ABA results demonstrate that the upslope sediment containing mine waste is unlikely to pose a threat to surface water quality, and by inference, sediment in Middle 2 drainage, with total metals and radionuclides concentrations much lower than the upslope sediment containing mine waste, is also unlikely to pose a threat to surface water quality. Additional source area sediment sampling would be required across all drainages to evaluate other source-related ephemeral sediment on downslope drainages.

6.0 SUMMARY OF OFFSITE MIGRATION

An evaluation of gamma survey and sediment sampling results indicate that the majority of AUMs appear to contribute to elevated concentrations of mine-related contaminants. For each drainage, gamma measurements and the concentrations of primary analytes relative to applied BTVs were considered, as well as the concentrations of analytes at each sampling location relative to upgradient and downgradient samples. Table J-64 presents the apparent mining-related contributors in each drainage, although the relative contribution of each AUM and Target in a drainage is not possible to determine. Table J-64 also identifies mines that have waste piles that are either within or adjacent to, or are directly eroding into the drainage, and presents the magnitude of exceedance of radium-226 and uranium concentrations as compared to the applied BTVs.

Figure J-54 through Figure J-55 identify the level of impact in each drainage reach based on the maximum concentrations of radium-226 and uranium compared to BTVs for the Tse Tah and Lukachukai Mountains Regions. Figure J-54 shows that with the exception of the Tse Tah West drainage, Step Mesa Wash, and Knife Edge Wash, all other sampled drainages have at least one radium-226 concentration that exceeds two times the applied BTV for sediment in regional drainages. Similarly, all drainages have at least one uranium concentration that exceeds two times the applied BTV for sediment in regional drainages, with the exception of Tse Tah West, Knife Edge Wash, and Middle 3G drainage. Although comparing maximum concentrations to the BTV is a conservative metric, the comparison shows that the majority of the drainages are impacted at least in some portions of a drainage reach by mine-related contaminants.

Radium-226 concentrations in Middle 1, Middle 1A, Middle 1B, Middle 2B, Middle 3, Middle 3E, Middle 3G exceed the BTV by over an order of magnitude (10 times). Some opportunistic sediment samples collected within or immediately downgradient of AUM waste piles within field mapped drainages (from Mesa II Mine No. 1, P-150, Mesa I Mine 12, Mesa I Mine 13, Mesa I Mine 14, Mesa IV Mine No. 2, Mesa I 1/2 Mine, and Mesa III Mine) also exceeded the radium-226 BTV by more than 10 times. The highest concentration of radium-226 was exhibited from within a drainage passing through a waste pile at Mesa III Mine, which flows into Middle 2B. The second highest concentration was from a sample collected along a drainage within Waste Pile M17 associated with Mesa V Mine – 103 that flows into Middle 1A drainage.

Uranium concentrations exceeded the BTV by over an order of magnitude (10 times) in all drainages except Tse Tah West, Cove Wash North, Middle 1G, Middle 3C, Middle 3D, Middle 3G, Knife Edge, and Step Mesa drainages. The two highest concentrations were detected at the same locations as the two highest radium-226 concentrations: from a sample collected along a drainage within Waste Pile M17 associated with Mesa V Mine – 103 that flows into Middle 1A drainage and from within a drainage passing through a waste pile at Mesa III Mine, which flows into Middle 2B. The sample collected below Mesa I Mine 12 waste pile upgradient of Middle 3E drainage exhibits the same elevated levels of elevated uranium concentration as the sample associated with Mesa III Mine.

The majority of Tronox AUMs have potential for offsite migration of contaminants in sediment via surface water runoff and active channel erosion; the SSRSEs discuss the offsite migration

potential at each Tronox AUM (Appendix H of the RSE Report) based on observations of waste piles, erosion, steepness of slope, and proximity to a drainage. Non-Tronox AUMs are also located in close proximity to drainages and may also contribute mine-related contaminants to drainages. Examples include the Middle 1B, 1C, and 1D drainages which do not contain a Tronox AUM, yet appear to contribute uranium and radionuclides to the Middle 1 drainage.

Table J-64. Summary of Apparent Primary Contributors to Drainages and Magnitude of Applied BTV Exceedance of Maximum Radium-226 and Uranium Concentrations

Drainage Name (No.)	Apparent Primary Contributors to Drainage[1]	Mines with Mine Waste Within and Adjacent to Drainage[2]	Ratio of Maximum Radium-226 Concentration / Applied BTV[3]	Ratio of Maximum Uranium Concentration / Applied BTV
Tse Tah West (DM1)	Brodie 1 (M1) Target T4 (BR-04)	Brodie 1 (M1)	1.0	1.2
Cove Wash North (DCWN)	Mesa VI Mine (M13) Frank Jr. Mine (M14) and Non-Tronox Mines	Mesa VI Mine (M13) Frank Jr. Mine (M14)	2.6	4.2
Middle 1 (DC1-1, DC1-2, DC1-3)	Mesa IV West Mine (M23) Middle 1C, 1D, 1E (Non-Tronox Mines)	Mesa IV West Mine (M23)	16	47
Middle 1A (DC1A)	Mesa V Incline (M15) Mesa V Adit (M16) Mesa V-103 (M17)	Mesa V Adit (M16) Mesa V-103 (M17)	62	260
Middle 1B (DC1B)	Mesa V - 508 Mine (M18) Mesa IV 1/2 Mine and Simpson 181 (M19) and Non-Tronox Mines	Mesa V - 508 Mine (M18) Mesa IV 1/2 Mine and Simpson 181 (M19)	29	59
Middle 1G (DC1-5)	Mesa IV Mine No. 2 (M21)	None	4.5	5.6
Cove Wash Middle (DT9)	Upgradient Cove Mines Cove Transfer Station (T9, T37, T38)	None	9.4	47
Middle 2 (DC2)	Mesa IV Mine No. 2 (M21)	None	7.0 [4]	50 [4]
			43 (M21)	154 (M21)
Middle 2A (DC2A)	Mesa IV Mine No.1 (M20) Mesa IV Mine No.3 (M22)	None	5.9	40
Middle 2B (DC2B)	Mesa II 1/2 Mine (M30) Mesa II 1/2 Mine 4 (M31) Mesa III Mine (M32)	Mesa II 1/2 Mine (M30) Mesa II 1/2 Mine 4 (M31) Mesa III Mine (M32)	51 [4]	139 [4]
			73 (M32)	174 (M32)
Middle 3 (DC3)	Upgradient Middle 3A and 3E Mines Mesa II Pit (M24)	None	10	16
Middle 3A (DC3A)	Mesa II Mine 4 Henry Phillips Mine (M11)	None	9.2	12

Table J-64. Summary of Apparent Primary Contributors to Drainages and Magnitude of Applied BTV Exceedance of Maximum Radium-226 and Uranium Concentrations (Continued)

Drainage Name (No.)	Apparent Primary Contributors to Drainage[1]	Mines with Mine Waste Within and Adjacent to Drainage[2]	Ratio of Maximum Radium-226 Concentration / Applied BTV[3]	Ratio of Maximum Uranium Concentration / Applied BTV
Middle 3B (DC3B)	Mesa I 3/4 Mine No. 2, P150 (M26) Mesa II Mine No. 1 and No. 2 and P-21 (M27) Mesa II Mine No. 1, P-150 (M28)	Mesa II Mine No. 1 and No. 2 and P-21 (M27) Mesa II Mine No. 1, P-150 (M28)	6.1 [4]	12 [4]
			11 (M28)	17 (M28)
Middle 3C (DC3C)	Mesa I 3/4 incline (M25)	Mesa I 3/4 incline (M25)	3.9 [4]	3.1 [4]
			5.6 (M25)	17 (M25)
Middle 3D (DC3D)	Mesa I 1/2, West Mine (M12)	Mesa I 1/2, West Mine (M12)	2.4	2.1
Middle 3E (DC3E)	Mesa I Mine 12 (M5) Mesa I Mine 14 (M7) Target T16 (M1-04) Target T36 (M1-06) Mesa I 1/2 Mine (M10) Mesa I 1/4 Mine (M9)	Mesa I Mine 12 (M5) Target T16 (M1-04) Target T36 (M1-06) Mesa I 1/2 Mine (M10)	9.9 [4]	19 [4]
			58 (M5)	174 (M5)
			24 (M7)	30 (M7)
			48 (M10)	85 (M10)
Middle 3F (DC3F)	Mesa I Mine 10 (M3) Mesa I Mine 13 (M6) Mesa I Mine 15 (M8)	Mesa I Mine 10 (M3) Mesa I Mine 13 (M6) Mesa I Mine 15 (M8)	9.9 [4]	38 [4]
			13 (M6)	38 (M6)
Middle 3G (DC3G)	Upgradient Middle 3F Mines	None	19	1.7
Knife Edge (DM33)	None	None	1.1	1.3
Black Mesa (DM35)	Black No.1 Mine (M34) Black No.2 Mine (M35) Black No.2 Mine (West) (M36) Flag No.1 Mine (M37)	Black No.1 Mine (M34) Black No.2 Mine (M35)	2.3	57
Tommy James (DM39)	Step Mesa Mine (M38) Tommy James Mine (M39)[1]	None	1.1	3.3

Notes:

[1] Based on apparent increase in primary analyte concentrations or gamma measurements downgradient of mine.

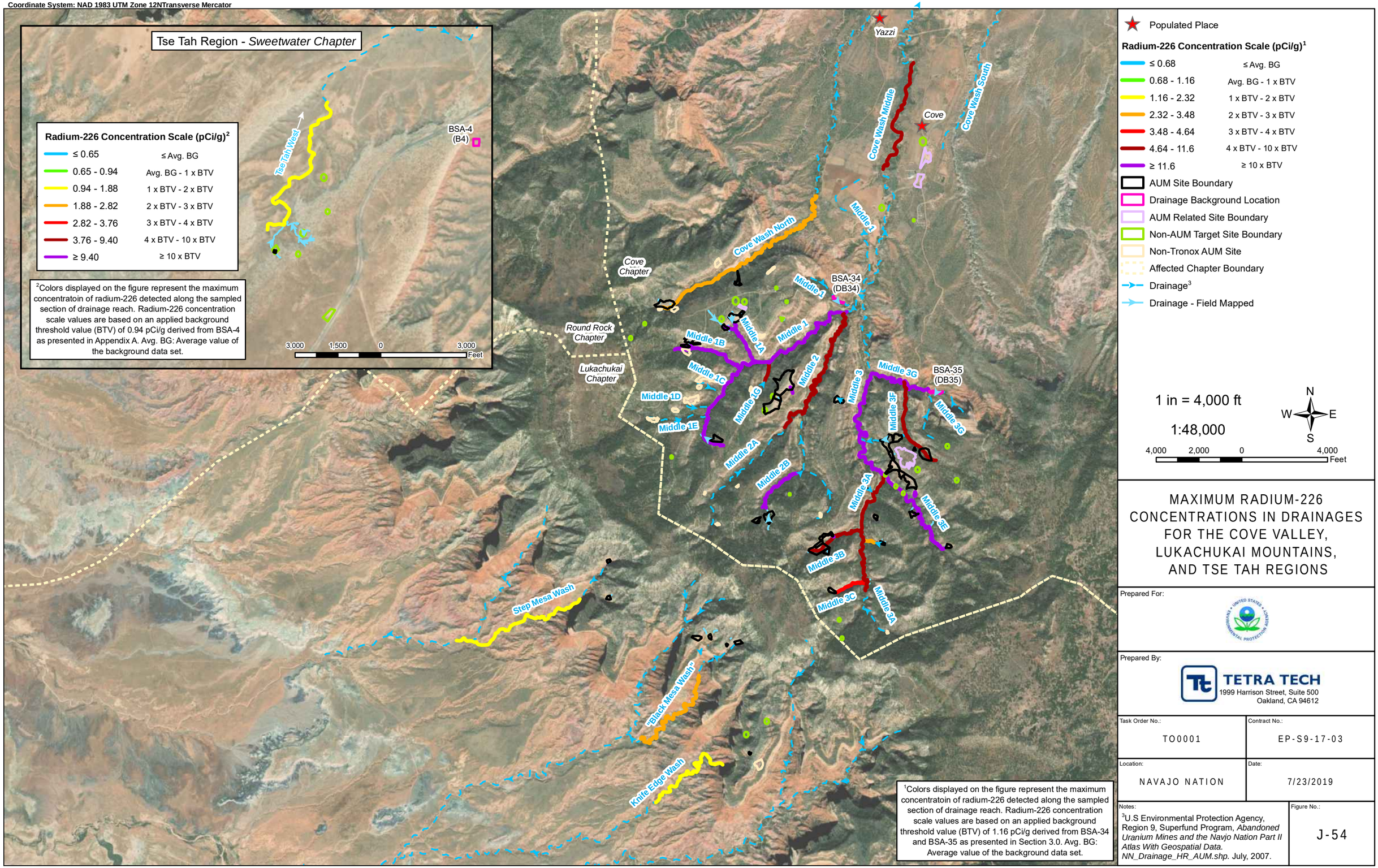
[2] Mines with unreclaimed waste piles within 500 feet of field-mapped drainage, where primary analyte concentrations or gamma activity showed increases in downgradient samples or measurements.

[3] M numbers in parentheses are Tetra Tech mine IDs, and indicate that the sample with the concentration/applied BTV represented was an opportunistic sample collected within a mine survey boundary.

[4] Value of maximum concentration within the drainage / applied BTV excluding the opportunistic samples.

BTV Background threshold value

Coordinate System: NAD 1983 UTM Zone 12NTransverse Mercator



MAXIMUM RADIUM-226 CONCENTRATIONS IN DRAINAGES FOR THE COVE VALLEY, LUKACHUKAI MOUNTAINS, AND TSE TAH REGIONS

Prepared For:

Prepared By:

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1999 Harrison Street, Suite 500
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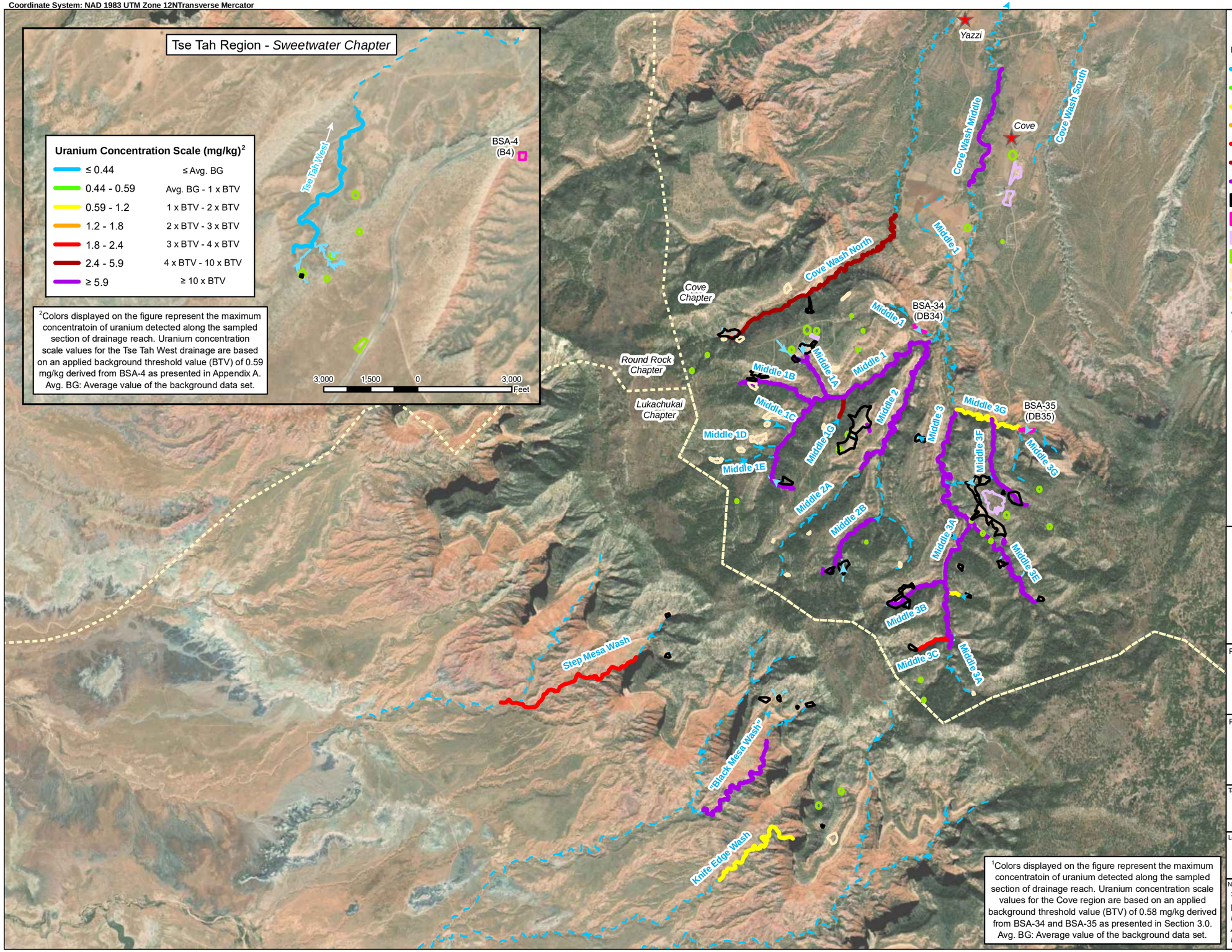
Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location:	**Date:**
NAVAJO NATION	7/23/2019

Notes:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: J-54

Coordinate System: NAD 1983 UTM Zone 12NTransverse Mercator



Populated Place

Uranium Concentration Scale (mg/Kg)[1]

≤ 0.35	≤ Avg. BG
0.35 - 0.58	Avg. BG - 1 x BTV
0.58 - 1.2	1 x BTV - 2 x BTV
1.2 - 1.7	2 x BTV - 3 x BTV
1.7 - 2.3	3 x BTV - 4 x BTV
2.3 - 5.8	4 x BTV - 10 x BTV
≥ 5.8	≥ 10 x BTV

- AUM Site Boundary
- Drainage Background Location
- AUM Related Site Boundary
- Non-AUM Target Site Boundary
- Non-Tronox AUM Site
- Affected Chapter Boundary
- Drainage[3]
- Drainage - Field Mapped

1 in = 4,000 ft

1:48,000

N W E S

4,000 2,000 0 4,000 Feet

MAXIMUM URANIUM CONCENTRATIONS IN DRAINAGES FOR THE COVE VALLEY, LUKACHUKAI MOUNTAINS, AND TSE TAH REGIONS

Prepared For:

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TETRA TECH
1999 Harrison Street, Suite 500
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Notes:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: J-55

7.0 CONCLUSIONS

Tetra Tech conducted an RSE investigation of the Northern Agency Tronox Mine drainages in 2018. There were several field mobilizations into the drainages as part of the Baseline Study and the Site Characterization Study. A comprehensive gamma radiation survey was performed within all drainages correlated with the 39 Tronox mines and select Targets. Sediment samples were collected from drainages within the Tse Tah, Lukachukai Mountains, and Cove Valley Regions and analyzed for metals and radionuclides, while surface water samples were collected from drainages with flowing water and analyzed for metals, radionuclides, and water quality parameters. Table J-65 identifies drainages with primary analytes and/or gamma radiation exceeding two times the applied BTV, which may be indicative of mining-related contamination requiring removal action or source control at individual AUMs. The conclusions from the drainage investigation are:

- Drainages are impacted from mining-related activities conducted within the Cove Valley Region and Lukachukai Mountains Region.
- The Tse Tah West drainage and Knife Edge drainage appear to be minimally impacted by mining-related activities in the drainage reaches where surveys and sampling were conducted.
- Offsite migration via the surface water pathway is occurring from multiple AUMs in a majority of the drainages. The most likely sources of contamination migrating into drainages are waste piles eroding off cliffs into drainages, or from onsite waste piles that have local drainages passing through or along the base of the waste piles.
- Linear extents of radiological contamination within the drainages were well documented through gamma radiation surveys, and the full longitudinal extent of radiological contamination above the applied BTV levels has been delineated except for areas where there was a poor GPS signal or areas that were inaccessible because of waterfalls or other hazardous terrain.
- Each primary analyte exceeded background concentrations in sediment in at least one drainage. Concentrations of arsenic, lead, and thorium infrequently exceeded BTVs within the drainages.
- Radium-226, uranium, and vanadium, all strong indicators of mine waste, are present at elevated levels in sediment in the majority of the drainages.
- Surface water in the Middle 3 and Middle 3E drainages exceeded maximum background concentrations (Weston 2018) of molybdenum in all samples collected from Middle 3 and radium-226 at one of six sample locations, but did not exceed background concentrations of other primary analytes. Sufficient flow was not observed in other drainages in September 2018.
- Mine-related analyte concentrations identified during the Tetra Tech 2018 low-flow surface water sampling are generally similar to the Weston Cove Wash watershed study (Weston 2018) concentrations in 2015, 2016, and 2017 during both low- and high-flow regimes, with few exceptions.

In general, the RSE investigation was successful at fulfilling most of the DQOs, and few data gaps remain for the drainages. The remaining data gaps are further investigation in areas with poor GPS signal (portions of Cove Wash North, Middle 1, Middle 2, Middle 3, and Middle 3E drainages) to better understand the linear extent of contamination in these areas. Advanced GPS-enabled equipment would be required to complete investigation in these areas, which was not available during the RSE investigation. The drainage east of the Knife Edge drainage was identified as containing a waste pile associated with Target T33 (KE-01), which has dropped over a cliff to a lower bench. Potential migration of the waste to the drainage several hundred feet below is not known. The drainage on the south side of Knife Edge mesa, where Target T33 (KE-01) is located, was not sampled; therefore, evaluation of primary analytes in sediment and gamma radiation levels remain a data gap.

Table J-65. Summary of Sediment Sampling and Gamma Survey Results Indicating Potential Impacts from Mine Waste within Drainages

Drainage ID[1]	Drainage Name	Soil Sampling Results Indicate Potential Impacts?	Gamma Survey Results Indicate Potential Impacts?
DM1	Tse Tah West	No (<2x BTV)	No (median <BTV)
DCWN	Cove Wash North	Yes (>2x BTV)	Yes, downgradient of Frank Jr. Mine (median <BTV, maximum value >2x BTV)
DC1	Middle 1	Yes (>2x BTV)	Yes, in multiple areas downgradient of Middle 1D confluence (maximum value >2x BTV)
DC1A	Middle 1A	Yes (>2x BTV)	Yes (maximum value >2x BTV)
DC1B	Middle 1B	Yes (>2x BTV)	Yes (maximum value >2x BTV)
DC1G	Middle 1G	Yes (>2x BTV)	No (maximum value >2x BTV, median <BTV)
DT9	Cove Wash Middle	Yes (>2x BTV)	Yes (maximum value >2x BTV)
DC2, M21	Middle 2	Yes (>2x BTV)	Yes (maximum value >2x BTV)
DC2A	Middle 2A	Yes (>2x BTV)	No (median <BTV)
DC2B, M32	Middle 2B	Yes (>2x BTV)	Yes (maximum value >2x BTV)
DC3	Middle 3	Yes (>2x BTV)	Yes (maximum value >2x BTV)
DC3A	Middle 3A	Yes (>2x BTV)	Yes (maximum value >2x BTV)
DC3B, M28	Middle 3B	Yes (>2x BTV)	Yes (maximum value >2x BTV)
DC3C, M25	Middle 3C	Yes (>2x BTV)	Yes (maximum value >2x BTV)
DC3D	Middle 3D	Yes (>2x BTV)	Yes (maximum value >2x BTV)
DC3E, M5, M7, M10	Middle 3E	Yes (>2x BTV)	No (median <BTV)
DC3F, M6	Middle 3F	Yes (>2x BTV)	Yes (maximum value >2x BTV)
DC3G	Middle 3G	No (<2x BTV)	Yes (maximum value >2x BTV)
DM33	Knife Edge	Yes (>2x BTV)	No (maximum value <BTV)
DM35	Black Mesa	Yes (>2x BTV)	No (maximum value <2xBTV)
DM39	Tommy James	Yes (>2x BTV)	No (maximum value <BTV)

Note:

[1] Drainage IDs beginning with “M” indicate that an opportunistic sediment sample was collected downgradient of a waste pile associated with the mine with that Tetra Tech ID.

BTV Background threshold value

8.0 REFERENCES

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ATTACHMENT J1

SEDIMENT AND SURFACE WATER SAMPLING RESULTS TABLES

Table J1-1. Summary of Geospatial Locations of Sediment Samples

Sample ID	Drainage Channel ID	Depth (inches)	Sample Type	Sample QC	Date Sampled	Latitude	Longitude
DM1-SD17-01-081918	Tse Tah West	0-6	Sediment Sample	Primary	8/19/2018	36.9079354	-109.3528254
DM1-SD16-01-081918	Tse Tah West	0-6	Sediment Sample	Primary	8/19/2018	36.90800831	-109.3520713
DM1-SD15-01-081918	Tse Tah West	0-6	Sediment Sample	Primary	8/19/2018	36.90864193	-109.3513621
DM1-SD14-01-081918	Tse Tah West	0-6	Sediment Sample	Primary	8/19/2018	36.90941341	-109.351569
DM1-SD13-01-081918	Tse Tah West	0-6	Sediment Sample	Primary	8/19/2018	36.90953944	-109.3526306
DM1-SD12-01-081918	Tse Tah West	0-6	Sediment Sample	Primary	8/19/2018	36.91017959	-109.3523059
DM1-SD11-01-081918	Tse Tah West	0-6	Sediment Sample	Primary	8/19/2018	36.91085037	-109.3515858
DM1-SD10-01-081918	Tse Tah West	0-6	Sediment Sample	Primary	8/19/2018	36.91152303	-109.3510144
DM1-SD9-01-081918	Tse Tah West	0-6	Sediment Sample	Primary	8/19/2018	36.91160261	-109.3500195
DM1-SD8-01-081918	Tse Tah West	0-6	Sediment Sample	Primary	8/19/2018	36.91215948	-109.3492146
DM1-SD7-01-081918	Tse Tah West	0-6	Sediment Sample	Primary	8/19/2018	36.91300138	-109.3491776
DM1-SD6-01-081918	Tse Tah West	0-6	Sediment Sample	Primary	8/19/2018	36.9138838	-109.3493366
DM1-SD5-01-081918	Tse Tah West	0-6	Sediment Sample	Primary	8/19/2018	36.91450146	-109.3493064
DM1-SD4-01-081918	Tse Tah West	0-6	Sediment Sample	Primary	8/19/2018	36.91541464	-109.3491805
DM1-SD3-01-081918	Tse Tah West	0-6	Sediment Sample	Primary	8/19/2018	36.91601001	-109.3482482
DM1-SD2-01-081918	Tse Tah West	0-6	Sediment Sample	Primary	8/19/2018	36.91641463	-109.34728
DM1-SD1-01-081918	Tse Tah West	0-6	Sediment Sample	Primary	8/19/2018	36.91717435	-109.3476851
DM1-SD1-02-081918	Tse Tah West	0-6	Sediment Sample	Duplicate	8/19/2018	36.91717435	-109.3476851
DCWN-SD20-01-062418	Cove Wash North	0-6	Sediment Sample	Primary	6/24/2018	36.54659046	-109.2494823
DCWN-SD21-01-062418	Cove Wash North	0-6	Sediment Sample	Primary	6/24/2018	36.54605423	-109.2502482
DCWN-SD21-02-062418	Cove Wash North	0-6	Sediment Sample	Duplicate	6/24/2018	36.54605423	-109.2502482
DCWN-SD22-01-062418	Cove Wash North	0-6	Sediment Sample	Primary	6/24/2018	36.54561924	-109.2511227
DCWN-SD23-01-062418	Cove Wash North	0-6	Sediment Sample	Primary	6/24/2018	36.54552419	-109.2521833
DCWN-SD24-01-062418	Cove Wash North	0-6	Sediment Sample	Primary	6/24/2018	36.54529249	-109.253181
DCWN-SD25-01-062418	Cove Wash North	0-6	Sediment Sample	Primary	6/24/2018	36.54477392	-109.2542843
DCWN-SD26-01-062418	Cove Wash North	0-6	Sediment Sample	Primary	6/24/2018	36.54451721	-109.2551987
DCWN-SD27-01-062418	Cove Wash North	0-6	Sediment Sample	Primary	6/24/2018	36.54370185	-109.2561354
DCWN-SD28-01-062418	Cove Wash North	0-6	Sediment Sample	Primary	6/24/2018	36.54312302	-109.2567389
DCWN-SD28A-01-062418	Cove Wash North	0-6	Sediment Sample	Primary	6/24/2018	36.54290154	-109.2571485
DCWN-SD29-01-062418	Cove Wash North	0-6	Sediment Sample	Primary	6/24/2018	36.54253807	-109.2576529
DCWN-SD30-01-062418	Cove Wash North	0-6	Sediment Sample	Primary	6/24/2018	36.54246948	-109.2584864
DCWN-SD28B-01-062418	Cove Wash North	0-6	Sediment Sample	Primary	6/24/2018	36.54268852	-109.257331
DCWN-SD1-01-062418	Cove Wash North	0-6	Sediment Sample	Primary	6/24/2018	36.55456624	-109.2347169
DCWN-SD2-01-062418	Cove Wash North	0-6	Sediment Sample	Primary	6/24/2018	36.55388543	-109.2347723
DCWN-SD3-01-062418	Cove Wash North	0-6	Sediment Sample	Primary	6/24/2018	36.55354544	-109.2352073
DCWN-SD4-01-062418	Cove Wash North	0-6	Sediment Sample	Primary	6/24/2018	36.55322712	-109.2362216
DCWN-SD5-01-062418	Cove Wash North	0-6	Sediment Sample	Primary	6/24/2018	36.55253202	-109.2365889
DCWN-SD6-01-062418	Cove Wash North	0-6	Sediment Sample	Primary	6/24/2018	36.55229819	-109.2371469

Table J1-1. Summary of Geospatial Locations of Sediment Samples (Continued)

Sample ID	Drainage Channel ID	Depth (inches)	Sample Type	Sample QC	Date Sampled	Latitude	Longitude
DCWN-SD7-01-062418	Cove Wash North	0-6	Sediment Sample	Primary	6/24/2018	36.55211039	-109.2382017
DCWN-SD8-01-062418	Cove Wash North	0-6	Sediment Sample	Primary	6/24/2018	36.55166433	-109.2390437
DCWN-SD9-01-062418	Cove Wash North	0-6	Sediment Sample	Primary	6/24/2018	36.5511712	-109.239871
DCWN-SD10-01-062418	Cove Wash North	0-6	Sediment Sample	Primary	6/24/2018	36.55081068	-109.2408776
DCWN-SD11-01-062418	Cove Wash North	0-6	Sediment Sample	Primary	6/24/2018	36.55032173	-109.2415564
DCWN-SD11-02-062418	Cove Wash North	0-6	Sediment Sample	Duplicate	6/24/2018	36.55032173	-109.2415564
DCWN-SD12-01-062418	Cove Wash North	0-6	Sediment Sample	Primary	6/24/2018	36.55024665	-109.2424285
DCWN-SD13-01-062418	Cove Wash North	0-6	Sediment Sample	Primary	6/24/2018	36.54953909	-109.2429748
DCWN-SD14-01-062418	Cove Wash North	0-6	Sediment Sample	Primary	6/24/2018	36.54922629	-109.243897
DCWN-SD15-01-062418	Cove Wash North	0-6	Sediment Sample	Primary	6/24/2018	36.54858189	-109.2446839
DCWN-SD16-01-062418	Cove Wash North	0-6	Sediment Sample	Primary	6/24/2018	36.54806311	-109.2455787
DCWN-SD17-01-062418	Cove Wash North	0-6	Sediment Sample	Primary	6/24/2018	36.54773278	-109.2465636
DCWN-SD18-01-062418	Cove Wash North	0-6	Sediment Sample	Primary	6/24/2018	36.54714103	-109.2474539
DCWN-SD19-01-062418	Cove Wash North	0-6	Sediment Sample	Primary	6/24/2018	36.54704116	-109.2485435
DC1-SD1-01-062118	Middle 1	0-6	Sediment Sample	Primary	6/21/2018	36.54140059	-109.2305126
DC1-SD2-01-062118	Middle 1	0-6	Sediment Sample	Primary	6/21/2018	36.54143335	-109.2315654
DC1-SD3-01-062118	Middle 1	0-6	Sediment Sample	Primary	6/21/2018	36.54120608	-109.2324825
DC1-SD4-01-062118	Middle 1	0-6	Sediment Sample	Primary	6/21/2018	36.54033889	-109.232835
DC1-SD5-01-062118	Middle 1	0-6	Sediment Sample	Primary	6/21/2018	36.54009034	-109.233844
DC1-SD6-01-062118	Middle 1	0-6	Sediment Sample	Primary	6/21/2018	36.53973895	-109.2344565
DC1-SD7-01-062118	Middle 1	0-6	Sediment Sample	Primary	6/21/2018	36.53897573	-109.2349933
DC1-SD8-01-062118	Middle 1	0-6	Sediment Sample	Primary	6/21/2018	36.53881289	-109.2358312
DC1-SD8A-01-062118	Middle 1	0-6	Sediment Sample	Primary	6/21/2018	36.53845525	-109.2359805
DC1-SD9-01-062118	Middle 1	0-6	Sediment Sample	Primary	6/21/2018	36.53796288	-109.2365744
DC1-SD10-01-062118	Middle 1	0-6	Sediment Sample	Primary	6/21/2018	36.53767234	-109.2376409
DC1-SD11-01-062118	Middle 1	0-6	Sediment Sample	Primary	6/21/2018	36.53703454	-109.2382671
DC1-SD12-01-062118	Middle 1	0-6	Sediment Sample	Primary	6/21/2018	36.53661168	-109.2392547
DC1-SD13-01-062118	Middle 1	0-6	Sediment Sample	Primary	6/21/2018	36.53667024	-109.2402655
DC1-SD14-01-062118	Middle 1	0-6	Sediment Sample	Primary	6/21/2018	36.53605471	-109.2411406
DC1-SD15-01-062118	Middle 1	0-6	Sediment Sample	Primary	6/21/2018	36.53541327	-109.241915
DC1-SD16-01-062118	Middle 1	0-6	Sediment Sample	Primary	6/21/2018	36.53526555	-109.2428816
DC1-SD17-01-062118	Middle 1	0-6	Sediment Sample	Primary	6/21/2018	36.53527461	-109.2439717
DC1-SD17-02-062118	Middle 1	0-6	Sediment Sample	Duplicate	6/21/2018	36.53527461	-109.2439717
DC1-SD18-01-062118	Middle 1	0-6	Sediment Sample	Primary	6/21/2018	36.5351295	-109.2450901
DC1-SD19-01-062118	Middle 1	0-6	Sediment Sample	Primary	6/21/2018	36.5350689	-109.2459335
DC1-SD20-01-062118	Middle 1	0-6	Sediment Sample	Primary	6/21/2018	36.53453786	-109.2467164
DC1-SD21-01-062118	Middle 1	0-6	Sediment Sample	Primary	6/21/2018	36.53391279	-109.2472751
DC1-SD22-01-062118	Middle 1	0-6	Sediment Sample	Primary	6/21/2018	36.53362284	-109.2484111
DC1-SD23-01-062318	Middle 1	0-6	Sediment Sample	Primary	6/23/2018	36.53277326	-109.2487401

Table J1-1. Summary of Geospatial Locations of Sediment Samples (Continued)

Sample ID	Drainage Channel ID	Depth (inches)	Sample Type	Sample QC	Date Sampled	Latitude	Longitude
DC1-SD24-01-062318	Middle 1	0-6	Sediment Sample	Primary	6/23/2018	36.5321785	-109.2492962
DC1-SD25-01-062318	Middle 1	0-6	Sediment Sample	Primary	6/23/2018	36.53125654	-109.2495277
DC1-SD26-01-062318	Middle 1	0-6	Sediment Sample	Primary	6/23/2018	36.53073442	-109.2503976
DC1-SD27-01-062318	Middle 1	0-6	Sediment Sample	Primary	6/23/2018	36.52997278	-109.251125
DC1-SD28-01-062318	Middle 1	0-6	Sediment Sample	Primary	6/23/2018	36.52941824	-109.2518896
DC1-SD29-01-062318	Middle 1	0-6	Sediment Sample	Primary	6/23/2018	36.52801252	-109.2521588
DC1-SD30-01-062318	Middle 1	0-6	Sediment Sample	Primary	6/23/2018	36.52719335	-109.2525955
DC1-SD31-01-062318	Middle 1	0-6	Sediment Sample	Primary	6/23/2018	36.52626308	-109.2527913
DC1-SD32-01-062318	Middle 1	0-6	Sediment Sample	Primary	6/23/2018	36.52594024	-109.25313
DC1A-SD1-01-062018	Middle 1A	0-6	Sediment Sample	Primary	6/20/2018	36.53541625	-109.2443975
DC1A-SD2-01-062018	Middle 1A	0-6	Sediment Sample	Primary	6/20/2018	36.53596935	-109.2450166
DC1A-SD2-02-062018	Middle 1A	0-6	Sediment Sample	Duplicate	6/20/2018	36.53596935	-109.2450166
DC1A-SD3-01-062018	Middle 1A	0-6	Sediment Sample	Primary	6/20/2018	36.53687331	-109.2454443
DC1A-SD4-01-062018	Middle 1A	0-6	Sediment Sample	Primary	6/20/2018	36.53800227	-109.2462282
DC1A-SD5-01-062018	Middle 1A	0-6	Sediment Sample	Primary	6/20/2018	36.5388084	-109.2469063
DC1A-SD6-01-062018	Middle 1A	0-6	Sediment Sample	Primary	6/20/2018	36.53998222	-109.2473597
DC1A-SD7-01-062018	Middle 1A	0-6	Sediment Sample	Primary	6/20/2018	36.5395651	-109.2478492
DC1A-SD7A-01-062018	Middle 1A	0-6	Sediment Sample	Primary	6/20/2018	36.53985695	-109.2490079
DC1A-SD7A-0612-01-062018	Middle 1A	6-12	Sediment Sample	Primary	6/20/2018	36.53985695	-109.2490079
DC1B-SD1-01-062118	Middle 1B	0-6	Sediment Sample	Primary	6/21/2018	36.5346569	-109.2470433
DC1B-SD2-01-062118	Middle 1B	0-6	Sediment Sample	Primary	6/21/2018	36.53514111	-109.2479732
DC1B-SD3-01-062118	Middle 1B	0-6	Sediment Sample	Primary	6/21/2018	36.53550253	-109.2488157
DC1B-SD9-01-062218	Middle 1B	0-6	Sediment Sample	Primary	6/22/2018	36.5370587	-109.2561274
DC1B-SD8A-01-062218	Middle 1B	0-6	Sediment Sample	Primary	6/22/2018	36.5369899	-109.2551014
DC1B-SD8-01-062218	Middle 1B	0-6	Sediment Sample	Primary	6/22/2018	36.5372188	-109.25399
DC1B-SD7A-01-062218	Middle 1B	0-6	Sediment Sample	Primary	6/22/2018	36.53702596	-109.2530455
DC1B-SD7-01-062218	Middle 1B	0-6	Sediment Sample	Primary	6/22/2018	36.53700523	-109.2526337
DC1B-SD6-01-062218	Middle 1B	0-6	Sediment Sample	Primary	6/22/2018	36.53690283	-109.2515714
DC1B-SD5A-01-062218	Middle 1B	0-6	Sediment Sample	Primary	6/22/2018	36.53692393	-109.2514157
DC1B-SD5-01-062218	Middle 1B	0-6	Sediment Sample	Primary	6/22/2018	36.53661839	-109.2504745
DC1B-SD4-01-062218	Middle 1B	0-6	Sediment Sample	Primary	6/22/2018	36.53633002	-109.2494608
DC1B-SD4-02-062218	Middle 1B	0-6	Sediment Sample	Duplicate	6/22/2018	36.53633002	-109.2494608
DC1G-SD1-01-062118	Middle 1G	0-6	Sediment Sample	Primary	6/21/2018	36.53436576	-109.2423008
DC1G-SD2-01-062118	Middle 1G	0-6	Sediment Sample	Primary	6/21/2018	36.53359712	-109.2425622
DC1G-SD3-01-062118	Middle 1G	0-6	Sediment Sample	Primary	6/21/2018	36.532902	-109.2429374
DT9-SD1-01-062418	Cove Transfer Station	0-6	Sediment Sample	Primary	6/24/2018	36.57288774	-109.2187609
DT9-SD1-02-062418	Cove Transfer Station	0-6	Sediment Sample	Duplicate	6/24/2018	36.57288774	-109.2187609
DT9-SD2-01-062418	Cove Transfer Station	0-6	Sediment Sample	Primary	6/24/2018	36.57200457	-109.2188619
DT9-SD3-01-062418	Cove Transfer Station	0-6	Sediment Sample	Primary	6/24/2018	36.57129024	-109.218993

Table J1-1. Summary of Geospatial Locations of Sediment Samples (Continued)

Sample ID	Drainage Channel ID	Depth (inches)	Sample Type	Sample QC	Date Sampled	Latitude	Longitude
DT9-SD4-01-062418	Cove Transfer Station	0-6	Sediment Sample	Primary	6/24/2018	36.57060643	-109.2190597
DT9-SD5-01-062418	Cove Transfer Station	0-6	Sediment Sample	Primary	6/24/2018	36.56998981	-109.2197338
DT9-SD6-01-062418	Cove Transfer Station	0-6	Sediment Sample	Primary	6/24/2018	36.56906559	-109.2196216
DT9-SD7-01-062418	Cove Transfer Station	0-6	Sediment Sample	Primary	6/24/2018	36.56836857	-109.2199322
DT9-SD8-01-062418	Cove Transfer Station	0-6	Sediment Sample	Primary	6/24/2018	36.56744747	-109.2203149
DT9-SD9-01-062418	Cove Transfer Station	0-6	Sediment Sample	Primary	6/24/2018	36.56712117	-109.2209907
DT9-SD10-01-062418	Cove Transfer Station	0-6	Sediment Sample	Primary	6/24/2018	36.56660697	-109.2211102
DT9-SD11-01-062418	Cove Transfer Station	0-6	Sediment Sample	Primary	6/24/2018	36.56591091	-109.2216511
DT9-SD11-02-062418	Cove Transfer Station	0-6	Sediment Sample	Duplicate	6/24/2018	36.56591091	-109.2216511
DT9-SD12-01-062418	Cove Transfer Station	0-6	Sediment Sample	Primary	6/24/2018	36.56498953	-109.2218781
DT9-SD13-01-062418	Cove Transfer Station	0-6	Sediment Sample	Primary	6/24/2018	36.56455756	-109.2213842
DT9-SD14-01-062418	Cove Transfer Station	0-6	Sediment Sample	Primary	6/24/2018	36.56415627	-109.2204665
DT9-SD15-01-062418	Cove Transfer Station	0-6	Sediment Sample	Primary	6/24/2018	36.5635499	-109.220626
DT9-SD16-01-062418	Cove Transfer Station	0-6	Sediment Sample	Primary	6/24/2018	36.56307757	-109.2213843
DT9-SD17-01-062418	Cove Transfer Station	0-6	Sediment Sample	Primary	6/24/2018	36.5622139	-109.2214432
DT9-SD18-01-062418	Cove Transfer Station	0-6	Sediment Sample	Primary	6/24/2018	36.56155421	-109.2216397
DT9-SD19-01-062418	Cove Transfer Station	0-6	Sediment Sample	Primary	6/24/2018	36.56123244	-109.2225676
DT9-SD20-01-062418	Cove Transfer Station	0-6	Sediment Sample	Primary	6/24/2018	36.56020929	-109.2228316
DT9-SD21-01-062418	Cove Transfer Station	0-6	Sediment Sample	Primary	6/24/2018	36.5597098	-109.2235241
DC2-SD1-01-062118	Middle 2	0-6	Sediment Sample	Primary	6/21/2018	36.54112878	-109.2303641
DC2-SD2-01-062118	Middle 2	0-6	Sediment Sample	Primary	6/21/2018	36.54041307	-109.230253
DC2-SD3-01-062118	Middle 2	0-6	Sediment Sample	Primary	6/21/2018	36.53965229	-109.2302882
DC2-SD4-01-062118	Middle 2	0-6	Sediment Sample	Primary	6/21/2018	36.53906863	-109.2308275
DC2-SD5-01-062118	Middle 2	0-6	Sediment Sample	Primary	6/21/2018	36.53857808	-109.2315953
DC2-SD6-01-062118	Middle 2	0-6	Sediment Sample	Primary	6/21/2018	36.5379353	-109.2320392
DC2-SD7-01-062118	Middle 2	0-6	Sediment Sample	Primary	6/21/2018	36.53714504	-109.2321692
DC2-SD8-01-062118	Middle 2	0-6	Sediment Sample	Primary	6/21/2018	36.53627334	-109.2324837
DC2-SD9-01-062118	Middle 2	0-6	Sediment Sample	Primary	6/21/2018	36.5356653	-109.2330879
DC2-SD10-01-062118	Middle 2	0-6	Sediment Sample	Primary	6/21/2018	36.5348747	-109.2332965
DC2-SD11-01-062118	Middle 2	0-6	Sediment Sample	Primary	6/21/2018	36.5340607	-109.233541
DC2-SD12-01-062118	Middle 2	0-6	Sediment Sample	Primary	6/21/2018	36.53337213	-109.2343345
DC2-SD13-01-062118	Middle 2	0-6	Sediment Sample	Primary	6/21/2018	36.53281197	-109.2349781
DC2-SD14-01-062118	Middle 2	0-6	Sediment Sample	Primary	6/21/2018	36.53216165	-109.2352796
DC2-SD15-01-062118	Middle 2	0-6	Sediment Sample	Primary	6/21/2018	36.53164928	-109.2351072
DC2-SD16-01-062118	Middle 2	0-6	Sediment Sample	Primary	6/21/2018	36.53108083	-109.2356746
DC2-SD16-02-062118	Middle 2	0-6	Sediment Sample	Duplicate	6/21/2018	36.53108083	-109.2356746
DC2-SD17-01-062118	Middle 2	0-6	Sediment Sample	Primary	6/21/2018	36.53017102	-109.2360975
DC2-SD18-01-062118	Middle 2	0-6	Sediment Sample	Primary	6/21/2018	36.52935163	-109.2364681
M21-SD1-01-091218	Middle 2	0-6	Sediment Sample	Primary	9/12/2018	36.53115546	-109.2385542

Table J1-1. Summary of Geospatial Locations of Sediment Samples (Continued)

Sample ID	Drainage Channel ID	Depth (inches)	Sample Type	Sample QC	Date Sampled	Latitude	Longitude
M21-SD2-01-091218	Middle 2	0-6	Sediment Sample	Primary	9/12/2018	36.53177038	-109.2387148
DC2A-SD19-01-062118	Middle 2A	0-6	Sediment Sample	Primary	6/21/2018	36.52872996	-109.2371328
DC2A-SD20-01-062118	Middle 2A	0-6	Sediment Sample	Primary	6/21/2018	36.5285631	-109.2381713
DC2A-SD21-01-062118	Middle 2A	0-6	Sediment Sample	Primary	6/21/2018	36.52840879	-109.2391129
DC2A-SD22-01-062118	Middle 2A	0-6	Sediment Sample	Primary	6/21/2018	36.52759236	-109.2393031
DC2A-SD23-01-062118	Middle 2A	0-6	Sediment Sample	Primary	6/21/2018	36.52685047	-109.240001
DC2B-SD2-01-062218	Middle 2B	0-6	Sediment Sample	Primary	6/22/2018	36.52091775	-109.2381404
DC2B-SD3-01-062218	Middle 2B	0-6	Sediment Sample	Primary	6/22/2018	36.52066471	-109.2393102
DC2B-SD4-01-062218	Middle 2B	0-6	Sediment Sample	Primary	6/22/2018	36.52024178	-109.2399896
DC2B-SD5-01-062218	Middle 2B	0-6	Sediment Sample	Primary	6/22/2018	36.51973072	-109.2408647
DC2B-SD6-01-062218	Middle 2B	0-6	Sediment Sample	Primary	6/22/2018	36.51921359	-109.2417994
DC2B-SD7-01-062218	Middle 2B	0-6	Sediment Sample	Primary	6/22/2018	36.51855624	-109.2426163
DC2B-SD8-01-062218	Middle 2B	0-6	Sediment Sample	Primary	6/22/2018	36.51777897	-109.2433415
DC2B-SD8A-01-062218	Middle 2B	0-6	Sediment Sample	Primary	6/22/2018	36.51749887	-109.2432083
DC2B-SD9-01-062218	Middle 2B	0-6	Sediment Sample	Primary	6/22/2018	36.51670519	-109.2436275
DC2B-SD9-02-062218	Middle 2B	0-6	Sediment Sample	Duplicate	6/22/2018	36.51670519	-109.2436275
M32-SD1-01-092918	Middle 2B	0-6	Sediment Sample	Primary	9/29/2018	36.51531035	-109.244229
DC3-SD1-01-062318	Middle 3	0-6	Sediment Sample	Primary	6/23/2018	36.53312532	-109.2262051
DC3-SD2-01-062318	Middle 3	0-6	Sediment Sample	Primary	6/23/2018	36.53227066	-109.226611
DC3-SD3-01-062318	Middle 3	0-6	Sediment Sample	Primary	6/23/2018	36.53145502	-109.2270093
DC3-SD4-01-062318	Middle 3	0-6	Sediment Sample	Primary	6/23/2018	36.53056028	-109.2272981
DC3-SD5-01-062318	Middle 3	0-6	Sediment Sample	Primary	6/23/2018	36.5298044	-109.2273424
DC3-SD6-01-062318	Middle 3	0-6	Sediment Sample	Primary	6/23/2018	36.52911851	-109.2279187
DC3-SD7-01-062318	Middle 3	0-6	Sediment Sample	Primary	6/23/2018	36.5282638	-109.2281175
DC3-SD8-01-062318	Middle 3	0-6	Sediment Sample	Primary	6/23/2018	36.52756688	-109.2286674
DC3-SD9-01-062318	Middle 3	0-6	Sediment Sample	Primary	6/23/2018	36.52696173	-109.2280427
DC3-SD10-01-062318	Middle 3	0-6	Sediment Sample	Primary	6/23/2018	36.5261075	-109.2279021
DC3-SD11-01-062318	Middle 3	0-6	Sediment Sample	Primary	6/23/2018	36.52524756	-109.2280536
DC3-SD12-01-062318	Middle 3	0-6	Sediment Sample	Primary	6/23/2018	36.52457309	-109.2274319
DC3-SD13-01-062318	Middle 3	0-6	Sediment Sample	Primary	6/23/2018	36.52388489	-109.2272877
DC3-SD14-01-062318	Middle 3	0-6	Sediment Sample	Primary	6/23/2018	36.52293129	-109.2277158
DC3-SD15-01-062318	Middle 3	0-6	Sediment Sample	Primary	6/23/2018	36.52257143	-109.2272
DC3-SD16-01-062318	Middle 3	0-6	Sediment Sample	Primary	6/23/2018	36.52210611	-109.2264708
DC3-SD17-01-062318	Middle 3	0-6	Sediment Sample	Primary	6/23/2018	36.52160063	-109.2262201
DC3-SD18-01-062318	Middle 3	0-6	Sediment Sample	Primary	6/23/2018	36.52112701	-109.2252985
DC3-SD18A-01-082118	Middle 3	0-6	Sediment Sample	Primary	8/21/2018	36.52073312	-109.2247247
DC3-SD10-01-082118	Middle 3	0-6	Sediment Sample	Primary	8/21/2018	36.5261075	-109.2279021
DC3A-SD9-01-061818	Middle 3A	0-6	Sediment Sample	Primary	6/18/2018	36.51362182	-109.2280105
DC3A-SD10-01-061818	Middle 3A	0-6	Sediment Sample	Primary	6/18/2018	36.51268681	-109.2279707

Table J1-1. Summary of Geospatial Locations of Sediment Samples (Continued)

Sample ID	Drainage Channel ID	Depth (inches)	Sample Type	Sample QC	Date Sampled	Latitude	Longitude
DC3A-SD11-01-061818	Middle 3A	0-6	Sediment Sample	Primary	6/18/2018	36.51197806	-109.2279
DC3A-SD12-01-061818	Middle 3A	0-6	Sediment Sample	Primary	6/18/2018	36.51114734	-109.2279085
DC3A-SD13-01-061818	Middle 3A	0-6	Sediment Sample	Primary	6/18/2018	36.51040929	-109.2279898
DC3A-SD14-01-061818	Middle 3A	0-6	Sediment Sample	Primary	6/18/2018	36.50933862	-109.2276931
DC3A-SD15-01-061818	Middle 3A	0-6	Sediment Sample	Primary	6/18/2018	36.50866795	-109.2276897
DC3A-SD16-01-061818	Middle 3A	0-6	Sediment Sample	Primary	6/18/2018	36.50774014	-109.2275634
DC3A-SD17-01-061818	Middle 3A	0-6	Sediment Sample	Primary	6/18/2018	36.50676128	-109.2272126
DC3A-SD1-01-062318	Middle 3A	0-6	Sediment Sample	Primary	6/23/2018	36.51961395	-109.2245306
DC3A-SD2-01-062318	Middle 3A	0-6	Sediment Sample	Primary	6/23/2018	36.51865492	-109.2254058
DC3A-SD3-01-062318	Middle 3A	0-6	Sediment Sample	Primary	6/23/2018	36.51809621	-109.2260884
DC3A-SD4-01-062318	Middle 3A	0-6	Sediment Sample	Primary	6/23/2018	36.51740581	-109.2257948
DC3A-SD5-01-062318	Middle 3A	0-6	Sediment Sample	Primary	6/23/2018	36.51711186	-109.2270246
DC3A-SD6-01-062318	Middle 3A	0-6	Sediment Sample	Primary	6/23/2018	36.51633048	-109.2273686
DC3A-SD7-01-062318	Middle 3A	0-6	Sediment Sample	Primary	6/23/2018	36.51535378	-109.2278246
DC3A-SD8-01-062318	Middle 3A	0-6	Sediment Sample	Primary	6/23/2018	36.51459877	-109.2279719
DC3B-SD1-01-061918	Middle 3B	0-6	Sediment Sample	Primary	6/19/2018	36.5133784	-109.2281445
DC3B-SD2-01-061918	Middle 3B	0-6	Sediment Sample	Primary	6/19/2018	36.51341616	-109.2290727
DC3B-SD3-01-061918	Middle 3B	0-6	Sediment Sample	Primary	6/19/2018	36.51313655	-109.2300365
DC3B-SD4-01-061918	Middle 3B	0-6	Sediment Sample	Primary	6/19/2018	36.51305741	-109.2311867
DC3B-SD5-01-061918	Middle 3B	0-6	Sediment Sample	Primary	6/19/2018	36.51282133	-109.232255
DC3B-SD5-02-061918	Middle 3B	0-6	Sediment Sample	Duplicate	6/19/2018	36.51282133	-109.232255
DC3B-SD6-01-061918	Middle 3B	0-6	Sediment Sample	Primary	6/19/2018	36.51215377	-109.2331543
M28-SD2-01-092618	Middle 3B	0-6	Sediment Sample	Primary	9/26/2018	36.51287744	-109.2321606
M28-SD1-01-092618	Middle 3B	0-6	Sediment Sample	Primary	9/26/2018	36.51268537	-109.2325156
DC3C-SD1-01-061818	Middle 3C	0-6	Sediment Sample	Primary	6/18/2018	36.50660592	-109.2276901
DC3C-SD2-01-061818	Middle 3C	0-6	Sediment Sample	Primary	6/18/2018	36.50676502	-109.2287024
DC3C-SD3-01-061818	Middle 3C	0-6	Sediment Sample	Primary	6/18/2018	36.50638971	-109.2301265
DC3C-SD4-01-061818	Middle 3C	0-6	Sediment Sample	Primary	6/18/2018	36.50616413	-109.230788
DC3C-SD5-01-061818	Middle 3C	0-6	Sediment Sample	Primary	6/18/2018	36.5057377	-109.2317928
DC3C-SD3A-01-061818	Middle 3C	0-6	Sediment Sample	Primary	6/18/2018	36.50625072	-109.2305402
M25-SD1-01-092818	Middle 3C	0-6	Sediment Sample	Primary	9/28/2018	36.50563678	-109.2325219
DC3D-SD1-01-061918	Middle 3D	0-6	Sediment Sample	Primary	6/19/2018	36.51211014	-109.227454
DC3D-SD2-01-061918	Middle 3D	0-6	Sediment Sample	Primary	6/19/2018	36.51206266	-109.2263276
DC3D-SD1A-01-061918	Middle 3D	0-6	Sediment Sample	Primary	6/19/2018	36.51210735	-109.2270816
DC3E-SD1-01-062318	Middle 3E	0-6	Sediment Sample	Primary	6/23/2018	36.51978251	-109.2235936
DC3E-SD2-01-062318	Middle 3E	0-6	Sediment Sample	Primary	6/23/2018	36.51915167	-109.2228572
DC3E-SD3-01-062318	Middle 3E	0-6	Sediment Sample	Primary	6/23/2018	36.51902095	-109.2222723
DC3E-SD4-01-062318	Middle 3E	0-6	Sediment Sample	Primary	6/23/2018	36.51850585	-109.2216102
DC3E-SD5-01-062318	Middle 3E	0-6	Sediment Sample	Primary	6/23/2018	36.51771434	-109.2208583

Table J1-1. Summary of Geospatial Locations of Sediment Samples (Continued)

Sample ID	Drainage Channel ID	Depth (inches)	Sample Type	Sample QC	Date Sampled	Latitude	Longitude
DC3E-SD5A-01-062318	Middle 3E	0-6	Sediment Sample	Primary	6/23/2018	36.51709404	-109.2207066
DC3E-SD6-01-081718	Middle 3E	0-6	Sediment Sample	Primary	8/17/2018	36.51718526	-109.2197766
DC3E-SD7-01-081718	Middle 3E	0-6	Sediment Sample	Primary	8/17/2018	36.51634579	-109.2193922
DC3E-SD8-01-081718	Middle 3E	0-6	Sediment Sample	Primary	8/17/2018	36.51561059	-109.2188818
DC3E-SD9-01-081718	Middle 3E	0-6	Sediment Sample	Primary	8/17/2018	36.5148615	-109.2184078
DC3E-SD10-01-081718	Middle 3E	0-6	Sediment Sample	Primary	8/17/2018	36.51394871	-109.2179779
DC3E-SD11-01-081718	Middle 3E	0-6	Sediment Sample	Primary	8/17/2018	36.51313087	-109.2169076
DC3E-SD12-01-081718	Middle 3E	0-6	Sediment Sample	Primary	8/17/2018	36.5123327	-109.2168395
DC3E-SD13-01-081718	Middle 3E	0-6	Sediment Sample	Primary	8/17/2018	36.51173519	-109.2163708
DC3E-SD14-01-081718	Middle 3E	0-6	Sediment Sample	Primary	8/17/2018	36.51110513	-109.2155002
DC3E-SD15-01-081718	Middle 3E	0-6	Sediment Sample	Primary	8/17/2018	36.5108178	-109.2139959
DC3E-SD10-01-093018	Middle 3E	0-6	Sediment Sample	Primary	9/30/2018	36.51394871	-109.2179779
DC3E-SD1-01-082118	Middle 3E	0-6	Sediment Sample	Primary	8/21/2018	36.51978251	-109.2235936
DC3E-SD14-01-093018	Middle 3E	0-6	Sediment Sample	Primary	9/30/2018	36.51110513	-109.2155002
DC3E-SD5A-01-082118	Middle 3E	0-6	Sediment Sample	Primary	8/21/2018	36.51709404	-109.2207066
M10-SD1-01-081718	Middle 3E	0-6	Sediment Sample	Primary	8/17/2018	36.51630046	-109.2196865
M10-SD2-01-081718	Middle 3E	0-6	Sediment Sample	Primary	8/17/2018	36.51548279	-109.2189553
M5-SD1-01-062318	Middle 3E	0-6	Sediment Sample	Primary	6/23/2018	36.52066347	-109.2241601
M7-SD1-01-062318	Middle 3E	0-6	Sediment Sample	Primary	6/23/2018	36.51832952	-109.2214943
M7-SD2-01-081418	Middle 3E	0-6	Sediment Sample	Primary	8/14/2018	36.51774363	-109.2194345
M7-SD3-01-081418	Middle 3E	0-6	Sediment Sample	Primary	8/14/2018	36.51779149	-109.2195611
DC3F-SD1-01-062318	Middle 3F	0-6	Sediment Sample	Primary	6/23/2018	36.53201314	-109.2207756
DC3F-SD2-01-062318	Middle 3F	0-6	Sediment Sample	Primary	6/23/2018	36.53132322	-109.2205574
DC3F-SD3-01-062318	Middle 3F	0-6	Sediment Sample	Primary	6/23/2018	36.53041306	-109.2205505
DC3F-SD4-01-062318	Middle 3F	0-6	Sediment Sample	Primary	6/23/2018	36.52965356	-109.2207579
DC3F-SD5-01-062318	Middle 3F	0-6	Sediment Sample	Primary	6/23/2018	36.52870607	-109.2206938
DC3F-SD6-01-062318	Middle 3F	0-6	Sediment Sample	Primary	6/23/2018	36.52787014	-109.221114
DC3F-SD7-01-062318	Middle 3F	0-6	Sediment Sample	Primary	6/23/2018	36.52695836	-109.2210343
DC3F-SD7-02-062318	Middle 3F	0-6	Sediment Sample	Duplicate	6/23/2018	36.52695836	-109.2210343
DC3F-SD8-01-062318	Middle 3F	0-6	Sediment Sample	Primary	6/23/2018	36.52607641	-109.2207239
DC3F-SD9-01-062318	Middle 3F	0-6	Sediment Sample	Primary	6/23/2018	36.5252134	-109.2202544
DC3F-SD10-01-062318	Middle 3F	0-6	Sediment Sample	Primary	6/23/2018	36.52458666	-109.219466
DC3F-SD8A-01-062318	Middle 3F	0-6	Sediment Sample	Primary	6/23/2018	36.52579105	-109.2206884
M6-SD1-01-091618	Middle 3F	0-6	Sediment Sample	Primary	9/16/2018	36.5236968	-109.2181452
M6-SD2-01-091618	Middle 3F	0-6	Sediment Sample	Primary	9/16/2018	36.52327101	-109.2177179
M6-SD3-01-091618	Middle 3F	0-6	Sediment Sample	Primary	9/16/2018	36.52257725	-109.2169559
DC3G-SD1-01-062318	Middle 3G	0-6	Sediment Sample	Primary	6/23/2018	36.5334615	-109.2254674
DC3G-SD1-02-062318	Middle 3G	0-6	Sediment Sample	Duplicate	6/23/2018	36.5334615	-109.2254674
DC3G-SD2-01-062318	Middle 3G	0-6	Sediment Sample	Primary	6/23/2018	36.53320855	-109.2244806

Table J1-1. Summary of Geospatial Locations of Sediment Samples (Continued)

Sample ID	Drainage Channel ID	Depth (inches)	Sample Type	Sample QC	Date Sampled	Latitude	Longitude
DC3G-SD3-01-062318	Middle 3G	0-6	Sediment Sample	Primary	6/23/2018	36.53291417	-109.2235262
DC3G-SD4-01-062318	Middle 3G	0-6	Sediment Sample	Primary	6/23/2018	36.53288045	-109.2225809
DC3G-SD5-01-062318	Middle 3G	0-6	Sediment Sample	Primary	6/23/2018	36.53245545	-109.222454
DC3G-SD6-01-062318	Middle 3G	0-6	Sediment Sample	Primary	6/23/2018	36.5322942	-109.2214515
DM33-SD16-01-081818	Knife Edge	0-6	Sediment Sample	Primary	8/18/2018	36.47968295	-109.2608864
DM33-SD16-02-081818	Knife Edge	0-6	Sediment Sample	Duplicate	8/18/2018	36.47968295	-109.2608864
DM33-SD15-01-081818	Knife Edge	0-6	Sediment Sample	Primary	8/18/2018	36.48036912	-109.2602493
DM33-SD14-01-081818	Knife Edge	0-6	Sediment Sample	Primary	8/18/2018	36.4805608	-109.2590985
DM33-SD13-01-081818	Knife Edge	0-6	Sediment Sample	Primary	8/18/2018	36.48105448	-109.2586529
DM33-SD12-01-081818	Knife Edge	0-6	Sediment Sample	Primary	8/18/2018	36.48164317	-109.25792
DM33-SD11-01-081818	Knife Edge	0-6	Sediment Sample	Primary	8/18/2018	36.48240064	-109.2573254
DM33-SD10-01-081818	Knife Edge	0-6	Sediment Sample	Primary	8/18/2018	36.48285132	-109.2564978
DM33-SD9-01-081818	Knife Edge	0-6	Sediment Sample	Primary	8/18/2018	36.48264067	-109.2556847
DM33-SD8-01-081818	Knife Edge	0-6	Sediment Sample	Primary	8/18/2018	36.48304986	-109.2547293
DM33-SD7-01-081818	Knife Edge	0-6	Sediment Sample	Primary	8/18/2018	36.48353453	-109.2548632
DM33-SD6-01-081818	Knife Edge	0-6	Sediment Sample	Primary	8/18/2018	36.48402374	-109.2547133
DM33-SD5-01-081818	Knife Edge	0-6	Sediment Sample	Primary	8/18/2018	36.48469682	-109.2541932
DM33-SD4-01-081818	Knife Edge	0-6	Sediment Sample	Primary	8/18/2018	36.48506351	-109.253295
DM33-SD3-01-081818	Knife Edge	0-6	Sediment Sample	Primary	8/18/2018	36.48425854	-109.2527199
DM33-SD2-01-081818	Knife Edge	0-6	Sediment Sample	Primary	8/18/2018	36.48381794	-109.2519564
DM33-SD1-01-081818	Knife Edge	0-6	Sediment Sample	Primary	8/18/2018	36.48382642	-109.2508415
DM35-SD21-01-081818	Black Mesa	0-6	Sediment Sample	Primary	8/18/2018	36.48822893	-109.2612832
DM35-SD19-01-082018	Black Mesa	0-6	Sediment Sample	Primary	8/20/2018	36.48928571	-109.2602432
DM35-SD18-01-082018	Black Mesa	0-6	Sediment Sample	Primary	8/20/2018	36.48964718	-109.2596206
DM35-SD17-01-082018	Black Mesa	0-6	Sediment Sample	Primary	8/20/2018	36.48978947	-109.259022
DM35-SD16-01-082018	Black Mesa	0-6	Sediment Sample	Primary	8/20/2018	36.49020012	-109.2583708
DM35-SD15-01-082018	Black Mesa	0-6	Sediment Sample	Primary	8/20/2018	36.49049335	-109.2573929
DM35-SD14-01-082018	Black Mesa	0-6	Sediment Sample	Primary	8/20/2018	36.49075913	-109.2564494
DM35-SD13-01-082018	Black Mesa	0-6	Sediment Sample	Primary	8/20/2018	36.49150826	-109.2567532
DM35-SD12-01-082018	Black Mesa	0-6	Sediment Sample	Primary	8/20/2018	36.4914948	-109.2557254
DM35-SD11-01-082018	Black Mesa	0-6	Sediment Sample	Primary	8/20/2018	36.49214883	-109.2552992
DM35-SD10-01-082018	Black Mesa	0-6	Sediment Sample	Primary	8/20/2018	36.49291856	-109.2547226
DM35-SD9-01-082018	Black Mesa	0-6	Sediment Sample	Primary	8/20/2018	36.49375202	-109.2547181
DM35-SD8-01-082018	Black Mesa	0-6	Sediment Sample	Primary	8/20/2018	36.49438506	-109.2543843
DM35-SD7-01-082018	Black Mesa	0-6	Sediment Sample	Primary	8/20/2018	36.49532396	-109.2542789
DM35-SD20-01-081818	Black Mesa	0-6	Sediment Sample	Primary	8/18/2018	36.4884852	-109.2601974
DM39-SD17-01-081618	Tommy James	0-6	Sediment Sample	Primary	8/16/2018	36.5034582	-109.2813951
DM39-SD16-01-081618	Tommy James	0-6	Sediment Sample	Primary	8/16/2018	36.50304942	-109.2805442
DM39-SD16-02-081618	Tommy James	0-6	Sediment Sample	Duplicate	8/16/2018	36.50304942	-109.2805442

Table J1-1. Summary of Geospatial Locations of Sediment Samples (Continued)

Sample ID	Drainage Channel ID	Depth (inches)	Sample Type	Sample QC	Date Sampled	Latitude	Longitude
DM39-SD15-01-081618	Tommy James	0-6	Sediment Sample	Primary	8/16/2018	36.50302047	-109.2795382
DM39-SD14-01-081618	Tommy James	0-6	Sediment Sample	Primary	8/16/2018	36.50279054	-109.2786174
DM39-SD13-01-081618	Tommy James	0-6	Sediment Sample	Primary	8/16/2018	36.50301156	-109.2779414
DM39-SD12-01-081618	Tommy James	0-6	Sediment Sample	Primary	8/16/2018	36.50337097	-109.2773679
DM39-SD11-01-081618	Tommy James	0-6	Sediment Sample	Primary	8/16/2018	36.50413684	-109.276603
DM39-SD10-01-081618	Tommy James	0-6	Sediment Sample	Primary	8/16/2018	36.50398816	-109.2755648
DM39-SD9-01-081618	Tommy James	0-6	Sediment Sample	Primary	8/16/2018	36.50424269	-109.2745719
DM39-SD8-01-081618	Tommy James	0-6	Sediment Sample	Primary	8/16/2018	36.50480367	-109.2737397
DM39-SD7-01-081618	Tommy James	0-6	Sediment Sample	Primary	8/16/2018	36.50536951	-109.2730274

Notes:
ID Identification
QC Quality control

Table J1-2. Summary of Geospatial Locations of Surface Water Samples

Sample ID	Drainage Channel ID	Date Sampled	Latitude	Longitude
DC3-SW10-01-082118	Middle 3	8/21/2019	36.52618331	-109.2279418
DC3-SW18A-01-082118	Middle 3	8/21/2019	36.52073312	-109.2247247
DC3E-SW1-01-082118	Middle 3E/DC3E	8/21/2018	36.51976642	-109.2235275
DC3E-SW5A-01-082118	Middle 3E/DC3E	8/21/2018	36.51714291	-109.2202792
DC3E-SW14-01-093018	Middle 3E/DC3E	9/30/2018	36.51114565	-109.2155543
DC3E-SW10-01-093018	Middle 3E/DC3E	9/30/2018	36.51376688	-109.2172292

Table J1-3. Metals Laboratory Analytical Results for Sediment Samples (1 of 31)

Analyte	Units	Sample ID									
		DM1-SD1-01-081918	DM1-SD2-01-081918	DM1-SD3-01-081918	DM1-SD4-01-081918	DM1-SD5-01-081918	DM1-SD6-01-081918	DM1-SD7-01-081918	DM1-SD8-01-081918	DM1-SD9-01-081918	DM1-SD10-01-081918
		Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
Drainage Channel ID		Tse Tah West	Tse Tah West	Tse Tah West	Tse Tah West	Tse Tah West	Tse Tah West	Tse Tah West	Tse Tah West	Tse Tah West	Tse Tah West
Aluminum	mg/kg	1,700	1,700	1,900	1,600	1,800	920	1,200	1,600	1,300	1,500
Antimony	mg/kg	<0.099 U	<0.097 U	0.028 J	<0.094 U	0.044 J	<0.097 U	<0.099 U	<0.098 U	<0.095 U	<0.097 U
Arsenic	mg/kg	0.94	0.99	0.92	0.71	1.1	0.73	0.65	0.71	0.61	0.79
Barium	mg/kg	81 J	48	54	39	50	60	52	48	68	62
Beryllium	mg/kg	0.12	0.1	0.13	0.11	0.13	0.062	0.088	0.11	0.091	0.11
Cadmium	mg/kg	<0.2 U	<0.19 U	<0.19 U	<0.19 U	0.032 J	<0.19 U	<0.2 U	<0.2 U	<0.19 U	<0.19 U
Calcium	mg/kg	11,000	13,000	12,000	11,000	9,000	7,100	8,300	8,100	7,200	9,800
Chromium	mg/kg	1.3	1.3	1.6	1.4	1.6	<0.97 U	1.1	1.4	1.1	0.99
Cobalt	mg/kg	0.85	0.76	0.98	0.73	1.1	0.52	0.59	0.8	0.67	0.74
Copper	mg/kg	1.6 J	1.5 J	2	1.5 J	2.5	0.9 J	1.2 J	1.5 J	1.1 J	1.3 J
Iron	mg/kg	2,200	1,900	2,500	2,000	2,200	1,600	1,700	2,000	1,700	1,800
Lead	mg/kg	2	1.7	2.3	1.8	3.1	1.3	1.5	1.9	1.6	1.7
Lithium	mg/kg	2.7	3	3.1	2.5	2.7	1.5 J	1.9 J	2.5	1.9	2.3
Magnesium	mg/kg	1,100	1,400	1,400	1,200	1,200	590	810	1,100	840	990
Manganese	mg/kg	99	88	100	98	92	75	66	82	75	89
Mercury	mg/kg	0.015 J-	0.0023 J-	0.0029 J-	0.0022 J-	0.0032 J-	0.0022 J-	0.0018 J-	0.0023 J-	0.0018 J-	0.016 J-
Molybdenum	mg/kg	0.1 J	0.14 J	0.12 J	0.082 J	0.18 J	0.14 J	0.072 J	0.083 J	0.08 J	0.11 J
Nickel	mg/kg	1.4 J	1.4 J	1.7 J	1.4 J	1.6 J	0.88 J	1.1 J	1.3 J	1.1 J	1.2 J
Selenium	mg/kg	<0.99 U	<0.97 U	<0.93 U	<0.94 U	<0.96 U	<0.97 U	<0.99 U	<0.98 U	<0.95 U	<0.97 U
Silver	mg/kg	<0.05 U	<0.048 U	<0.047 U	<0.047 U	<0.048 U	<0.048 U	<0.05 U	<0.049 U	<0.047 U	<0.048 U
Sodium	mg/kg	<99 U	<97 U	<93 U	<94 U	20 J	<97 U	<99 U	17 J	<95 U	<97 U
Thallium	mg/kg	0.019	0.017	0.025	0.018	0.021	0.014	0.015	0.02	0.014	0.019
Thorium	mg/kg	1.1	0.94	1.3	1	1.2	0.74	1	1.1	0.92	0.95
Uranium	mg/kg	0.45	0.7	0.56	0.51	0.42	0.31	0.46	0.49	0.36	0.47
Vanadium	mg/kg	4.1	4.4	4.6	3.7	4.8	3	3.5	4	3.5	4.3
Zinc	mg/kg	<9.9 U	<9.7 U	5.1 J	17	4.8 J	<9.7 U	<9.9 U	<9.8 U	<9.5 U	<9.7 U

Table J1-3. Metals Laboratory Analytical Results for Sediment Samples (2 of 31)

Analyte	Units	Sample ID									
		DM1-SD11-01-081918	DM1-SD12-01-081918	DM1-SD13-01-081918	DM1-SD14-01-081918	DM1-SD15-01-081918	DM1-SD16-01-081918	DM1-SD17-01-081918	DCWN-SD1-01-062418	DCWN-SD2-01-062418	DCWN-SD3-01-062418
		Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
Drainage Channel ID		Tse Tah West	Tse Tah West	Tse Tah West	Tse Tah West	Tse Tah West	Tse Tah West	Tse Tah West	Cove Wash North	Cove Wash North	Cove Wash North
Aluminum	mg/kg	1,700	1,200	1100 J	2,100	1,200	1,600	1,500	3,300	2,400	1,800
Antimony	mg/kg	<0.1 U	<0.095 U	<0.099 UJ	0.035 J	<0.096 U	0.041 J	<0.099 U	0.063 J	0.072 J	0.052 J
Arsenic	mg/kg	0.98	0.8	0.59	1	0.75	1.3	0.93	1.6	1.6	1.4
Barium	mg/kg	62	76	67	69	95	85	62	160	120	120
Beryllium	mg/kg	0.12	0.089	0.079	0.15	0.085	0.15	0.11	0.14	0.14	0.11
Cadmium	mg/kg	<0.2 U	<0.19 U	<0.2 U	<0.19 U	<0.19 U	0.035 J	<0.2 U	0.06 J	<0.2 U	<0.2 U
Calcium	mg/kg	16,000	11,000	6,500	13,000	16,000	16,000	11,000	53,000	23,000	21,000
Chromium	mg/kg	1.3	1.1	1	1.5	0.98	1.3	1.3	3.2	2.7	2.5
Cobalt	mg/kg	2.5	0.63	0.59	1.1	0.67	1.1	0.8	2.2	1.5	1.1
Copper	mg/kg	1.7 J	1.2 J	1 J	2	1.2 J	1.8 J	1.5 J	2.7	1.7 J-	1.2 J-
Iron	mg/kg	2,100	1,800	1600 J	2,600	1,600	2,500	2,300	3,300	3,100	2,400
Lead	mg/kg	2.2	1.6	1.5	2.3	1.5	2.2	2.3	4.3	3.3	2.9
Lithium	mg/kg	2.6	1.9	1.7 J	3.8	2.3	2.5	2.2	4.9	3.8	3.1
Magnesium	mg/kg	1,100	860	720	1,700	820	1,000	890	6,000	3,500	2,800
Manganese	mg/kg	160	97	69	120	140	140	94	250	210	160
Mercury	mg/kg	0.0074 J-	0.0037 J-	0.0035 J-	0.0032 J-	0.0031 J-	0.0037 J-	0.0033 J-	<0.033UJ	0.0011 J-	<0.03 U
Molybdenum	mg/kg	0.13 J	0.098 J	0.067 J	0.1 J	0.51	0.15 J	0.13 J	0.072 J	0.22	0.18 J
Nickel	mg/kg	1.5 J	1.1 J	0.85 J	1.8 J	0.94 J	1.6 J	1.3 J	3.7	2.7	2
Selenium	mg/kg	<1 U	<0.95 U	<0.99 U	<0.97 U	<0.96 U	<0.94 U	<0.99 U	0.6 J	0.39 J	0.34 J
Silver	mg/kg	<0.05 U	<0.047 U	<0.049 U	<0.049 U	<0.048 U	<0.047 U	<0.05 U	<0.047 U	<0.05 U	<0.049 U
Sodium	mg/kg	<100 U	<95 U	<99 U	<97 U	<96 U	<94 U	<99 U	880	520	240
Thallium	mg/kg	0.02	0.017	0.014	0.025	0.015	0.021	0.022	0.027	0.023	<0.0098 UJ
Thorium	mg/kg	1.2	0.89	0.95 J	1.3	0.79	1.2	1.2	2.3	2.5	1.2
Uranium	mg/kg	0.62	0.42	0.39	0.68	0.47	0.39	0.3	0.26	0.35	0.27
Vanadium	mg/kg	4.4	3.4	3.2	5.5	3.3	4.3	4	8.2	6.8	8.5
Zinc	mg/kg	4.8 J	<9.5 U	<9.9 U	6 J	<9.6 U	5.8 J	<9.9 U	6.8 J	6.6 J	5.4 J

Table J1-3. Metals Laboratory Analytical Results for Sediment Samples (3 of 31)

Analyte	Units	Sample ID									
		DCWN-SD4-01-062418	DCWN-SD5-01-062418	DCWN-SD6-01-062418	DCWN-SD7-01-062418	DCWN-SD8-01-062418	DCWN-SD9-01-062418	DCWN-SD10-01-062418	DCWN-SD11-01-062418	DCWN-SD12-01-062418	DCWN-SD13-01-062418
		Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
Drainage Channel ID		Cove Wash North	Cove Wash North	Cove Wash North	Cove Wash North	Cove Wash North	Cove Wash North	Cove Wash North	Cove Wash North	Cove Wash North	Cove Wash North
Aluminum	mg/kg	2,500	2,400	2,000	1,900	2,300	1,800	1,600	5800 J	2,000	1,500
Antimony	mg/kg	0.055 J	0.042 J	0.039 J	0.042 J	0.048 J	0.055 J	0.036 J	0.062 J	0.068 J	<0.11 U
Arsenic	mg/kg	1.7 J	6.7	0.98	1	1.3	1.1	0.93	2	1.7	1.5
Barium	mg/kg	120	140	95	110	110	110	98	130	92	87
Beryllium	mg/kg	0.13	0.17	0.13	0.13	0.17	0.13	0.12	0.5 J	0.17	0.12
Cadmium	mg/kg	0.059 J	0.052 J	0.04 J	0.048 J	0.039 J	0.032 J	<0.19 U	0.058 J	<0.2 U	<0.22 U
Calcium	mg/kg	36,000	29,000	20,000	24,000	27,000	21,000	10,000	12,000	20,000	19,000
Chromium	mg/kg	2.8	2.7	3.1	2.8	2.8	2.9	2.4	4.4	2.4	2
Cobalt	mg/kg	1.8	1.4	1.3	1.2	1.4	1.2	0.94	3 J	1.3	0.86
Copper	mg/kg	1.8 J-	1.6 J-	1.3 J-	1.3 J-	1.9 J-	1.3 J-	1.2 J-	7.4	1.6 J-	1.2 J-
Iron	mg/kg	2,900	4,900	2,400	2,300	2,800	2,500	2,100	5900 J	2,900	1,700
Lead	mg/kg	3.5 J	3.2	2.8	2.9	3.3	2.8	2.2	6.5 J	3.4	2.1
Lithium	mg/kg	5	5.4	4.5	4.3	4.8	4.1	3.8	10 J	4.6	3.7
Magnesium	mg/kg	5,600	4,200	3,600	3,600	3,400	3,500	2,100	4700 J	2,500	1,700
Manganese	mg/kg	280	330	170	220	260	190	120	160	210	230
Mercury	mg/kg	<0.033 U	<0.033 U	<0.032 U	<0.032 U	<0.032 U	<0.032 U	0.00083 J-	0.0021 J-	<0.029 UJ	<0.035 UJ
Molybdenum	mg/kg	0.096 J	0.14 J	0.11 J	0.11 J	0.16 J	0.12 J	0.11 J	0.28	0.21	0.12 J
Nickel	mg/kg	3.2	2.1	2.3	2.1	2.2	2.2	1.5 J	3.6	1.9 J	1.2 J
Selenium	mg/kg	0.45 J	0.38 J	0.32 J	<1 U	0.45 J	<0.99 U	<0.93 U	0.57 J	0.37 J	<1.1 U
Silver	mg/kg	<0.051 U	<0.05 U	<0.048 U	<0.05 U	<0.049 U	<0.049 U	<0.046 U	0.038 J	<0.049 U	<0.056 U
Sodium	mg/kg	470	38 J	82 J	37 J	48 J	62 J	160	240	51 J	57 J
Thallium	mg/kg	0.021 J+	0.011	0.015	<0.01 UJ	0.016	0.013	0.01	0.041 J	0.011	<0.011 UJ
Thorium	mg/kg	1.7 J	1.3	1.3	1.2	1.4	1.2	0.9	2.7 J	1.4	0.91
Uranium	mg/kg	0.49 J	0.42	0.36	0.6	0.49	0.47	0.44	2.4 J	1.2	0.42
Vanadium	mg/kg	15 J	15	10	12	8	11	7.2	15	12	22
Zinc	mg/kg	7.1 J	8.2 J	6.5 J	5.9 J	7.1 J	7.6 J	5.5 J	18	7 J	<11 U

Table J1-3. Metals Laboratory Analytical Results for Sediment Samples (4 of 31)

Analyte	Units	Sample ID									
		DCWN-SD14-01-062418	DCWN-SD15-01-062418	DCWN-SD16-01-062418	DCWN-SD17-01-062418	DCWN-SD18-01-062418	DCWN-SD19-01-062418	DCWN-SD20-01-062418	DCWN-SD21-01-062418	DCWN-SD22-01-062418	DCWN-SD23-01-062418
		Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
Drainage Channel ID		Cove Wash North	Cove Wash North	Cove Wash North	Cove Wash North	Cove Wash North	Cove Wash North	Cove Wash North	Cove Wash North	Cove Wash North	Cove Wash North
Aluminum	mg/kg	1,600	2,200	2,000	2,100	1,400	2,300	2,000	2,300	1,900	2,000
Antimony	mg/kg	0.039 J	0.04 J	0.041 J	0.047 J	<0.095 U	0.051 J	0.04 J	0.05 J	0.039 J	0.035 J
Arsenic	mg/kg	0.85	1.1	1.4	1.2	0.82	1.4 J	1.3	1.7	1.1	1
Barium	mg/kg	88	81	74	72	74	93	94	80 J	210	120
Beryllium	mg/kg	0.14	0.15	0.15	0.14	0.11	0.18	0.16	0.18	0.16	0.17
Cadmium	mg/kg	0.055 J	<0.22 U	<0.24 U	<0.2 U	<0.19 U	<0.2 U	<0.19 U	<0.2 U	<0.2 U	<0.19 U
Calcium	mg/kg	58,000	6,600	9,500	7,000	5,500	6,200	13,000	9,200	7,600	7,400
Chromium	mg/kg	1.9	2.6	2.6	2.7	1.8	2.3	2.2	2.5	1.9	2
Cobalt	mg/kg	0.89	1.2	1.1	1.1	0.84	1.2	1.2	1.4	1.1	1.2
Copper	mg/kg	0.98 J-	1.4 J-	1.4 J-	1.7 J-	1.1 J-	1.7 J-	1.9	2 J-	1.6 J-	1.9 J-
Iron	mg/kg	1,800	2,500	2,500	2,400	2,000	3,000	2,800	3,200	2,800	3,000
Lead	mg/kg	1.9	2.7	2.6	2.9	1.9	3	2.8	2.9	2.6	2.9
Lithium	mg/kg	4	5.7	4	5.1	2.5	5.2	3.6	4.4	3.6	3.4
Magnesium	mg/kg	1,900	2,500	1,700	2,100	1,000	2100 J	1,500	1900 J	1,500	1,500
Manganese	mg/kg	280	110	130	200	120	130	180	190 J	150	140
Mercury	mg/kg	0.0012 J-	0.00099 J-	0.008 J-	0.0044 J-	0.0021 J-	0.002 J-	0.001 J-	0.0015 J-	0.0012 J-	0.0019 J-
Molybdenum	mg/kg	0.09 J	0.14 J	0.18 J	0.3	0.13 J	0.22	0.2	0.24	0.18 J	0.13 J
Nickel	mg/kg	1.4 J	1.7 J	1.4 J	1.7 J	1.1 J	1.5 J	1.5 J	1.8 J	1.4 J	1.4 J
Selenium	mg/kg	<1 U	<1.1 U	0.42 J	0.44 J	<0.95 U	<0.98 U	<0.96 U	0.38 J	<0.99 U	0.34 J
Silver	mg/kg	<0.051 U	<0.054 U	<0.059 U	<0.05 U	<0.047 U	<0.049 U	<0.048 U	<0.051 U	<0.05 U	<0.048 U
Sodium	mg/kg	34 J	67 J	54 J	25 J	<95 U	18 J	<96 U	19 J	32 J	21 J
Thallium	mg/kg	<0.01 UJ	<0.011 UJ	<0.012 UJ	0.011	<0.0095 UJ	0.014	0.014	0.013	0.014	0.012
Thorium	mg/kg	1.1	1.1	1.4	1.1	1	1.3	1.3	1.5	1.3	1.5
Uranium	mg/kg	0.3	0.82	0.71	1.2	0.29	0.38 J	0.59	0.48	0.49	0.55
Vanadium	mg/kg	19	19	19	41	6.4	47 J	8.8	8.7	9.1	7.9
Zinc	mg/kg	<10 U	6.7 J	6 J	19	5.1 J	7.7 J	7.1 J	7.6 J	7.5 J	7.9 J

Table J1-3. Metals Laboratory Analytical Results for Sediment Samples (5 of 31)

Analyte	Units	Sample ID									
		DCWN-SD24-01-062418	DCWN-SD25-01-062418	DCWN-SD26-01-062418	DCWN-SD27-01-062418	DCWN-SD28-01-062418	DCWN-SD28A-01-062418	DCWN-SD28B-01-062418	DCWN-SD29-01-062418	DCWN-SD30-01-062418	DC1-SD1-01-062118
		Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
Drainage Channel ID		Cove Wash North	Cove Wash North	Cove Wash North	Cove Wash North	Cove Wash North	Cove Wash North	Cove Wash North	Cove Wash North	Cove Wash North	Middle 1
Aluminum	mg/kg	2,400	2,500	1,500	2,000	2,900	1,300	3,000	2,100	2,300	3,600
Antimony	mg/kg	0.049 J	0.057 J	0.037 J	0.049 J	0.055 J	0.038 J	0.095 J	0.04 J	0.042 J	0.056 J
Arsenic	mg/kg	1.6	1.5	2.6	2	2.4	1.6	3.4	1.7	8.3	2.7
Barium	mg/kg	250	120	130	80	66	66	98	68	75	100
Beryllium	mg/kg	0.17	0.19	0.13	0.19	0.23	0.14	0.31	0.18	0.22	0.26
Cadmium	mg/kg	<0.2 U	<0.2 U	<0.19 U	<0.19 U	<0.2 U	<0.2 U	0.047 J	<0.2 U	<0.2 U	0.093 J
Calcium	mg/kg	18,000	8,600	6,400	7,100	7,300	3,900	11,000	13,000	6,200	46,000
Chromium	mg/kg	2.5	2.3	1.2	1.7	3.3	1.5	1.8	1.6	2.1	3.6
Cobalt	mg/kg	1.4	1.5	1.3	1.3	1.7	0.81	1.7	1.3	1.5	2.1
Copper	mg/kg	1.7 J-	2.4	2	2.2	2.6	1.2 J-	4.1	2.3	2.4	3.8
Iron	mg/kg	3,400	3,500	2,400	3,000	3,700	2,300	4,200	3,000	3,200	4,600
Lead	mg/kg	3.1	3.5	2.5	3	3.7	2.7	4.2	3.3	3.6	4.4
Lithium	mg/kg	4.6	4.4	2	2.8	5.2	1.5 J	3.3	2.8	3.9	8
Magnesium	mg/kg	2,000	2,000	820	1,200	2,100	630	1,400	1,200	1,600	3,500
Manganese	mg/kg	250	170	220	140	150	120	190	230	150	510
Mercury	mg/kg	0.0013 J-	0.0028 J-	<0.032 U	<0.032 U	<0.033 U	<0.033 U	<0.037 U	<0.031 U	<0.031 U	<0.03 U
Molybdenum	mg/kg	0.18 J	0.24	0.43	0.43	0.41	0.32	0.62	0.26	0.22	0.52
Nickel	mg/kg	1.6 J	1.6 J	0.9 J	1.3 J	2.1	0.89 J	1.8 J	1.4 J	1.6 J	3
Selenium	mg/kg	<0.98 U	0.37 J	<0.97 U	0.36 J	0.48 J	<0.99 U	0.75 J	0.39 J	0.32 J	0.98 J
Silver	mg/kg	<0.049 U	0.0089 J	0.011 J	0.01 J	0.014 J	<0.05 U	0.013 J	0.0089 J	0.009 J	0.014 J
Sodium	mg/kg	<98 U	<99 U	<97 U	<95 U	<98 U	<99 U	<110 U	<99 U	18 J	140
Thallium	mg/kg	0.015	0.018	0.012	0.019	0.024	<0.0099 UJ	0.027	0.02	0.029	0.044
Thorium	mg/kg	1.5	1.6	1	1.9	1.7	1.2	2.2	1.6	1.6	1.7
Uranium	mg/kg	0.55	0.69	0.41	0.74	0.94	0.44	1.3	0.82	0.77	8.1
Vanadium	mg/kg	9.3	10	8.6	8.8	11	5.2	11	29	17	63
Zinc	mg/kg	8.9 J	10	5.6 J	7.5 J	10	5 J	11	7.6 J	7.9 J	11

Table J1-3. Metals Laboratory Analytical Results for Sediment Samples (6 of 31)

Analyte	Units	Sample ID									
		DC1-SD2-01-062118	DC1-SD3-01-062118	DC1-SD4-01-062118	DC1-SD5-01-062118	DC1-SD6-01-062118	DC1-SD7-01-062118	DC1-SD8-01-062118	DC1-SD8A-01-062118	DC1-SD9-01-062118	DC1-SD10-01-062118
		Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
Drainage Channel ID		Middle 1	Middle 1	Middle 1	Middle 1	Middle 1	Middle 1	Middle 1	Middle 1	Middle 1	Middle 1
Aluminum	mg/kg	2,800	3,600	3,000	2,500	2,000	1,900	2,200	2,300	3,400	3,100
Antimony	mg/kg	0.047 J	0.074 J	0.061 J	0.052 J	0.051 J	0.058 J	0.053 J	0.055 J	0.072 J	0.041 J
Arsenic	mg/kg	2.4	3.1	1.6	3	1.6	1.9	1.6	2	2.8	2.7
Barium	mg/kg	80	140	61	77	56	64	83	120	75	78
Beryllium	mg/kg	0.19	0.25	0.19	0.17	0.13	0.24	0.15	0.15	0.23	0.2
Cadmium	mg/kg	0.037 J	0.042 J	<0.23 U	<0.2 U	<0.24 U	0.13 J	<0.23 U	0.059 J	0.037 J	0.043 J
Calcium	mg/kg	14,000	18,000	12,000	16,000	8,700	12,000	10,000	39,000	12,000	20,000
Chromium	mg/kg	2.9	4.9	3.5	2.6	2.2	4.2	3.2	2.9	4	3.5
Cobalt	mg/kg	1.7	3.2	1.5	1.5	1.1	1.4	1.2	1.4	2	1.8
Copper	mg/kg	2.7	3.8	2.1 J-	2.5	1.8 J-	4.3	1.5 J-	2.2	3.6	2.8
Iron	mg/kg	3,800	5,700	3,500	3,400	2,500	2,400	2,700	3,100	3,800	3,900
Lead	mg/kg	3.6	3.9	3.1	3.1	2.5	2.8	2.9	8.6	4.4	3.5
Lithium	mg/kg	6.6	8.7	7.3	5.7	4.8	7.8	5.5	5.2	8.1	7.1
Magnesium	mg/kg	2,800	9,300	2,900	2,300	1,800	1,900	2,200	1,900	3100 J	2,800
Manganese	mg/kg	170	690	140	150	100	140	110	460	160	200
Mercury	mg/kg	<0.032 U	<0.031 U	<0.039 U	<0.034 U	<0.04 U	<0.038 U	<0.037 U	<0.034 U	<0.031 U	<0.033 U
Molybdenum	mg/kg	0.42	0.33	0.36	0.62	0.98	0.61	0.44	0.26	0.69	0.54
Nickel	mg/kg	2.5	6.2	2.3	2.1	1.5 J	2.9	2 J	2.1	2.9	2.4
Selenium	mg/kg	1	0.52 J	0.45 J	0.58 J	0.44 J	0.81 J	<1.2 U	0.91 J	1.1	0.87 J
Silver	mg/kg	0.012 J	<0.051 U	<0.058 U	0.01 J	<0.06 U	0.079	<0.058 U	0.011 J	0.012 J	<0.053 U
Sodium	mg/kg	99 J	120	160	93 J	72 J	190	100 J	23 J	28 J	81 J
Thallium	mg/kg	0.036	0.034	0.026	0.026	0.019	0.027	0.02	0.03	0.044	0.038
Thorium	mg/kg	1.3	2.2	1.2	1.1	0.96	1.6	1.2	1.2	1.5	1.6
Uranium	mg/kg	7.6	1.3	5.3	11	5.3	7	5.4	11	14	8.2 J
Vanadium	mg/kg	44	12	30	57	48	49	30	100	73	42 J
Zinc	mg/kg	9.5 J	12	8.6 J	9.2 J	16	16	6.9 J	7.7 J	12	9.1 J

Table J1-3. Metals Laboratory Analytical Results for Sediment Samples (7 of 31)

Analyte	Units	Sample ID									
		DC1-SD11-01-062118	DC1-SD12-01-062118	DC1-SD13-01-062118	DC1-SD14-01-062118	DC1-SD15-01-062118	DC1-SD16-01-062118	DC1-SD17-01-062118	DC1-SD18-01-062118	DC1-SD19-01-062118	DC1-SD20-01-062118
		Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
Drainage Channel ID		Middle 1	Middle 1	Middle 1	Middle 1	Middle 1	Middle 1	Middle 1	Middle 1	Middle 1	Middle 1
Aluminum	mg/kg	2,900	2,800	2,800	2,200	<12 U	3,400	3800 J	1,800	2,500	2,600
Antimony	mg/kg	0.055 J	0.063 J	0.064 J	0.11 J	<0.12 U	0.075 J	0.077 J	0.056 J	0.043 J	0.043 J
Arsenic	mg/kg	2.2	2	3.1	24	<0.23 U	2.5	3.4 J	1.1	1.2	1.3
Barium	mg/kg	86	71	79	230	<0.58 U	140	170 J	110	87	63
Beryllium	mg/kg	0.19	0.16	0.17	0.16	<0.058 U	0.23	0.25 J	0.12	0.16	0.17
Cadmium	mg/kg	0.035 J	<0.2 U	0.052 J	0.072 J	<0.23 U	<0.26 U	0.074 J	<0.24 U	<0.23 U	<0.22 U
Calcium	mg/kg	8,400	8,300	26,000	69,000	<120 U	9,600	42000 J	11,000	8,900	7,900
Chromium	mg/kg	2.8	2.8	2.9	2.4	<1.2 U	4.2	4 J	1.8	2.7	2.8
Cobalt	mg/kg	1.6	1.5	1.8	1.6	<0.58 U	2	2.2 J	0.99	1.4	1.4
Copper	mg/kg	2.8	2.1	3	4.1	<2.3 UJ	2.8	3.4 J	1.2 J-	1.9 J-	1.7 J-
Iron	mg/kg	3,800	3,500	3,800	5,000	0.82 J	5,900	5500 J	2,400	3,200	3,200
Lead	mg/kg	3.5	3.4	3.7	5.1	<0.23 J	4.9	4.9 J	2.2	2.9	2.7
Lithium	mg/kg	6.5	6.9	6.6	5	<2.3 U	8.1	8.3 J	4.5	5.8	6
Magnesium	mg/kg	2,400	2,600	2,500	2,000	<12 J	3,000	3300 J	1,700	2,200	2,400
Manganese	mg/kg	130	120	250	1000	0.77	180	860 J	130	140	130
Mercury	mg/kg	<0.031 U	<0.03 U	<0.032 U	<0.037 U	<0.037 U	<0.039 U	<0.029 U	<0.036 U	<0.038 U	<0.038 U
Molybdenum	mg/kg	0.5	0.49	0.84	0.88	<0.23 U	0.32	1.9 J	0.19 J	0.11 J	0.16 J
Nickel	mg/kg	2.2	2.2	2.3	2 J	<2.3 U	2.8	3	1.3 J	1.8 J	1.9 J
Selenium	mg/kg	0.93 J	0.79 J	1.3	1.1 J	<1.2 U	1.4	1.1	0.55 J	0.69 J	0.74 J
Silver	mg/kg	0.0086 J	0.03 J	<0.05 U	0.01 J	<0.058 U	<0.064 U	0.013 J	<0.059 U	<0.058 U	<0.055 U
Sodium	mg/kg	34 J	55 J	50 J	52 J	<120 U	120 J	110	49 J	76 J	53 J
Thallium	mg/kg	0.036	0.028	0.05	0.077	<0.012 U	0.041	0.052 J	0.017	0.021	0.023
Thorium	mg/kg	1.4	1.2	2.2	1.2	<0.023 U	3	2.2 J	0.93	1.2	1.3
Uranium	mg/kg	11	8.6	9	6.3	0.0023 J	13	12	8.9	9.2	5.8
Vanadium	mg/kg	58	53	58	57	<0.58 U	88	76 J	79	55	29
Zinc	mg/kg	9.3 J	8.4 J	9.8 J	6.5 J	<12 U	11 J	12 J	<12 U	7.3 J	7.8 J

Table J1-3. Metals Laboratory Analytical Results for Sediment Samples (8 of 31)

Analyte	Units	Sample ID									
		DC1-SD21-01-062118	DC1-SD22-01-062118	DC1-SD23-01-062318	DC1-SD24-01-062318	DC1-SD25-01-062318	DC1-SD26-01-062318	DC1-SD27-01-062318	DC1-SD28-01-062318	DC1-SD29-01-062318	DC1-SD30-01-062318
		Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
Drainage Channel ID		Middle 1	Middle 1	Middle 1	Middle 1	Middle 1	Middle 1	Middle 1	Middle 1	Middle 1	Middle 1
Aluminum	mg/kg	3,700	2,300	2,100	1,500	2,600	2,600	2,000	1,800	2,000	2,400
Antimony	mg/kg	0.056 J	0.034 J	0.069 J	0.044 J	0.15 J	0.071 J	0.06 J	0.038 J	0.044 J	0.057 J
Arsenic	mg/kg	1.3	1	1	0.74	1.8	1.3	0.94	1	0.89	1
Barium	mg/kg	94	100	100	88	150 J	120	170	130	56	82
Beryllium	mg/kg	0.22	0.17	0.13	0.098	0.17	0.18	0.14	0.18	0.13	0.15
Cadmium	mg/kg	<0.23 U	<0.2 U	<0.19 U	<0.19 U	<0.2 U	<0.2 U	<0.19 U	<0.19 U	<0.19 U	<0.2 U
Calcium	mg/kg	9,300	6,800	7,600	3,500	14,000	7,600	11,000	6,800	6,400	4,700
Chromium	mg/kg	3.7	2.3	2.5	2	2.8	2.9	2	1.5	2.6	3.2
Cobalt	mg/kg	2	1.3	1.2	0.88	1.5	1.5	1.1	1.3	1.1	1.2
Copper	mg/kg	3.3	1.9 J-	1.7 J-	0.89 J-	2.8	2.3	1.7 J-	2.2	1.3 J-	1.5 J-
Iron	mg/kg	4,700	3,300	2,900	2,200	3,900	3,600	2,800	3,300	2,500	3,100
Lead	mg/kg	4.4	2.9	3	1.7	3.7	3.3	2.8	2.6	2.1	2.6
Lithium	mg/kg	9	4.8	5.7	4	6.7	6.4	5.3	2.9	5.2	5.6
Magnesium	mg/kg	3,300	1,800	1,900	1,400	2300 J	2,200	1,700	1,000	2,000	2,000
Manganese	mg/kg	120	120	100	70	160	120	140	150	86	97
Mercury	mg/kg	<0.034 U	<0.034 U	<0.033 UJ	<0.032 UJ	<0.034 UJ	<0.032 UJ	<0.03 UJ	0.0046 J-	0.0012 J-	0.0023 J-
Molybdenum	mg/kg	0.11 J	0.073 J	0.12 J	0.08 J	0.16 J	0.11 J	0.091 J	0.087 J	0.07 J	0.091 J
Nickel	mg/kg	2.8	1.8 J	1.7 J	1.2 J	2.3	2.2	1.5 J	1.4 J	1.5 J	1.7 J
Selenium	mg/kg	2.1	0.73 J	1.3	0.36 J	0.81 J	0.58 J	0.51 J	0.36 J	<0.95 U	0.34 J
Silver	mg/kg	0.014 J	<0.051 U	0.0096 J	<0.046 U	0.014 J	<0.049 U	0.0084 J	<0.047 U	<0.048 U	<0.051 U
Sodium	mg/kg	53 J	<100 U	<96 UJ	<93 UJ	<98 UJ	<98 UJ	<94 UJ	<94 UJ	<95 UJ	<100 UJ
Thallium	mg/kg	0.037	0.018	0.032	0.015	0.031	0.027	0.024	0.022	0.014	0.018
Thorium	mg/kg	1.7	1.4	1.2	0.99	1.4	1.5	1.3	1.9	1	1.2
Uranium	mg/kg	7.7	6.6	27	5.2	26	9.6	26	1.1	0.68	0.85
Vanadium	mg/kg	85	35	100	25	120 J	57	120	9.5	11	12
Zinc	mg/kg	11 J	7.6 J	5.8 J-	<9.3 UJ	7.4 J-	7.7 J-	6.1 J-	6.3 J-	5.4 J-	6.7 J-

Table J1-3. Metals Laboratory Analytical Results for Sediment Samples (9 of 31)

Analyte	Units	Sample ID									
		DC1-SD31-01-062318	DC1-SD32-01-062318	DC1A-SD1-01-062018	DC1A-SD2-01-062018	DC1A-SD3-01-062018	DC1A-SD4-01-062018	DC1A-SD5-01-062018	DC1A-SD6-01-062018	DC1A-SD7-01-062018	DC1A-SD7A-01-062018
		Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
Drainage Channel ID		Middle 1	Middle 1	Middle 1A	Middle 1A	Middle 1A	Middle 1A	Middle 1A	Middle 1A	Middle 1A	Middle 1A
Aluminum	mg/kg	2,900	3,100	2,300	2,600	4,000	3,200	2,700	4,200	2,500	3,700
Antimony	mg/kg	0.09 J	0.068 J	0.061 J	0.067 J	0.11	0.081 J	0.076 J	0.097 J	0.088 J	0.12
Arsenic	mg/kg	2	1.4	3.1	4.1	7.1	6	3.9	7.5	2.5	5.3
Barium	mg/kg	250	100	59	110 J	160	84	41	73	61	40
Beryllium	mg/kg	0.18	0.19	0.14	0.17	0.26	0.21	0.16	0.23	0.18	0.2
Cadmium	mg/kg	<0.2 U	<0.2 U	<0.19 U	0.053 J	0.084 J	0.037 J	0.047 J	0.05 J	<0.2 U	0.18 J
Calcium	mg/kg	10,000	11,000	17,000	33000 J	110,000	13,000	11,000	31,000	8,200	14,000
Chromium	mg/kg	3.6	3.9	2.5	2.7	4.2	3.1	3.5	3.2	3.7	6.2
Cobalt	mg/kg	1.5	1.8	1.4	2.2	2.4	2.2	1.7	2.5	1.7	2.2
Copper	mg/kg	2.6	2.4	2.3	3.2	5.4	4.5	3.3	6.6	2.5	3.8
Iron	mg/kg	3,800	4,000	3,300	3,900	6,300	4,900	3,800	6,400	3,500	5,100
Lead	mg/kg	3.8	3	3.6	4	6.2	5	4.6	5.6	4.7	8
Lithium	mg/kg	8.4	8	5.3	5.9	9.9	6.4	6.5	9.3	5.9	8.4
Magnesium	mg/kg	3,300	3,100	2,100	2300 J	4,000	2,400	2,200	3,600	2,300	2,600
Manganese	mg/kg	160	160	160	320 J	1500	170	110	310	120	130
Mercury	mg/kg	0.00022 J-	<0.034 UJ	<0.031 U	<0.032 U	<0.034 U	<0.033 U	<0.034 U	<0.032 U	<0.034 U	<0.03 U
Molybdenum	mg/kg	0.2	0.099 J	0.89	1.1 J	1.7	1.6	2.2	2.7	1	3.7
Nickel	mg/kg	1.9 J	2.3	2.1	2.4	3.7	2.9	2.5	3.8	2.3	3.5
Selenium	mg/kg	0.63 J	<0.99 U	0.57 J	0.66 J	1.4	0.72 J	2.8	1.2	1.3	6.5
Silver	mg/kg	<0.051 U	<0.05 U	<0.048 U	0.0087 J	0.011 J	0.035 J	0.012 J	0.024 J	0.017 J	0.03 J
Sodium	mg/kg	<100 UJ	<99 UJ	<96 UJ	<97 UJ	<98 UJ	<97 UJ	<97 UJ	<100 UJ	<100 UJ	<98 UJ
Thallium	mg/kg	0.017	0.023	0.051	0.074	0.09	0.079	0.12	0.1	0.052	0.13
Thorium	mg/kg	1.3	1.5	1.5	1.7 J	2.4	2	1.7	2.3	1.8	2.2
Uranium	mg/kg	2.1	0.84	6.9	43 J	14	11	26	24	26	150
Vanadium	mg/kg	24	10	52	73 J	79	330	160	180	59	360
Zinc	mg/kg	11	9.4 J-	8.3 J	9.1 J	18	11	10	16	9.5 J	17

Table J1-3. Metals Laboratory Analytical Results for Sediment Samples (10 of 31)

Analyte	Units	Sample ID									
		DC1A-SD7A-0612-01-062018	DC1B-SD1-01-062118	DC1B-SD2-01-062118	DC1B-SD3-01-062118	DC1B-SD4-01-062218	DC1B-SD5-01-062218	DC1B-SD5A-01-062218	DC1B-SD6-01-062218	DC1B-SD7-01-062218	DC1B-SD7A-01-062218
		Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
Drainage Channel ID		Middle 1A	Middle 1B	Middle 1B	Middle 1B	Middle 1B	Middle 1B	Middle 1B	Middle 1B	Middle 1B	Middle 1B
Aluminum	mg/kg	3,500	2,700	2000 J	2,000	2,300	2,600	3,000	2,300	2,000	2,800
Antimony	mg/kg	0.11	0.066 J	0.053 J	0.05 J	0.077 J	0.32	0.065 J	0.058 J	0.048 J	0.079 J
Arsenic	mg/kg	4.5	1.5	4.2 J	1.5	1.6	3.2	4.4	1.5	1.8	2.2
Barium	mg/kg	36	67	48	53	96	150	140	110	130	110
Beryllium	mg/kg	0.19	0.2	0.14	0.16	0.15	0.17	0.2	0.17	0.17	0.23
Cadmium	mg/kg	0.065 J	<0.2 U	0.039 J	<0.2 U	<0.2 U	0.11 J	0.039 J	<0.2 U	<0.2 U	0.043 J
Calcium	mg/kg	14,000	9,400	38000 J	7,700	11,000	14,000	9,300	8,500	6,600	8,200
Chromium	mg/kg	7.5	2.5	1.8	1.9	2.8	2.9	2.2	2.1	1.7	2.7
Cobalt	mg/kg	2.2	1.9	1.4	1.4	1.4	1.7	2.6	1.3	1.5	1.9
Copper	mg/kg	4	2.6	2.3	2.2	1.8 J-	2.7	3.1	2.4	2.7	3.6
Iron	mg/kg	4,700	3,300	2,700	2,700	3,000	6,200	5,200	3,500	3,300	4,400
Lead	mg/kg	11	3.8	3	2.9	2.7	6.2	4.6	2.8	2.9	3.9
Lithium	mg/kg	7.8	5.4	4.2	4	6.4	7.9	5.4	5.6	3.5	5.4
Magnesium	mg/kg	2,500	2,500	1900 J	1,600	2,600	2,700	2,100	2,300	1,200	1,900
Manganese	mg/kg	130	160	560 J	130	130	200	170	140	140	170
Mercury	mg/kg	<0.033 U	<0.031 U	<0.033 U	<0.033 U	<0.033 UJ	0.00019 J-	0.00012 J-	0.00048 J-	0.0011 J-	0.0035 J-
Molybdenum	mg/kg	2.6	0.35	0.34	0.23	0.27	1.2	1.1	0.36	0.23	0.52
Nickel	mg/kg	3.3	2.4	1.6 J	1.7 J	1.9 J	2.5	2.3	1.8 J	1.7 J	2.5
Selenium	mg/kg	6.3	7.1	0.94 J	0.52 J	2.6	1.7	3.5	0.9 J	1.5	1.8
Silver	mg/kg	0.057	0.012 J	0.0092 J	0.012 J	<0.05 U	<0.055 U	0.017 J	<0.05 U	<0.05 U	0.014 J
Sodium	mg/kg	<99 UJ	21 J	<100 U	<100 U	<100 UJ	85 J-	<98 UJ	24 J-	<100 UJ	<99 UJ
Thallium	mg/kg	0.12	0.085	0.059	0.027	0.032 J	0.034	0.13	0.026	0.03	0.039
Thorium	mg/kg	1.1	1.8	1.4	1.3	1.1	1.5	1.6	1.5	1.7	1.8
Uranium	mg/kg	120	7.8	25 J	6.7	13 J	13	13	14	9.6	21
Vanadium	mg/kg	340	53	75 J	29	39 J	63	1700	61	62	67
Zinc	mg/kg	16	10	7.6 J	7.4 J	9.4 J-	9.3 J-	9.5 J-	7.3 J-	6.9 J-	11

Table J1-3. Metals Laboratory Analytical Results for Sediment Samples (11 of 31)

Analyte	Units	Sample ID									
		DC1B-SD8-01-062218	DC1B-SD8A-01-062218	DC1B-SD9-01-062218	DC1G-SD1-01-062118	DC1G-SD2-01-062118	DC1G-SD3-01-062118	DT9-SD1-01-062418	DT9-SD2-01-062418	DT9-SD3-01-062418	DT9-SD4-01-062418
		Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
Drainage Channel ID		Middle 1B	Middle 1B	Middle 1B	Middle 1G	Middle 1G	Middle 1G	Cove Transfer Station	Cove Transfer Station	Cove Transfer Station	Cove Transfer Station
Aluminum	mg/kg	2,100	2,600	2,100	2,800	3,200	2,600	1,600	4,700	3,300	2,500
Antimony	mg/kg	0.06 J	0.086 J	0.049 J	0.07 J	0.11	0.05 J	0.031 J	0.064 J	0.048 J	0.034 J
Arsenic	mg/kg	1.8	1.6	1.1	1.9	1.5	1.1	1.3	2.9	2.3	1.5
Barium	mg/kg	110	55	110	46	66	85	96	120	190	88
Beryllium	mg/kg	0.19	0.21	0.17	0.18	0.22	0.17	0.13	0.37	0.24	0.19
Cadmium	mg/kg	0.036 J	<0.2 U	<0.2 U	0.037 J	0.05 J	0.04 J	<0.2 U	0.089 J	0.038 J	0.033 J
Calcium	mg/kg	6,400	3,900	2,600	24,000	11,000	25,000	10,000	32,000	20,000	17,000
Chromium	mg/kg	2.1	2.3	2.1	2.7	3.6	2.9	1.9	4.5	3.6	2.7
Cobalt	mg/kg	1.5	1.6	1.4	1.6	1.8	1.3	1	2.9	2	1.6
Copper	mg/kg	2.8	2.7	1.8 J-	2.5	3	1.4 J-	1.5 J	5.9	3.5	2.4
Iron	mg/kg	4,000	3,900	3,700	3,000	3,500	2,300	2,300	5,800	4,400	3,400
Lead	mg/kg	3.3	4.1	2.7	3.9	4	2.4	2.7	5.7	4.1	3.3
Lithium	mg/kg	3.6	5.8	2.9	7.2	7.7	7.4	3	9.4	6.5	5.5
Magnesium	mg/kg	1,300	1,500	880	3,100	3,300	3,200	1,800	4,500	3,600	3,200
Manganese	mg/kg	140	100 J	120	220	150	230	110	340	210	180
Mercury	mg/kg	0.0019 J-	0.0025 J-	0.0042 J-	<0.034 U	<0.033 U	<0.032 U	0.0034 J-	0.0091 J-	0.0037 J-	0.0041 J-
Molybdenum	mg/kg	0.42	0.49	0.1 J	0.6	0.41	0.12 J	0.098 J	0.28	0.19 J	0.12 J
Nickel	mg/kg	1.8 J	2.4	1.7 J	2.4	2.9	2 J	2.1	4.7	3.4	2.6
Selenium	mg/kg	1.8	2.9 J	0.43 J	0.48 J	0.6 J	0.4 J	<0.98 U	0.99 J	0.52 J	0.47 J
Silver	mg/kg	0.009 J	0.01 J	<0.049 U	<0.051 U	0.0088 J	<0.051 U	0.015 J	0.028 J	0.01 J	<0.047 U
Sodium	mg/kg	<99 UJ	<100 UJ	<98 UJ	18 J	18 J	<100 U	110	150	150	78 J
Thallium	mg/kg	0.033	0.049	0.02	0.024	0.03	0.015	0.013	0.05	0.031	0.021
Thorium	mg/kg	1.7	2.2 J	1.8	1.1	1.4	1	1.7	2.5	2	1.7
Uranium	mg/kg	15	34 J	0.39	1.4	3.2	0.31	1.1 J	8.4	4	2.6
Vanadium	mg/kg	65	150 J	7.9	64	23	9.4	9.5 J	31	20	15
Zinc	mg/kg	8.3 J-	7.9 J-	6.8 J-	10 J	12	8.2 J	5.2 J	17	12	8.6 J

Table J1-3. Metals Laboratory Analytical Results for Sediment Samples (12 of 31)

Analyte	Units	Sample ID									
		DT9-SD5-01-062418	DT9-SD6-01-062418	DT9-SD7-01-062418	DT9-SD8-01-062418	DT9-SD9-01-062418	DT9-SD10-01-062418	DT9-SD11-01-062418	DT9-SD12-01-062418	DT9-SD13-01-062418	DT9-SD14-01-062418
		Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
Drainage Channel ID		Cove Transfer Station	Cove Transfer Station	Cove Transfer Station	Cove Transfer Station	Cove Transfer Station	Cove Transfer Station	Cove Transfer Station	Cove Transfer Station	Cove Transfer Station	Cove Transfer Station
Aluminum	mg/kg	2,300	2,300	1,500	3,400	1,900	4,000	2,500	11,000	2,500	1,800
Antimony	mg/kg	0.04 J	0.041 J	0.044 J	0.15 J	0.039 J	0.04 J	0.07 J	0.1 J	0.041 J	0.035 J
Arsenic	mg/kg	1.6	1.9	0.99	3.8 J	1.1	2.6	1.3	5.7	1.8	1.1
Barium	mg/kg	76	120	130	120	93	100	64	200	120	110
Beryllium	mg/kg	0.17	0.17	0.11	0.27	0.13	0.27	0.16	0.73	0.14	0.13
Cadmium	mg/kg	0.033 J	0.059 J	<0.19 U	0.083 J	0.056 J	0.047 J	0.043 J	0.14 J	0.058 J	<0.19 U
Calcium	mg/kg	17,000	31,000	16,000	31,000	11,000	14,000	28000 J	36,000	56,000	14,000
Chromium	mg/kg	2.8	3.4	2.7	5.3	2.5	3.6	2.6	8.7	2.8	2.2
Cobalt	mg/kg	1.5	1.7	1.1	2.5	1.1	2.3	1.6	6.2	2.3	1.2
Copper	mg/kg	2.5	2	1.3 J-	3.8	1.6 J-	4.5	2.2 J	13	3.7	1.6 J
Iron	mg/kg	3,200	3,400	2,500	4,900	2,600	4,800	3,000	12,000	2,600	2,500
Lead	mg/kg	3	5.5	2.8	5.1	2.7	4.5	3.1	11	3.7	2.6
Lithium	mg/kg	4.5	4.7	3	6.7	3.7	7.9	4.9	22	6.4	4
Magnesium	mg/kg	2,600	3,400	2,400	4,800	2,200	3,600	3,700	12,000	12,000	2,600
Manganese	mg/kg	160	270	140	260	120	180	230 J	410	340	140
Mercury	mg/kg	0.0045 J-	0.0037 J-	<0.03 U	<0.031 U	<0.03 U	0.0086 J-	0.0039 J-	0.017 J-	0.0057 J-	0.0031 J-
Molybdenum	mg/kg	0.12 J	0.16 J	0.11 J	0.26	0.13 J	0.31	0.066 J	0.73	0.096 J	0.096 J
Nickel	mg/kg	2.6	3.9	2.2	4.8	2.1	3.4	3	8.9	3.7	2.1
Selenium	mg/kg	0.4 J	0.44 J	<0.96 U	0.69 J	0.32 J	0.8 J	0.39 J	2.3	0.42 J	0.34 J
Silver	mg/kg	0.0085 J	<0.049 U	<0.048 U	0.033 J	<0.047 U	0.023 J	<0.059 U	0.064 J	<0.053 U	<0.047 U
Sodium	mg/kg	170	320	130	340	83 J	160	370 J	570	380	200
Thallium	mg/kg	0.022	0.023	0.014	0.041	0.02	0.047	0.021	0.15	0.022	0.015
Thorium	mg/kg	2.5	1.9	4.6	2.4	1.2	2	1.6	4.5	1.6	1.3
Uranium	mg/kg	2.2	1.1	1.3	3.9	1.9	7.7	3 J	27	1.1	2.4
Vanadium	mg/kg	12	15	9.3	19	13	34	12	100	8.4	11
Zinc	mg/kg	7.5 J	7.6 J	5.7 J	15	6.9 J	13	7.4 J	37	9.4 J	6.8 J

Table J1-3. Metals Laboratory Analytical Results for Sediment Samples (13 of 31)

Analyte	Units	Sample ID									
		DT9-SD15-01-062418	DT9-SD16-01-062418	DT9-SD17-01-062418	DT9-SD18-01-062418	DT9-SD19-01-062418	DT9-SD20-01-062418	DT9-SD21-01-062418	DC2-SD1-01-062118	DC2-SD2-01-062118	DC2-SD3-01-062118
		Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
Drainage Channel ID		Cove Transfer Station	Cove Transfer Station	Cove Transfer Station	Cove Transfer Station	Cove Transfer Station	Cove Transfer Station	Cove Transfer Station	Middle 2	Middle 2	Middle 2
Aluminum	mg/kg	2,500	4,100	2,000	2,400	1,500	1,500	1,800	1,700	2,000	1,400
Antimony	mg/kg	0.039 J	0.056 J	0.041 J	0.041 J	0.037 J	0.039 J	0.041 J	0.049 J	0.072 J	0.055 J
Arsenic	mg/kg	1.3	2.4	1.8	1.5	0.92	1.2	1.2	1.2	1.3	1.5
Barium	mg/kg	200 J	100	84	85	120	110	85	67	280	71
Beryllium	mg/kg	0.18	0.3	0.16	0.18	0.11	0.13	0.14	0.12	0.15	0.12
Cadmium	mg/kg	0.047 J	0.16 J	0.057 J	0.037 J	0.044 J	<0.2 U	<0.19 U	0.035 J	0.041 J	0.036 J
Calcium	mg/kg	30,000	26,000	38,000	24,000	11,000	14,000	14,000	34,000	24,000	33,000
Chromium	mg/kg	2.6	3.7	2.9	3.3	2	2	2.5	3.6	2.9	2.6
Cobalt	mg/kg	1.6	2.6	1.5	1.7	1	0.98	1.1	1.1	1.3	1
Copper	mg/kg	2.8	4.5	2.1	2.1 J-	1.2 J-	1.3 J-	1.5 J-	1.5 J-	1.8 J-	1.3 J-
Iron	mg/kg	3,100	4,900	2,900	3,100	2,400	2,300	2,400	2,900	3,300	3,300
Lead	mg/kg	3.4	5.1	3	3.2	2.3	2.4	2.5	2.4	2.9	2.6
Lithium	mg/kg	5.4	8.3	4	4.6	3	3.1	3.4	3.9	4.8	3
Magnesium	mg/kg	4,400	5,100	3,400	3,800	2,000	2,200	2,400	1,700	2,100	1,300
Manganese	mg/kg	290	250	350	200	110	120	140	210	220	340
Mercury	mg/kg	0.0099 J-	0.0058 J-	0.0035 J-	0.0032 J-	0.0029 J-	0.0023 J-	0.0014 J-	<0.031 UJ	0.0034 J-	0.000075 J-
Molybdenum	mg/kg	0.1 J	0.2 J	0.12 J	0.097 J	0.074 J	0.085J	0.072 J	0.35	0.28	0.21
Nickel	mg/kg	3.2	4.5	3.6	3.9	1.8 J	2	2.5	1.7 J	2 J	1.5 J
Selenium	mg/kg	0.52 J	0.71 J	0.35 J	0.51 J	<0.95 U	0.34 J	0.31 J	0.46 J	0.6 J	0.41 J
Silver	mg/kg	0.0088 J	0.019 J	<0.05 U	<0.052 U	<0.048 U	<0.05 U	<0.047 U	<0.05 U	<0.055 U	<0.05 U
Sodium	mg/kg	160	350	320	750	170	220	260	170	94 J	<99 U
Thallium	mg/kg	0.022	0.046	0.019	0.026	0.01	0.013	0.017	0.015	0.021	0.014
Thorium	mg/kg	1.7 J	2.5	1.7	2.1	1.2	1.4	1.5	1.3	1.3	1.3
Uranium	mg/kg	3.2 J-	5.7	1.3	3.6	0.95	1.5	1	2.5	4.1	4.1
Vanadium	mg/kg	22 J	23	8.8	16	9.7	8.8	11	19	68	33
Zinc	mg/kg	9 J	28	9.6 J	7 J	7.8 J	5 J	5 J	7.4 J	7.2 J	6.6 J

Table J1-3. Metals Laboratory Analytical Results for Sediment Samples (14 of 31)

Analyte	Units	Sample ID									
		DC2-SD4-01-062118	DC2-SD5-01-062118	DC2-SD6-01-062118	DC2-SD7-01-062118	DC2-SD8-01-062118	DC2-SD9-01-062118	DC2-SD10-01-062118	DC2-SD11-01-062118	DC2-SD12-01-062118	DC2-SD13-01-062118
		Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
Drainage Channel ID		Middle 2	Middle 2	Middle 2	Middle 2	Middle 2	Middle 2	Middle 2	Middle 2	Middle 2	Middle 2
Aluminum	mg/kg	1,500	3,000	1,700	1,700	1,600	1,600	2,000	1,600	1,700	2,100
Antimony	mg/kg	0.062 J	0.037 J	0.092 J	0.055 J	0.069 J	0.074 J	0.06 J	0.047 J	0.043 J	0.055 J
Arsenic	mg/kg	1.4	1.8	3.8	2.5	1.7	1.4	1.1	1.1	1.2	1.4
Barium	mg/kg	120	130	170	64	99	130	66	55	140	100
Beryllium	mg/kg	0.11	0.16	0.15	0.12	0.12	0.11	0.14	0.13	0.11	0.16
Cadmium	mg/kg	0.057 J	<0.2 U	0.057 J	0.067 J	0.051 J	0.055 J	<0.2 U	<0.21 U	0.037 J	<0.21 U
Calcium	mg/kg	29,000	15,000	24,000	26,000	32,000	35,000	7,900	11,000	22,000	14,000
Chromium	mg/kg	2.7	3	3.7	3	2.6	2	3.4	2.7	2.7	2.6
Cobalt	mg/kg	0.9 J-	1.2	1.4	1	1.2	1	1.2	1.1	1	1.2
Copper	mg/kg	1.4 J	2 J-	1.9 J-	1.5 J-	1.3 J-	1.4 J-	1.7 J-	1.5 J-	1.6 J-	1.6 J-
Iron	mg/kg	2,700	3,800	4,700	3,300	3,300	2,700	3,200	2,700	2,900	3,400
Lead	mg/kg	3.2	5.4	6.1	2.8	2.6	2.7	2.7	2.3	2.3	2.9
Lithium	mg/kg	3	7.8	3.6	3.5	3.6	3.5	4.3	3.5	3.6	4.8
Magnesium	mg/kg	1,300	2,300	1,400	1,600	1,600	1,500	1,800	1,400	1,600	2,100
Manganese	mg/kg	320	160	240	240	450	270	110	120	230	150
Mercury	mg/kg	<0.031 UJ	0.00016 J-	0.00017 J-	0.00064 J-	0.00052 J-	0.0062 J-	0.0015 J-	0.00037 J-	<0.038 UJ	0.00025 J-
Molybdenum	mg/kg	0.21	0.24	0.53	0.35	0.22	0.23	0.19 J	0.27	0.21 J	0.36
Nickel	mg/kg	1.5 J	2.3	2.7	1.7 J	1.5 J	1.5 J	1.9 J	1.7 J	1.6 J	2.1
Selenium	mg/kg	0.41 J	1.8	0.58 J	0.37 J	0.41 J	1.4	0.34 J	0.42 J	0.41 J	0.4 J
Silver	mg/kg	<0.051 U	<0.049 U	<0.048 U	<0.051 U	<0.048 U	<0.052 U	<0.051 U	<0.053 U	0.0098 J	<0.053 U
Sodium	mg/kg	<100 U	19 J	23 J	<100 U	67 J	32 J	18 J	62 J	75 J	290
Thallium	mg/kg	0.018	0.038	0.026	0.017	0.018	0.029	0.018	0.017	0.015	0.044
Thorium	mg/kg	1.1	1.2	1.6	1.2	1.1	1	1.1	1.1	1	1.3
Uranium	mg/kg	8.9	25	3	1.4	2	29	3	9.1	2.1	4.5
Vanadium	mg/kg	37	760	130	35	23	67	20	27	22	19
Zinc	mg/kg	4.9 J	7.6 J	9.2 J	5.8 J	7.2 J	5.8 J	7.2 J	6.2 J	5.8 J	7.1 J

Table J1-3. Metals Laboratory Analytical Results for Sediment Samples (15 of 31)

Analyte	Units	Sample ID									
		DC2-SD14-01-062118	DC2-SD15-01-062118	DC2-SD16-01-062118	DC2-SD17-01-062118	DC2-SD18-01-062118	M21-SD1-01-091218	M21-SD2-01-091218	DC2A-SD19-01-062118	DC2A-SD20-01-062118	DC2A-SD21-01-062118
		Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
Drainage Channel ID		Middle 2	Middle 2	Middle 2	Middle 2	Middle 2	Middle 2	Middle 2	Middle 2A	Middle 2A	Middle 2A
Aluminum	mg/kg	1,600	1,700	1,700	2,400	2,200	3,600	3,400	2,700	3,100	2,400
Antimony	mg/kg	0.063 J	0.046 J	0.066 J	0.052 J	0.062 J	0.2	0.14	0.061 J	0.08 J	0.072 J
Arsenic	mg/kg	1.4	0.95	2.3 J	0.98	1.4	2.9	4.1	1.5	2	1.3
Barium	mg/kg	70	98	71	23	60 J	66	58	45	58	69
Beryllium	mg/kg	0.11	0.12	0.12	0.23	0.13	0.18	0.17	0.16	0.17	0.19
Cadmium	mg/kg	<0.22 U	0.034 J	0.035 J	<0.22 U	0.037 J	0.056 J	0.057 J	0.034 J	0.048 J	0.047 J
Calcium	mg/kg	14,000	26,000	21,000	12,000	34,000	22,000	12,000	15,000	22,000	20,000
Chromium	mg/kg	2.3	2.1	2.2	2.4	3.1	2.7	2.6	2.6	3.3	3.3
Cobalt	mg/kg	1.1	0.97	1.1	0.97	1.5	2.3	2.4	1.4	1.7	1.4
Copper	mg/kg	1.4 J-	1.4 J-	2	0.98 J-	1.6 J-	4.2	9.6	2.6	2.6	2.5
Iron	mg/kg	3,500	2,600	3,100	2,500	3500 J	4,600	4,900	3,100	4,000	2,900
Lead	mg/kg	2.5	2.4	2.6	2.9	2.4 J	6.4	8	3.4	3.7	3.2
Lithium	mg/kg	3.3	3.7	3.8	5.3	5	9.2	8.6	6.3	7.3	5.6
Magnesium	mg/kg	1,400	1,500	1,600	2,900	2400 J	3,100	3,000	2,200	3,200	2,400
Manganese	mg/kg	160	190	200 J	68	340	240	130	210	270	220
Mercury	mg/kg	<0.034 UJ	0.00022 J-	0.00086 J-	<0.037 UJ	0.00034 J-			<0.034 U	<0.033 U	<0.035 U
Molybdenum	mg/kg	0.28	0.12 J	0.55	0.098 J	0.21	0.56	1.3	0.25	0.19 J	0.1 J
Nickel	mg/kg	1.6 J	1.8 J	1.7 J	2.9	2.2	7.2	3	2	2.5	2.2 J
Selenium	mg/kg	0.45 J	0.4 J	0.34 J	<1.1 U	0.37 J	2.2	2.6	0.37 J	0.55 J	0.53 J
Silver	mg/kg	<0.056 U	0.011 J	<0.048 U	<0.056 U	<0.052 U	0.086	0.018 J	<0.049 U	<0.054 U	0.011 J
Sodium	mg/kg	81 J	82 J	34 J	320	38 J	<92 U	<97 U	21 J	100 J	58 J
Thallium	mg/kg	0.015	0.02	0.06 J	0.01 J-	0.022	0.082	0.55	0.026	0.029	0.023
Thorium	mg/kg	1.2	1.1	1.3	1.1	1.2 J	1.8	1.7	1.3	1.2	1.2
Uranium	mg/kg	3.7	0.9	3.1 J	0.91	2.1 J	89	89	3.4	23	1.3
Vanadium	mg/kg	46	15	110 J	3.1	23 J	230	180	180	51	52
Zinc	mg/kg	6.8 J	6 J	6.6 J	5.5 J	8.4 J	10	15	8.9 J	11 J	9.3 J

Table J1-3. Metals Laboratory Analytical Results for Sediment Samples (16 of 31)

Analyte	Units	Sample ID									
		DC2A-SD22-01-062118	DC2A-SD23-01-062118	DC2B-SD2-01-062218	DC2B-SD3-01-062218	DC2B-SD4-01-062218	DC2B-SD5-01-062218	DC2B-SD6-01-062218	DC2B-SD7-01-062218	DC2B-SD8-01-062218	DC2B-SD8A-01-062218
		Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
Drainage Channel ID		Middle 2A	Middle 2A	Middle 2B	Middle 2B	Middle 2B	Middle 2B	Middle 2B	Middle 2B	Middle 2B	Middle 2B
Aluminum	mg/kg	1,900	1,500	2,200	2,300	2,200	2,700	2,100	3,600	2,500	2,800
Antimony	mg/kg	0.057 J	0.046 J	0.11	0.077 J	0.053 J	0.083 J	0.066 J	0.11	0.14	0.1 J
Arsenic	mg/kg	0.96	0.79	1.5	2.2	1.5	2.4	1.8	4.9	2.5	2.5
Barium	mg/kg	47	31	72	72	120	77	210	330	97	100
Beryllium	mg/kg	0.14	0.11	0.16	0.18	0.16	0.19	0.15	0.26	0.19	0.19
Cadmium	mg/kg	<0.2 U	<0.19 U	<0.19 U	0.034 J	0.031 J	0.033 J	0.033 J	0.044 J	<0.19 U	0.04 J
Calcium	mg/kg	7,000	6,900	12,000	11,000	12,000	17,000	16,000	26,000	17,000	25,000
Chromium	mg/kg	2.8	2.6	2.3	2.4	2.4	3.5	2.4	3.5	2.5	3
Cobalt	mg/kg	1.2	0.9	1.4	1.5	1.5	1.7	1.5	2.3	1.6	1.7
Copper	mg/kg	1.7 J-	1.1 J-	2.1	2.2	2.3	3	2.2	4.5	3.1	2.9
Iron	mg/kg	2,600	2,000	3,300	3,500	3,300	4,500	3,500	5,800	4,200	4,300
Lead	mg/kg	2.6	1.9	2.8	3.1	2.7	3.3	3	5.5	3.7	3.5
Lithium	mg/kg	4.2	3.3	4.5	5.2	4.4	6	4.7	8.1	5.3	6.6
Magnesium	mg/kg	1,800	1,400	1,600	2,000	1,600	2,300	1,600	2,900	1,900	2,300
Manganese	mg/kg	110	95	160	150	150	180	200	270	180	290
Mercury	mg/kg	<0.033 U	<0.033 U	0.0045 J-	0.006 J-	0.0047 J-	0.0048 J-	0.0037 J-	0.00088 J-	0.0019 J-	0.0037 J-
Molybdenum	mg/kg	0.11 J	0.076 J	0.39	3.1	0.39	2.6	0.46	2.8	1.1	1.5
Nickel	mg/kg	1.7 J	1.3 J	1.8 J	2	2	2.6	2	3.6	2.3	2.5
Selenium	mg/kg	0.34 J	<0.97 U	0.55 J	0.66 J	0.52 J	0.83 J	0.84 J	2	1.6	0.78 J
Silver	mg/kg	<0.049 U	<0.049 U	<0.048 U	<0.047 U	<0.048 U	<0.048 U	<0.05 U	0.016 J	<0.049 U	0.011 J
Sodium	mg/kg	<99 U	<97 U	<96 UJ	<95 UJ	<97 UJ	<96 UJ	<100 UJ	<98 UJ	<97 UJ	<100 UJ
Thallium	mg/kg	0.016	0.011	0.025	0.027	0.026	0.036	0.029	0.099	0.044	0.035
Thorium	mg/kg	1.3	0.86	1.4	1.4	1.4	1.6	1.9	2.3	1.7	1.6
Uranium	mg/kg	0.57	0.28	10	5.2	5.2	23	14	80	69	14
Vanadium	mg/kg	7	5.1	32	24	21	56	66	140	60	47
Zinc	mg/kg	7.5 J	5.6 J	12	8.4 J-	8.5 J-	13	8.3 J-	15	12	11

Table J1-3. Metals Laboratory Analytical Results for Sediment Samples (17 of 31)

Analyte	Units	Sample ID									
		DC2B-SD9-01-062218	M32-SD1-01-092918	DC3-SD1-01-062318	DC3-SD2-01-062318	DC3-SD3-01-062318	DC3-SD4-01-062318	DC3-SD5-01-062318	DC3-SD6-01-062318	DC3-SD7-01-062318	DC3-SD8-01-062318
		Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
Drainage Channel ID		Middle 2B	Middle 2B	Middle 3	Middle 3	Middle 3	Middle 3	Middle 3	Middle 3	Middle 3	Middle 3
Aluminum	mg/kg	2,200	4,500	1,400	2,100	1,900	2,500	4,600	4,000	1,300	2,200
Antimony	mg/kg	0.067 J	0.13	0.055 J	0.067 J	0.08 J	0.14	0.16	0.14 J	0.035 J	0.11 J
Arsenic	mg/kg	1.7	5.6	1.1	1.3	1.8	5.9	3	2.5	0.84	1.9
Barium	mg/kg	77 J	58	48	79	100	84	160	140	51	60
Beryllium	mg/kg	0.15	0.24	0.1	0.17	0.15	0.19	0.37	0.38	0.1	0.15
Cadmium	mg/kg	<0.2 U	0.063 J	<0.24 U	0.037 J	<0.22 U	0.044 J	0.08 J	0.11 J	<0.24 U	<0.23 U
Calcium	mg/kg	11000 J	20,000	12,000	16,000	14,000	19,000	23,000	22,000	5,900	20,000
Chromium	mg/kg	2.3	3.7	2.1	2.8	2.9	3.3	5.3	4.2	2.2	3.7
Cobalt	mg/kg	1.5	2.8	0.87	1.3	1.5	1.5	2.9	2.6	0.84	1.7
Copper	mg/kg	3	6.8	1.3 J-	2.1 J-	2.2 J-	4.4	5.7	8.9	1.1 J-	3.1
Iron	mg/kg	3,800	6,700	2,400	3,300	4,000	4,100	6,800	5,200	2,200	4,100
Lead	mg/kg	3	5.7	3.3	3	4.1	3.1	7	5.7	1.9	5.5
Lithium	mg/kg	4.9	10	2.9	4.6	3.6	5	8	6.3	2.2 J	4.4
Magnesium	mg/kg	1,600	3,500	1,400	2,100	1,700	2,100	3,400	2700 J	950	1,900
Manganese	mg/kg	140 J	170	110	150	170	210	390	240	86	280
Mercury	mg/kg	0.0047 J-		<0.035 U	<0.034 U	<0.034 U	<0.04 U	<0.043 U	<0.054 U	<0.04 U	<0.037 U
Molybdenum	mg/kg	0.96 J	4.2	0.12 J	0.17 J	0.19 J	1.7	0.69	0.79	0.078 J	0.23
Nickel	mg/kg	2	5	<2.4 U	<2.1 U	<2.2 U	2.5	4.2	3.5	1.1 J	2.2 J
Selenium	mg/kg	0.72 J	2.3	<1.2 U	0.45 J	0.42 J	0.55 J	0.95 J	1.2 J	<1.2 U	0.42 J
Silver	mg/kg	<0.049 U	0.03 J	<0.059 U	<0.053 U	<0.056 U	<0.058 U	0.02 J	0.036 J	<0.059 U	0.13
Sodium	mg/kg	<98 UJ	40 J	<120 U	94 J	40 J	83 J	110 J	99 J	<120 U	42 J
Thallium	mg/kg	0.029	0.73	0.015	0.02	0.025	0.042	0.05	0.048	0.011 J-	0.024
Thorium	mg/kg	1.5	2.8	0.9	1.1	1.6	1.5	3	2.3	1.1	1.4
Uranium	mg/kg	10 J	100	3.3	2.9	3.7	2.2	5.2	9	1	1.7
Vanadium	mg/kg	53 J	260	14	13	14	16	22	20	7.2	21
Zinc	mg/kg	8.7 J-	17	<12 U	8.5 J	9.5 J	16	22	18	7.3 J	13

Table J1-3. Metals Laboratory Analytical Results for Sediment Samples (18 of 31)

Analyte	Units	Sample ID									
		DC3-SD9-01-062318	DC3-SD10-01-062318	DC3-SD10-01-082118	DC3-SD11-01-062318	DC3-SD12-01-062318	DC3-SD13-01-062318	DC3-SD14-01-062318	DC3-SD15-01-062318	DC3-SD16-01-062318	DC3-SD17-01-062318
		Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
Drainage Channel ID		Middle 3	Middle 3	Middle 3	Middle 3	Middle 3	Middle 3	Middle 3	Middle 3	Middle 3	Middle 3
Aluminum	mg/kg	2,200	1600 J	1,600	1,400	1,600	1,700	1,600	1,600	1,200	1,500
Antimony	mg/kg	0.062 J	0.074 J	0.042 J	0.046 J	0.061 J	0.053 J	0.057 J	0.058 J	0.044 J	0.044 J
Arsenic	mg/kg	1.6	1.2	1	1.2	1.1	1.6	1.4	1.5	0.83	1.4
Barium	mg/kg	65	40 J	47	50	54	35	68	110	27	34
Beryllium	mg/kg	0.17	0.12	0.11	0.12	0.13	0.15	0.13	0.12	0.16	0.12
Cadmium	mg/kg	<0.23 U	<0.23 U	<0.24 U	<0.23 U	<0.24 U	<0.22 U	<0.23 U	<0.23 U	<0.23 U	<0.24 U
Calcium	mg/kg	17,000	7,800	10,000	9,700	11,000	13,000	8,000	10,000	4,600	8,400
Chromium	mg/kg	2.4	2	1.7	2.8	2.2	2.7	2.8	2.6	2.3	2.5
Cobalt	mg/kg	1.3	1	0.94	0.96	1	1.2	1.4	1.1	0.61	0.95
Copper	mg/kg	2.5	1.8 J-	1.3 J	1.3 J-	1.4 J-	2 J-	2 J-	1.6 J-	0.64 J-	1.7 J-
Iron	mg/kg	3,300	2,500	2,300	2,300	2,600	2,700	3,100	2,600	1,500	2,200
Lead	mg/kg	2.8	2.7	2.1	2.2	2.7	2.7	3.7	2.4	2	2.3
Lithium	mg/kg	4	2.7	3.2	2.5	3.2	3.1	2.6	2.8	1.3 J	2.7
Magnesium	mg/kg	1,700	1200 J	1,300	1,100	1,300	1,300	1,200	1,200	700	1,200
Manganese	mg/kg	210	120	130	200	120	160	180	140	85	110
Mercury	mg/kg	<0.038 U	<0.037 U	<0.039 U	<0.035 U	<0.034 U	<0.038 U	<0.039 U	<0.037 U	<0.038 U	<0.04 U
Molybdenum	mg/kg	0.16 J	0.14 J	0.089 J	0.13 J	0.11 J	0.13 J	0.2 J	0.12 J	0.088 J	0.12 J
Nickel	mg/kg	1.9 J	<2.3 U	1.5 J	<2.3 U	<2.4 U	<2.2 U	<2.3 U	<2.3 U	<2.3 U	<2.4 U
Selenium	mg/kg	0.42 J	<1.1 U	<1.2 U	<1.2 U	<1.2 U	1.7	0.38 J	0.39 J	<1.1 U	0.39 J
Silver	mg/kg	<0.058 U	<0.057 U	<0.06 U	<0.059 U	<0.059 U	<0.055 U	<0.057 U	<0.058 U	<0.057 U	<0.06 U
Sodium	mg/kg	34 J	37 J	<120 U	32 J	32 J	23 J	45 J	31 J	29 J	28 J
Thallium	mg/kg	0.022	0.017	0.015	0.018	0.02	0.02	0.019	0.019	0.0057 J-	0.017
Thorium	mg/kg	1.5	1.1	1.1	0.99	1.1	1.4	1.4	1.3	0.82	1
Uranium	mg/kg	2.1	0.92 J	1.3	2.2	5.4	1.6	1.6	1.6	0.3	1.5
Vanadium	mg/kg	13	9.2	9.2	13	17	13	11	14	2.7	16
Zinc	mg/kg	8.7 J	7.4 J	<12 U	<12 U	6.2 J	6.9 J	7.9 J	6.4 J	<11 U	6.1 J

Table J1-3. Metals Laboratory Analytical Results for Sediment Samples (19 of 31)

Analyte	Units	Sample ID									
		DC3-SD18-01-062318	DC3-SD18A-01-082118	DC3A-SD1-01-062318	DC3A-SD2-01-062318	DC3A-SD3-01-062318	DC3A-SD4-01-062318	DC3A-SD5-01-062318	DC3A-SD6-01-062318	DC3A-SD7-01-062318	DC3A-SD8-01-062318
		Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
Drainage Channel ID		Middle 3	Middle 3	Middle 3A	Middle 3A	Middle 3A	Middle 3A	Middle 3A	Middle 3A	Middle 3A	Middle 3A
Aluminum	mg/kg	2,100	1600 J	1,900	1,400	1,400	2,000	2,700	1,400	2,200	1,100
Antimony	mg/kg	0.049 J	0.056 J	0.08 J	0.052 J	0.038 J	0.059 J	0.084 J	0.046 J	0.067 J	0.062 J
Arsenic	mg/kg	1.3	1.2	2	1.3	1.2	1.7	1.8	1.1	1.3	1.5
Barium	mg/kg	30	29 J	42	28	28	30	41	28	37	39
Beryllium	mg/kg	0.15	0.12	0.16	0.12	0.11	0.16	0.2	0.12	0.15	0.1
Cadmium	mg/kg	<0.24 U	<0.24 U	<0.2 U	<0.2 U	<0.19 U	<0.2 U	0.055 J	<0.23 U	0.063 J	<0.23 U
Calcium	mg/kg	9,700	4900 J	12,000	8,400	6,900	11,000	52,000	6,500	33,000	7,000
Chromium	mg/kg	2.4	1.5	2.4	1.9	1.9	2.6	3.4	2	3.1	2.3
Cobalt	mg/kg	1.3	1	1.5	0.97	0.93	1.4	1.7	0.92	1.5	0.81
Copper	mg/kg	2.1 J-	1.3 J	2.3	1.6 J-	1.5 J-	2.3	3.2	1.4 J-	1.9 J-	1.3 J-
Iron	mg/kg	2,900	2800 J	3,500	2,500	2,200	3,100	3,900	2,300	2,700	2,200
Lead	mg/kg	2.8	2.2	3.1	2.4	2.1	2.8	3.5	2.2	2.5	3.9
Lithium	mg/kg	3.4	2.8	3.3	2.2	2.4	3.6	6.5	2.6	5.2	2 J
Magnesium	mg/kg	1,500	920	1,400	990	1,000	1,500	2,900	1,000	2,300	860
Manganese	mg/kg	130	100 J	170	130	100	150	570	93	330	160
Mercury	mg/kg	<0.04 U	<0.037 U	<0.032 U	<0.031 U	<0.03 U	<0.032 U	<0.032 U	<0.038 U	<0.037 U	<0.035 U
Molybdenum	mg/kg	0.12 J	0.13 J	0.2 J	0.15 J	0.12 J	0.19 J	0.32	0.17 J	0.18 J	0.23
Nickel	mg/kg	<2.4 U	1.3 J	<2 U	<2 U	<1.9 U	<2 U	2.6	<2.3 U	<2.2 U	<2.3 U
Selenium	mg/kg	<1.2 U	<1.2 U	0.38 J	<1 U	<0.97 U	0.38 J	0.82 J	0.36 J	0.51 J	0.38 J
Silver	mg/kg	<0.061 U	<0.06 U	0.036 J	<0.05 U	<0.048 U	<0.05 U	<0.048 U	<0.057 U	0.017 J	<0.057 U
Sodium	mg/kg	36 J	<120 U	<100 U	18 J	46 J	67 J	34 J	94 J	160	100 J
Thallium	mg/kg	0.022	0.017	0.023	0.016	0.016	0.023	0.028	0.018	0.018	0.015
Thorium	mg/kg	1.3	1.4 J	1.5	1.2	1.2	1.6	1.5	1.2	1.3	1.3
Uranium	mg/kg	1.6	0.57 J	1.3	0.96	1.1	1.4	2.8	1.3	2.2	1.4
Vanadium	mg/kg	12	9.7 J	9.7	7.1	8.4	9.2	29	6.4	12	6.2
Zinc	mg/kg	8.5 J	<12 U	8.4 J	6.5 J	6 J	8.6 J	10	6.5 J	8.2 J	<11 U

Table J1-3. Metals Laboratory Analytical Results for Sediment Samples (20 of 31)

Analyte	Units	Sample ID									
		DC3A-SD9-01-061818	DC3A-SD10-01-061818	DC3A-SD11-01-061818	DC3A-SD12-01-061818	DC3A-SD13-01-061818	DC3A-SD14-01-061818	DC3A-SD15-01-061818	DC3A-SD16-01-061818	DC3A-SD17-01-061818	DC3B-SD1-01-061918
		Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
Drainage Channel ID		Middle 3A	Middle 3A	Middle 3A	Middle 3A	Middle 3A	Middle 3A	Middle 3A	Middle 3A	Middle 3A	Middle 3B
Aluminum	mg/kg	1,700	1,900	1,200	970	3,300	1700 J	3,100	1,400	1,100	1,800
Antimony	mg/kg	0.041 J	0.081 J	<0.098 U	<0.1 U	0.064 J	0.035 J	0.14	0.038 J	<0.098 U	0.062 J
Arsenic	mg/kg	1.6	2.1	1.2	1.4	4.4	1.6	6.3	3.4	1.3	1.8
Barium	mg/kg	43	100	34	39	83	90	72	69	49	95
Beryllium	mg/kg	0.12	0.15	0.11	0.097	0.22	0.14	0.2	0.13	0.1	0.12
Cadmium	mg/kg	0.07 J	0.075 J	<0.2 U	<0.21 U	0.059 J	<0.2 U	0.049 J	<0.21 U	<0.2 U	<0.22 U
Calcium	mg/kg	47,000	12,000	5,900	4,900	18,000	7,700	27,000	5,200	5,000	11,000
Chromium	mg/kg	3.2	2.4	1.4	1.1	2.9	1.7	21	1.3	1.3	1.9
Cobalt	mg/kg	1.2	1.4	0.78	0.75	2	1.2	2.3	1	0.8	1.2
Copper	mg/kg	1.5 J-	2.3	1.2 J-	0.9 J-	4.3	1.9 J-	3.3	1.7 J-	1.1 J-	1.9 J-
Iron	mg/kg	2,400	3,100	1,800	1,800	4,700	2,800	5,300	4,600	1,900	3,100
Lead	mg/kg	2.3	3.7	1.8	1.6	4	2.9	5.1	2.5	1.7	3.8
Lithium	mg/kg	4.3	4	2.4	2 J	7	2.9	6	2.4	2.2	3.7
Magnesium	mg/kg	1,700	1,600	800	640	3,100	1,200	3,000	940	740	1,500
Manganese	mg/kg	380	200	85	79	200	130	350	88	82	150
Mercury	mg/kg	<0.036 UJ	0.0013 J-	0.00023 J-	0.00012 J-	0.00052 J-	0.0024 J-	0.0018 J-	<0.033 UJ	<0.031 UJ	<0.038 U
Molybdenum	mg/kg	0.29	0.23	0.068 J	0.088 J	0.46	0.12 J	0.25	0.71	0.092 J	0.53
Nickel	mg/kg	1.8 J	1.8 J	1.2 J	0.99 J	2.8	1.4 J	3	1.2 J	1.1 J	1.6 J
Selenium	mg/kg	0.75 J	0.68 J	<0.98 U	<1 U	0.61 J	0.35 J	0.46 J	<1 U	<0.98 U	0.62 J
Silver	mg/kg	<0.056 U	<0.05 U	<0.049 U	<0.052 U	0.014 J	<0.05 U	<0.052 U	<0.051 U	<0.049 U	<0.056 U
Sodium	mg/kg	250	69 J-	<98 UJ	<100 UJ	<100 UJ	<100 UJ	<100 UJ	<100 UJ	<98 UJ	200
Thallium	mg/kg	0.037	0.022	0.015	0.011	0.047	0.018	0.03	0.019	0.016	0.026
Thorium	mg/kg	1.3	1.5	1.2	1	1.9	1.4	1.6	1.4	1.1	1.7
Uranium	mg/kg	3.5	5.7	0.49	0.38	5.8	0.76 J	6.8	0.71	0.38	5.7
Vanadium	mg/kg	14	16	4.6	4.8	39	7.4	68	6.3	5.3	13
Zinc	mg/kg	5.5 J-	7.9 J-	<9.8 UJ	<10 UJ	14	6.5 J-	14	5.9 J-	<9.8 UJ	7.2 J

Table J1-3. Metals Laboratory Analytical Results for Sediment Samples (21 of 31)

Analyte	Units	Sample ID									
		DC3B-SD2-01-061918	DC3B-SD3-01-061918	DC3B-SD4-01-061918	DC3B-SD5-01-061918	DC3B-SD6-01-061918	M28-SD1-01-092618	M28-SD2-01-092618	DC3C-SD1-01-061818	DC3C-SD2-01-061818	DC3C-SD3-01-061818
		Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
Drainage Channel ID		Middle 3B	Middle 3B	Middle 3B	Middle 3B	Middle 3B	Middle 3B	Middle 3B	Middle 3C	Middle 3C	Middle 3C
Aluminum	mg/kg	2,700	2,700	1,600	3,100	2,400	2,700	2,900	1,500	1,600	2,400
Antimony	mg/kg	0.073 J	0.072 J	0.068 J	0.083 J	0.045 J	0.091 J	0.058 J	0.038 J	0.036 J	0.038 J
Arsenic	mg/kg	2.3	2.7	3.1	4.4 J	2.1	3.1	2.8	2.5	1.7	2.5
Barium	mg/kg	99	44	39	65	56	87	81	43	61	75
Beryllium	mg/kg	0.2	0.18	0.15	0.2	0.17	0.22	0.29	0.12	0.14	0.22
Cadmium	mg/kg	0.055 J	0.056 J	<0.2 U	0.039 J	<0.2 U	0.056 J	0.049 J	0.036 J	<0.2 U	<0.21 U
Calcium	mg/kg	17,000	31,000	9,000	20,000	10,000	13,000	13,000	13,000	7,900	13,000
Chromium	mg/kg	2.5	2.2	1.3	2.6	2	2.1	1.7	1.4	2.6	2
Cobalt	mg/kg	1.8	1.9	1.3	2.2	1.7	1.8	2	1.1	1.1	1.5
Copper	mg/kg	3.8	3.9	2.1	4.5	3.2	4.4	5	2 J-	1.8 J-	3.7
Iron	mg/kg	4,500	4,200	3,200	5,200	3,700	4,400	4,100	2,600	2,700	3,800
Lead	mg/kg	4.2	3.8	3.2	4.6	3.3	4.1	3.9	2.7	2.7	3.3
Lithium	mg/kg	5	4.7	2.6	6.2	4.4	5.4	4.8	3	2.9	4.2
Magnesium	mg/kg	2,100	2,200	990	2,700	1,900	2,200	1,900	1,100	1,100	1,900
Manganese	mg/kg	210	450	140	220	120	160	220	230	120	160
Mercury	mg/kg	<0.033 U	<0.032 U	<0.033 U	<0.033 U	<0.033 U	0.017 J-	0.0017 J-	0.00044 J-	0.0016 J-	<0.032 UJ
Molybdenum	mg/kg	0.34	0.18 J	0.27	0.43	0.22	0.61	1.1	0.19 J	0.13 J	0.24
Nickel	mg/kg	2.3	2.5	1.5 J	3.1	2.1	2.6	2.5	1.4 J	1.5 J	1.9 J
Selenium	mg/kg	0.7 J	0.59 J	0.45 J	0.5 J	0.45 J	0.94 J	1.7	0.41 J	<1 U	0.5 J
Silver	mg/kg	0.013 J	<0.048 U	<0.05 U	0.019 J	0.009 J	0.017 J	0.019 J	0.013 J	<0.051 U	<0.052 U
Sodium	mg/kg	<100 UJ	18 J-	<100 UJ	<100 UJ	<100 UJ	26 J	300	<100 UJ	<100 UJ	<100 UJ
Thallium	mg/kg	0.038	0.033	0.025	0.045	0.032	0.058	0.036	0.04	0.022	0.029
Thorium	mg/kg	2.2	2.1	1.6	2.8	2	2.4	2.4	1.2	1.3	1.9
Uranium	mg/kg	7.1	1.5	1	4.1	2.1	10	10	1.3	0.59	1.8
Vanadium	mg/kg	26	9.6	8.9	31 J	11	31	24	10	6.2	9.7
Zinc	mg/kg	10 J	10	6.6 J	13	9.4 J	10	10 J	5.8 J-	5.8 J-	9.4 J-

Table J1-3. Metals Laboratory Analytical Results for Sediment Samples (22 of 31)

Analyte	Units	Sample ID									
		DC3C-SD3A-01-061818	DC3C-SD4-01-061818	DC3C-SD5-01-061818	M25-SD1-01-092818	DC3D-SD1-01-061918	DC3D-SD1A-01-061918	DC3D-SD2-01-061918	DC3E-SD1-01-062318	DC3E-SD1-01-082118	DC3E-SD2-01-062318
		Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
Drainage Channel ID		Middle 3C	Middle 3C	Middle 3C	Middle 3C	Middle 3D	Middle 3D	Middle 3D	Middle 3E	Middle 3E	Middle 3E
Aluminum	mg/kg	1,200	2,000	1,600	8,700	2,500	2,800	2,300	2,300	1,700	2,900
Antimony	mg/kg	0.05 J	0.035 J	0.034 J	0.043 J	0.078 J	0.069 J	0.039 J	0.064 J	0.091 J	0.081 J
Arsenic	mg/kg	1.7	1.6	2	14	1.7	1.4	0.8	1.5	2.3	1.7
Barium	mg/kg	84	78	29	130	61	100	60	71	37	93
Beryllium	mg/kg	0.11	0.17	0.13	0.52	0.22	0.23	0.17	0.17	0.15	0.22
Cadmium	mg/kg	<0.19 U	<0.2 U	<0.2 U	0.084 J	0.061 J	0.051 J	<0.21 U	<0.25 U	<0.22 U	<0.24 U
Calcium	mg/kg	5,300	8,400	8,600	26,000	30,000	20,000	12,000	12,000	15,000	16,000
Chromium	mg/kg	1	2	1.6	5.7	2.4	2.3	2.2	2.3	2.1	3
Cobalt	mg/kg	0.88	1.3	1	7.2	1.7	1.9	1.3	1.5	1.3	2
Copper	mg/kg	1.3 J-	2.4	1.9 J-	17	2.9	3	1.4 J-	2.3 J-	2.1 J	3.7
Iron	mg/kg	2,400	3,200	2,400	12,000	4,500	4,500	3,100	3,600	3,400	4,300
Lead	mg/kg	1.9	2.7	2.2	9.9	3.9	4.2	2.7	3.3	3.8	4
Lithium	mg/kg	1.7 J	3.3	3.5	20	4.2	4.3	4.6	4.9	3.7	6.7
Magnesium	mg/kg	730	1,400	1,300	8,700	1,800	1,900	1,900	1,800	1,300	2,400
Manganese	mg/kg	89	110	99	260	490	260	140	150	180	160
Mercury	mg/kg	<0.031 UJ	0.00025 J-	0.0001 J-		<0.033 U	<0.031 U	<0.032 U	<0.041 UJ	<0.036 U	0.0022 J-
Molybdenum	mg/kg	0.12 J	0.11 J	0.11 J	0.8	0.14 J	0.072 J	0.064 J	0.15 J	0.44	0.13 J
Nickel	mg/kg	0.91 J	1.6 J	1.6 J	7.9	2	2.2	1.6 J	2.1 J	1.8 J	2.7
Selenium	mg/kg	<0.95 U	0.37 J	0.36 J	0.94 J	0.55 J	0.5 J	0.36 J	0.41 J	0.43 J	0.66 J
Silver	mg/kg	<0.047 UJ	<0.05 UJ	<0.049 UJ	0.032 J	<0.05 U	<0.051 U	<0.052 U	0.013 J	<0.055 U	0.015 J
Sodium	mg/kg	<95 UJ	<100 UJ	<98 UJ	85 J	<100 UJ	<100 UJ	<100 UJ	<130 U	<110 U	27 J
Thallium	mg/kg	0.013	0.023	0.021	0.17	0.027	0.031	0.018	0.023	0.02	0.033
Thorium	mg/kg	1.3	1.5	1.3	5.3	2.4	2.5	1.6	1.7	1.5	2.3
Uranium	mg/kg	0.48	1.6	1	10	0.63	1.2	0.38	3.2	3.5	11
Vanadium	mg/kg	4.9	8.7	6.1	25	8.7	13	5.4	19	40	32
Zinc	mg/kg	5 J-	8.6 J-	6.2 J-	33	14	10 J	7 J	9.5 J	6.5 J	19

Table J1-3. Metals Laboratory Analytical Results for Sediment Samples (23 of 31)

Analyte	Units	Sample ID									
		DC3E-SD3-01-062318	DC3E-SD4-01-062318	DC3E-SD5-01-062318	DC3E-SD5A-01-062318	DC3E-SD5A-01-082118	DC3E-SD6-01-081718	DC3E-SD7-01-081718	DC3E-SD8-01-081718	DC3E-SD9-01-081718	DC3E-SD10-01-081718
		Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
Drainage Channel ID		Middle 3E	Middle 3E	Middle 3E	Middle 3E	Middle 3E	Middle 3E	Middle 3E	Middle 3E	Middle 3E	Middle 3E
Aluminum	mg/kg	2,500	2,300	1,700	2,700	1,400	2,800	2,200	1600 J	2,100	1,500
Antimony	mg/kg	0.075 J	0.071 J	0.053 J	0.082 J	0.035 J	0.091 J	0.039 J	<0.12 UJ	<0.12 UJ	0.037 J
Arsenic	mg/kg	1.4	1.8	0.9	1.4	0.83	1.4	1.3	0.89	1.4	0.89
Barium	mg/kg	94	83	58	82	33	78	69	51 J	93	67
Beryllium	mg/kg	0.19	0.15	0.13	0.19	0.11	0.21	0.15	0.13	0.19	0.12
Cadmium	mg/kg	<0.25 U	<0.24 U	<0.25 U	0.047 J	<0.22 U	0.085 J	<0.24 U	<0.24 U	<0.24 U	<0.24 U
Calcium	mg/kg	15,000	12,000	7,700	23,000	3,900	17,000	10,000	6,000	8,800	6,500
Chromium	mg/kg	2.7	2.7	2.4	3.8	1.2	2.6	2.1	1.8	1.9	<1.2 U
Cobalt	mg/kg	1.6	1.6	1.1	1.8	0.9	1.7	1.3	0.99	1.4	0.91
Copper	mg/kg	2.7	2.7	1.4 J-	2.7	1.1 J	3.1	2.1 J	<2.4 U	<2.4 U	1.4 J
Iron	mg/kg	4,000	3,500	2,900	4,100	2,500	3,900	3,200	2,600	3,700	2,600
Lead	mg/kg	3.6	3.3	2.4	3.8	2	5.5	3.2	2.2	3.2	2.2
Lithium	mg/kg	5.2	5.2	3.5	6.4	2.3	6.2	4.4	3.2	3.9	2.6
Magnesium	mg/kg	1,800	1,900	1,200	2,300	750	2,200	1,600	1100 J	1,300	880
Manganese	mg/kg	150	140	100	220	87	230	120	83 J	160	140
Mercury	mg/kg	0.0021 J-	0.00042 J-	<0.041 UJ	<0.037 UJ	<0.039 U	<0.036 UJ	<0.039 UJ	<0.04 U	<0.038 U	<0.04 UJ
Molybdenum	mg/kg	0.11 J	0.14 J	0.095 J	0.12 J	0.067 J	0.13 J	0.23 J	0.071 J	0.12 J	0.068 J
Nickel	mg/kg	2.3 J	2.2 J	1.6 J	3	1 J	2.5	1.9 J	1.4 J	1.8 J	1.2 J
Selenium	mg/kg	0.75 J	0.49 J	<1.3 U	0.56 J	<1.1 U	0.67 J	0.43 J	<1.2 U	0.44 J	<1.2 U
Silver	mg/kg	0.011 J	<0.06 U	<0.063 U	<0.059 U	<0.055 U	0.034 J	0.018 J	<0.059 U	<0.06 U	0.032 J
Sodium	mg/kg	<120 U	<120 U	<130 U	<120 U	<110 U	56 J	32 J	<120 U	<120 U	<120 U
Thallium	mg/kg	0.026	0.026	0.014	0.024	0.013	0.031	0.019	0.014	0.02	0.013
Thorium	mg/kg	1.9	1.6	1.5	2.1	1.2	2.3	1.6	1.4 J+	2.3	1.5
Uranium	mg/kg	3.2	11	2.1	2.9	0.51	7.3	11	1.4 J	0.6	0.39
Vanadium	mg/kg	19	33	12	33	6.6	32	29	14 J	7.8	5.8
Zinc	mg/kg	9.8 J	8.7 J	6.9 J	11 J	<11 U	<11 U	<12 U	<12 U	<12 U	<12 U

Table J1-3. Metals Laboratory Analytical Results for Sediment Samples (24 of 31)

Analyte	Units	Sample ID									
		DC3E-SD10-01-093018	DC3E-SD11-01-081718	DC3E-SD12-01-081718	DC3E-SD13-01-081718	DC3E-SD14-01-081718	DC3E-SD14-01-093018	DC3E-SD15-01-081718	M10-SD1-01-081718	M10-SD2-01-081718	M5-SD1-01-062318
		Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
Drainage Channel ID		Middle 3E	Middle 3E	Middle 3E	Middle 3E	Middle 3E	Middle 3E	Middle 3E	Middle 3E	Middle 3E	Middle 3E
Aluminum	mg/kg	1,400	2,200	1,500	1,600	1,400	1,100	2,400	3,500	3,300	3,400
Antimony	mg/kg	0.038 J	0.052 J	0.049 J	<0.12 U	0.033 J	<0.086 U	0.067 J	<0.1 U	<0.097 U	0.22
Arsenic	mg/kg	1.5	1.2	1.2	0.91	0.64	1.1	1.6	2	1.5	2.8
Barium	mg/kg	74	68	68	87	88	29	53	38	62	90
Beryllium	mg/kg	0.13	0.2	0.14	0.14	0.13	0.097	0.19	0.22	0.19	0.18
Cadmium	mg/kg	<0.22 U	<0.2 U	<0.22 U	<0.23 U	<0.21 U	<0.17 U	<0.23 U	<0.2 U	<0.19 U	0.052 J
Calcium	mg/kg	5,400	17,000	5,800	6,100	4,800	4,600	9,600	8,100	23,000	14,000
Chromium	mg/kg	1.3	2.1	1.6	1.7	1.4	0.84 J	2.5	2.8	2.6	3
Cobalt	mg/kg	0.92	1.3	0.94	0.97	0.97	0.7	1.8	1.9	2	1.9
Copper	mg/kg	<2.2 U	2.1	1.4 J	1.5 J	1.5 J	<1.7 U	2.3	4.3	4.5	3.8
Iron	mg/kg	3,100	3,800	3,100	3,000	3,200	2,100	4,200	3,800	4,400	4,800
Lead	mg/kg	2.4	3.5	2.5	2.3	2.4	1.7	3	5.4	5.1	7.7
Lithium	mg/kg	2.7	4.2	3	2.9	2.1	2.1	5.1	7.8	6.9	9.5
Magnesium	mg/kg	800	1,500	920	1,000	770	610	1,600	2,700	2,500	2,900
Manganese	mg/kg	150	230	98	85	90	86	130	69	250	120
Mercury	mg/kg		<0.032 UJ	<0.039 UJ	<0.039 UJ	<0.033 UJ		<0.038 UJ	<0.032 U	<0.031 U	0.0061 J-
Molybdenum	mg/kg	0.12 J	0.074 J	0.11 J	0.075 J	0.061 J	0.088 J	0.11 J	0.67	0.17 J	0.39
Nickel	mg/kg	1.1 J	1.9 J	1.2 J	1.4 J	1.1 J	0.78 J	2.5	3.6	3.2	3.2
Selenium	mg/kg	0.36 J	0.55 J	<1.1 U	<1.2 U	<1 U	0.33 J	0.5 J	3.8	0.91 J	7
Silver	mg/kg	<0.056 U	0.009 J	<0.056 U	<0.058 U	<0.051 U	<0.043 U	0.072	0.018 J	0.025 J	0.056
Sodium	mg/kg	<110 U	19 J	22 J	<120 U	23 J	<86 U	22 J	22 J	28 J	<95 U
Thallium	mg/kg	0.013	0.019	0.016	0.013	0.011	0.011	0.023	0.041	0.036	0.096
Thorium	mg/kg	1.5	1.9	2.1	1.6	1.4	1.3	3.4	2	1.9	1.8
Uranium	mg/kg	0.34	0.82	0.3	0.47	0.35	0.53	0.49	47	49	100
Vanadium	mg/kg	7.8	8.5	6.2	6.6	7.2	6.6	11	160	120	360
Zinc	mg/kg	<11 U	<10 U	<11 U	<12 U	<10 U	<8.6 U	<11 U	24	12	11

Table J1-3. Metals Laboratory Analytical Results for Sediment Samples (25 of 31)

Analyte	Units	Sample ID									
		M7-SD1-01-062318	M7-SD2-01-081418	M7-SD3-01-081418	DC3F-SD1-01-062318	DC3F-SD2-01-062318	DC3F-SD3-01-062318	DC3F-SD4-01-062318	DC3F-SD5-01-062318	DC3F-SD6-01-062318	DC3F-SD7-01-062318
		Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
Drainage Channel ID		Middle 3E	Middle 3E	Middle 3E	Middle 3F	Middle 3F	Middle 3F	Middle 3F	Middle 3F	Middle 3F	Middle 3F
Aluminum	mg/kg	2,900	3,000	3,500	2,800	2,300	2,600	2,400	2,300	1,900	2,500
Antimony	mg/kg	0.11	<0.092 U	<0.097 U	0.097 J	0.078 J	0.077 J	0.064 J	0.058 J	0.056 J	0.11
Arsenic	mg/kg	2.1	0.79	1.2	1.7	1.2	2.2	1.2	1.2	1.1	7.1 J
Barium	mg/kg	92	38	54	130	120	75	62	52	50	53
Beryllium	mg/kg	0.2	0.17	0.22	0.23	0.2	0.21	0.19	0.17	0.15	0.19
Cadmium	mg/kg	0.03 J	<0.18 U	<0.19 U	0.041 J	<0.2 U	0.035 J	<0.2 U	<0.19 U	<0.19 U	<0.2 U
Calcium	mg/kg	20,000	4,100	11,000	19,000	18,000	17,000	11,000	9,300	7,000	8,100
Chromium	mg/kg	3.2	4.1	4	4	3.8	3.3	3	2.6	2.5	3.1
Cobalt	mg/kg	2	1.4	1.9	2.1	1.5	1.6	1.5	1.9	1.3	1.9
Copper	mg/kg	4	2.1	2.8	2.6	1.8 J-	1.8 J-	1.9 J-	1.9 J-	1.5 J-	2.4
Iron	mg/kg	4,700	1,900	3,900	4,100	3,400	3,800	3,300	3,100	2,700	4,000
Lead	mg/kg	5.2	1.5	3.7	3.3	3.1	3.2	2.9	2.9	2.4	3.5
Lithium	mg/kg	7.1	9.1	8.5	6.4	5.3	6.4	5.3	5.1	4.4	5.7
Magnesium	mg/kg	2,500	3,700	3,000	2,300	2,000	2,400	1,900	1,900	1,500	2,100
Manganese	mg/kg	180	140	110	230	180	160	140	130	110	150 J
Mercury	mg/kg	0.0014 J-	<0.033 U	<0.032 U	0.00083 J-	<0.033 UJ	<0.032 UJ	<0.032 UJ	<0.033 UJ	<0.034 UJ	0.013 J-
Molybdenum	mg/kg	0.25	0.056 J	0.087 J	0.11 J	0.08 J	0.12 J	0.087 J	0.092 J	0.063 J	0.43
Nickel	mg/kg	3.3	1.9	2.9	3.7	3.4	3	2.7	2.4	2	3.1
Selenium	mg/kg	1	<0.92 U	<0.97 U	0.6 J	0.44 J	0.59 J	0.48 J	0.44 J	0.32 J	0.37 J
Silver	mg/kg	0.021 J	<0.046 U	0.0087 J	<0.051 U	<0.05 U	<0.049 U	<0.051 U	<0.048 U	<0.048 U	<0.051 U
Sodium	mg/kg	230	16 J	18 J	<100 UJ	<99 UJ	<98 UJ	<100 UJ	<96 UJ	<96 UJ	<100 UJ
Thallium	mg/kg	0.042	0.011	0.022	0.029	0.023	0.022	0.026	0.021	0.021	0.029
Thorium	mg/kg	2	0.96	1.8	2.1	1.8	1.7	1.6	1.4	1.3	1.9
Uranium	mg/kg	17	0.27	3.1	3.2	3.2	2.7	2.2	4.7	6.1	4
Vanadium	mg/kg	54	2.1	31	72	22	17	20	21	21	31
Zinc	mg/kg	11	<9.2 U	11	8 J-	6.7 J-	8.1 J-	6.7 J-	7.4 J-	5.4 J-	7.7 J-

Table J1-3. Metals Laboratory Analytical Results for Sediment Samples (26 of 31)

Analyte	Units	Sample ID									
		DC3F-SD8-01-062318	DC3F-SD8A-01-062318	DC3F-SD9-01-062318	DC3F-SD10-01-062318	M6-SD1-01-091618	M6-SD2-01-091618	M6-SD3-01-091618	DC3G-SD1-01-062318	DC3G-SD2-01-062318	DC3G-SD3-01-062318
		Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
Drainage Channel ID		Middle 3F	Middle 3F	Middle 3F	Middle 3F	Middle 3F	Middle 3F	Middle 3F	Middle 3G	Middle 3G	Middle 3G
Aluminum	mg/kg	2,900	2,500	2,200	2,600	4,200	4,100	5,000	2,400	2,000	2,400
Antimony	mg/kg	0.093 J	0.1	0.073 J	0.087 J	0.18	0.12	<0.11 U	0.084 J	0.084 J	0.097 J
Arsenic	mg/kg	1.6	2.2	1.3	1.3	2.9	3.7	7	1.5	1.3	1.3
Barium	mg/kg	71	91	46	88	66	80	140	90	77	87
Beryllium	mg/kg	0.22	0.32	0.16	0.19	0.27	0.32	0.37	0.22	0.16	0.16
Cadmium	mg/kg	<0.25 U	<0.19 U	<0.2 U	<0.2 U	0.055 J	0.039 J	0.057 J	0.066 J	0.045 J	0.053 J
Calcium	mg/kg	9,700	8,800	10,000	12,000	22,000	21,000	22,000	40,000	33,000	38,000
Chromium	mg/kg	3.8	6.3	2.7	3.4	4	3.3	2.7	6.4	3.7	3.9
Cobalt	mg/kg	1.8	2.7	1.5	1.8	3.1	3.2	4	2.2	1.9	1.9
Copper	mg/kg	2.6	4.1	2.3	2.7	6.4	6.5	10	2.4	1.8	1.9 J-
Iron	mg/kg	3,800	4,500	3,200	3,700	6,200	6,000	7,300	4,100	3,400	4,100
Lead	mg/kg	3.4	5	3.2	3.2	8.4	6.2	7.1	4.6	4.2	4.4
Lithium	mg/kg	6.8	5.4	4.4	5.7	9.7	7.7	7.8	5.8	4.9	5.8
Magnesium	mg/kg	2,300	2,300	1,700	2,000	3,300	3,000	3,400	6,800	5,800	5,800
Manganese	mg/kg	90	190	130	130	180	200	330	250	220	220
Mercury	mg/kg	0.00079 J-	<0.034 U	<0.032 U	<0.035 UJ				0.0011 J-	0.0011 J-	0.00017 J-
Molybdenum	mg/kg	0.11 J	0.15 J	0.11 J	0.099 J	0.2	0.16 J	0.43	0.075 J	0.075 J	0.081 J
Nickel	mg/kg	3.3	8.4	2.4	2.8	5.3	4.9	5	7.2 J	4.1	4.1
Selenium	mg/kg	1.9	0.77 J	0.37 J	0.52 J	2	1.6	1.3	0.55 J	0.42 J	0.58 J
Silver	mg/kg	<0.063 U	0.015 J	<0.05 U	<0.05 U	0.033 J	0.016 J	0.025 J	0.0085 J	<0.044 U	<0.051 U
Sodium	mg/kg	<130 UJ	<96 UJ	<99 UJ	<99 UJ	<89 U	<99 U	<110 U	120	81 J	160
Thallium	mg/kg	0.035	0.053	0.027	0.026	0.054	0.048	0.071	0.035	0.026	0.031
Thorium	mg/kg	1.9	4.3	1.8 J	1.7	3.1	3.4	3.5	3.1	2.1	2.2
Uranium	mg/kg	22	12	3.2 J	3.2	22	9.8	3	0.75 J	0.54	0.45
Vanadium	mg/kg	57	80	23 J	21	120	50	10	13 J	9.5	6.3
Zinc	mg/kg	8.3 J-	11	7.7 J	8.8 J-	17	16	19	9.9	7.9 J	8.6 J

Table J1-3. Metals Laboratory Analytical Results for Sediment Samples (27 of 31)

Analyte	Units	Sample ID									
		DC3G-SD4-01-062318	DC3G-SD5-01-062318	DC3G-SD6-01-062318	DM33-SD1-01-081818	DM33-SD2-01-081818	DM33-SD3-01-081818	DM33-SD4-01-081818	DM33-SD5-01-081818	DM33-SD6-01-081818	DM33-SD7-01-081818
		Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
Drainage Channel ID		Middle 3G	Middle 3G	Middle 3G	Knife Edge	Knife Edge	Knife Edge	Knife Edge	Knife Edge	Knife Edge	Knife Edge
Aluminum	mg/kg	2,200	2,300	2,200	3,800	3,500	5,900	6,600	5,900	5,800	7,100
Antimony	mg/kg	0.093 J	0.087 J	0.1	0.078 J	0.097	0.27	0.16 J	0.14	0.15	0.22
Arsenic	mg/kg	1.2	1.4	1.3	1.5	1.5	1.9	1.9	2.9	2.6	3.4
Barium	mg/kg	86	100	89	130	150	140	100 J	120	140	160
Beryllium	mg/kg	0.15	0.19	0.15	0.21	0.18	0.25	0.24	0.2	0.22	0.23
Cadmium	mg/kg	0.066 J	0.058 J	0.062 J	0.063 J	0.068 J	0.067 J	0.077 J	0.044 J	0.045 J	0.043 J
Calcium	mg/kg	41,000	39,000	39,000	37,000	45,000	48,000	51,000	44,000	42,000	42,000
Chromium	mg/kg	3.5	4.7	3.4	5.3	4.5	5.8	5.7	4.1	4.5	4.5
Cobalt	mg/kg	2	1.9	1.8	2.7	2.3	3.1	3.2	2.7	2.8	3.4
Copper	mg/kg	2 J-	2.1	1.9 J-	2.7	2.3	3.4	3.9	4	3.5	4.5
Iron	mg/kg	3,800	3,900	3,800	6,100	5,200	7,500	6,800	6,600	6,700	7,600
Lead	mg/kg	4.9	4.5	4.1	5.3	5.1	6.6	6.2	5.5	5.5	7
Lithium	mg/kg	5.5	5.3	5.3	10	8.2	9.9	9.2	6.9	7.7	7.7
Magnesium	mg/kg	8,700	5,700	5,900	8,100	8,000	8,500	10,000	8,400	7,400	7,800
Manganese	mg/kg	250	300	230	290	280	290	320	340	250	430
Mercury	mg/kg	0.00039 J-	0.00042 J-	0.00037 J-	<0.033 UJ	<0.032 UJ	<0.031 UJ	<0.034 UJ	<0.032 UJ	<0.031 UJ	<0.031 UJ
Molybdenum	mg/kg	0.061 J	0.058 J	0.074 J	0.093 J	0.085 J	0.092 J	0.073 J	0.13 J	0.12 J	0.081 J
Nickel	mg/kg	3.9	4.6	3.7	6.2	5.1	7.1	7.2	5.6	6.1	7
Selenium	mg/kg	0.57 J	0.51 J	0.51 J	0.54 J	0.49 J	0.64 J	0.62 J	0.57 J	0.59 J	0.76 J
Silver	mg/kg	<0.051 U	<0.05 U	0.011 J	0.011 J	0.0084 J	<0.048 U	0.011 J	0.017 J	<0.05 U	0.0091 J
Sodium	mg/kg	140	62 J	120	160	340	1600	2400 J	2300	1900	3000
Thallium	mg/kg	0.032	0.03	0.028	0.033	0.029	0.052	0.051	0.039	0.047	0.049
Thorium	mg/kg	2.3	2.3	1.9	2.6	2.3	3.4	3.4	3	2.7	3.4
Uranium	mg/kg	0.33	1 J	0.52	0.49	0.4	0.43	0.61 J	0.73	0.46	0.42
Vanadium	mg/kg	8	14 J	6.6	8.6	7	8.5	8.4 J	10	9.8	13
Zinc	mg/kg	9.4 J	8.3 J	8 J	12	10	12	12	10	13	12

Table J1-3. Metals Laboratory Analytical Results for Sediment Samples (28 of 31)

Analyte	Units	Sample ID									
		DM33-SD8-01-081818	DM33-SD9-01-081818	DM33-SD10-01-081818	DM33-SD11-01-081818	DM33-SD12-01-081818	DM33-SD13-01-081818	DM33-SD14-01-081818	DM33-SD15-01-081818	DM33-SD16-01-081818	DM35-SD7-01-082018
		Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
Drainage Channel ID		Knife Edge	Knife Edge	Knife Edge	Knife Edge	Knife Edge	Knife Edge	Knife Edge	Knife Edge	Knife Edge	Black Mesa
Aluminum	mg/kg	8,600	8,500	6,800	6,100	6,900	6,500	8,300	7,800	7,800	1,900
Antimony	mg/kg	0.16	0.19	0.12	0.1	0.16	0.11	0.17	0.15	0.17	<0.098 U
Arsenic	mg/kg	3.9	3.4	3	3.3	3.5	2.9	4.1	5.6	3.8	1.8
Barium	mg/kg	120	120	150	170	130	120	180	160	470 J	100
Beryllium	mg/kg	0.26	0.28	0.23	0.22	0.25	0.22	0.27	0.26	0.24	0.15
Cadmium	mg/kg	0.043 J	0.052 J	0.049 J	0.052 J	0.047 J	0.053 J	0.044 J	0.037 J	0.049 J	<0.2 U
Calcium	mg/kg	34,000	48,000	48,000	44,000	52,000	47,000	52,000	39,000	56,000	12,000
Chromium	mg/kg	4.6	4.9	4.2	3.8	4.7	5.1	5.7	4.9	4.9	2
Cobalt	mg/kg	3.6	3.6	3.1	3.3	3.5	3.2	4	3.6	3.9	1.2
Copper	mg/kg	5.1	4.8	4.1	4.3	5.1	4.1	5.7	5.3	5.6	2.3
Iron	mg/kg	8,400	8,500	7,400	7,500	7,900	7,300	8,900	8,300	7,900	3,100
Lead	mg/kg	6.4	7.8	6.1	7.1	7.4	6.2	6.9	6.4	6.8	2.7
Lithium	mg/kg	7.5	7.3	7.2	6.8	7.8	7.7	8.1	7.6	7.4	3.5
Magnesium	mg/kg	8,000	8,100	8,000	7,900	12,000	8,900	10,000	8,800	11,000	1,600
Manganese	mg/kg	270	310	280	330	320	300	350	290	350	120
Mercury	mg/kg	<0.031 UJ	<0.03 UJ	<0.031 UJ	<0.03 UJ	<0.031 UJ	<0.034 UJ	<0.032 UJ	<0.032 UJ	<0.031 UJ	<0.031 U
Molybdenum	mg/kg	0.087 J	0.087 J	0.056 J	0.078 J	0.1 J	0.081 J	0.086 J	0.13 J	0.07 J	0.2
Nickel	mg/kg	7.8	7.8	6.8	7	7.7	7.1	8.7	7.9	8	1.7 J
Selenium	mg/kg	0.68 J	0.72 J	0.66 J	0.65 J	0.73 J	0.66 J	0.79 J	0.69 J	0.8 J	0.51 J
Silver	mg/kg	0.014 J	0.012 J	0.01 J	<0.048 U	0.01 J	<0.05 U	0.0094 J	0.011 J	0.016 J	<0.049 U
Sodium	mg/kg	4000	4000	3000	2700	3100	2600	4000	3700	4000	40 J
Thallium	mg/kg	0.062	0.068	0.052	0.047	0.052	0.049	0.055	0.053	0.054	0.02
Thorium	mg/kg	3.9	4.1	3.7	3.4	3.9	3.3	3.9	4.1	3.9	1.6
Uranium	mg/kg	0.46	0.51	0.41	0.44	0.37	0.4	0.41	0.46	0.36	2.9
Vanadium	mg/kg	15	14	13	15	14	13	16	16	16	15
Zinc	mg/kg	12	12	11	11	13	11	13	12	12	<9.8 U

Table J1-3. Metals Laboratory Analytical Results for Sediment Samples (29 of 31)

Analyte	Units	Sample ID									
		DM35-SD8-01-082018	DM35-SD9-01-082018	DM35-SD10-01-082018	DM35-SD11-01-082018	DM35-SD12-01-082018	DM35-SD13-01-082018	DM35-SD14-01-082018	DM35-SD15-01-082018	DM35-SD16-01-082018	DM35-SD17-01-082018
		Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
Drainage Channel ID		Black Mesa	Black Mesa	Black Mesa	Black Mesa	Black Mesa	Black Mesa	Black Mesa	Black Mesa	Black Mesa	Black Mesa
Aluminum	mg/kg	1,700	2,000	2,000	2,000	1,800	1,800	3,200	1,600	2,200	2,900
Antimony	mg/kg	<0.098 U	<0.099 U	<0.097 U	0.11	<0.1 U	0.14	<0.097 U	<0.092 U	<0.096 U	0.18
Arsenic	mg/kg	1.2	1.5	4.2	2.3	2.2	1.2	2.3	1.1	1.6	2.7
Barium	mg/kg	95	120	100	94	110	85	74	110	69	94
Beryllium	mg/kg	0.13	0.14	0.14	0.14	0.14	0.12	0.16	0.12	0.14	0.13
Cadmium	mg/kg	<0.2 U	<0.2 U	<0.19 U	<0.19 U	<0.2 U	<0.2 U	<0.19 U	<0.18 U	<0.19 U	<0.2 U
Calcium	mg/kg	12,000	18,000	18,000	20,000	19,000	13,000	36,000	14,000	19,000	77,000
Chromium	mg/kg	1.9	2.5	2.4	2.3	2	1.9	2.6	1.9	2.3	2.2
Cobalt	mg/kg	1.1	1.4	1.4	1.4	1.2	1.2	1.8	1.1	1.3	1.7
Copper	mg/kg	<2 U	<2 U	2.6	2.1	2.1	<2 U	3	<1.8 U	2	2.5
Iron	mg/kg	2,600	3,200	5,000	3,700	2,800	2,600	3,900	2,500	3,000	3,400
Lead	mg/kg	2.3	2.9	3.1	3.3	2.9	2.4	3.7	2.5	2.9	4.8
Lithium	mg/kg	3.6	4.4	4.8	4.4	3.9	3.8	5.3	3.6	4.4	3.7
Magnesium	mg/kg	1,800	2,500	2,500	2,800	3,200	2,000	4,400	2,400	2,900	4,000
Manganese	mg/kg	120	160	160	170	120	130	260	120	160	550
Mercury	mg/kg	<0.032 U	<0.032 U	<0.029 U	<0.033 U	<0.031 U	<0.03 U	<0.03 U	<0.031 U	<0.032 U	<0.032 U
Molybdenum	mg/kg	0.12 J	0.31	0.52	0.3	0.16 J	0.13 J	0.15 J	0.11 J	0.16 J	0.15 J
Nickel	mg/kg	1.7 J	2.3	2.6	2.5	2.2	1.8 J	3.7	1.9	2.3	3.2
Selenium	mg/kg	<0.98 U	0.36 J	0.73 J	0.35 J	0.38 J	0.36 J	0.43 J	0.33 J	0.34 J	0.47 J
Silver	mg/kg	<0.049 U	<0.05 U	0.013 J	<0.048 U	<0.05 U	<0.05 U	0.0087 J	<0.046 U	<0.048 U	0.01 J
Sodium	mg/kg	26 J	55 J	49 J	51 J	74 J	31 J	720	98	160	1000
Thallium	mg/kg	0.017	0.02	0.026	0.025	0.021	0.018	0.032	0.017	0.021	0.029
Thorium	mg/kg	1.4	1.7	1.6	1.6	1.6	1.6	2.3	1.4	1.7	2.2
Uranium	mg/kg	2.3	2.8	7.1	2.6	2.7	2.8	1.6	1.6	3.7	1.5
Vanadium	mg/kg	12	12	28	12	17	13	13	8.6	16	12
Zinc	mg/kg	<9.8 U	<9.9 U	<9.7 U	26	<10 U	12	<9.7 U	<9.2 U	<9.6 U	<10 U

Table J1-3. Metals Laboratory Analytical Results for Sediment Samples (30 of 31)

Analyte	Units	Sample ID									
		DM35-SD18-01-082018	DM35-SD19-01-082018	DM35-SD20-01-081818	DM35-SD21-01-081818	DM39-SD7-01-081618	DM39-SD8-01-081618	DM39-SD9-01-081618	DM39-SD10-01-081618	DM39-SD11-01-081618	DM39-SD12-01-081618
		Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
Drainage Channel ID		Black Mesa	Black Mesa	Black Mesa	Black Mesa	Tommy James	Tommy James	Tommy James	Tommy James	Tommy James	Tommy James
Aluminum	mg/kg	4,000	3,800	3,300	3,500	1,900	2,500	1,300	1900 J	2,100	1,700
Antimony	mg/kg	<0.099 U	0.21	0.069 J	0.071 J	0.044 J	0.075 J	0.037 J	0.047 J	0.032 J	0.048 J
Arsenic	mg/kg	1.7	2.5	2.6	1.6	1.8	3.4	1.4	1.1	1.2	1.4
Barium	mg/kg	110	140	140	140	53	71	81	64 J	120	51
Beryllium	mg/kg	0.16	0.15	0.17	0.17	0.15	0.2	0.11	0.13	0.12	0.14
Cadmium	mg/kg	<0.2 U	<0.2 U	<0.19 U	<0.2 U	<0.19 U	0.038 J	<0.2 U	0.032 J	0.033 J	<0.2 U
Calcium	mg/kg	33,000	20,000	29,000	22,000	13,000	16,000	8,100	20000 J	18,000	11,000
Chromium	mg/kg	2.8	2.6	3	3.1	1.9	2.8	1.5	1.8	1.9	1.4
Cobalt	mg/kg	1.9	1.8	1.8	1.7	1.2	1.8	1	1.4	1.2	1.1
Copper	mg/kg	2.6	2.7	2.6	2.2	2.2	3.6	1.9 J	1.8 J	1.8 J	1.9 J
Iron	mg/kg	3,600	4,100	5,000	4,600	3,200	4,600	2,500	2600 J	2,700	2,700
Lead	mg/kg	3.4	3.3	4.2	4	2.4	3.8	3.1	2.5	2.3	2.3
Lithium	mg/kg	4.9	4.5	4.9	5.3	4.1	5.5	2.6	3.9	3.6	3.5
Magnesium	mg/kg	4,800	3,800	4,400	3,800	1,700	2,800	1,400	3000 J	2,200	1,300
Manganese	mg/kg	180	160	200	190	160	170	140	170	130	130
Mercury	mg/kg	<0.032 U	<0.033 U	<0.031 UJ	<0.033 UJ	<0.03 UJ	<0.032 UJ	<0.032 UJ	<0.032 UJ	0.0084 J-	<0.032 UJ
Molybdenum	mg/kg	0.099 J	0.13 J	0.32	0.12 J	0.21	0.76	0.64	0.097 J	0.12 J	0.12 J
Nickel	mg/kg	3.9	3.6	3.3	3.6	1.7 J	2.8	1.3 J	2.2	1.9	1.4 J
Selenium	mg/kg	0.42 J	0.37 J	0.49 J	0.39 J	<0.95 U	0.38 J	<0.99 U	0.33 J	0.37 J	0.32 J
Silver	mg/kg	0.0099 J	<0.051 U	<0.048 U	<0.05 U	<0.048 U	<0.051 U	<0.049 U	<0.048 U	<0.048 U	<0.05 U
Sodium	mg/kg	1500	1500	710	950	31 J	520	110	450 J	410	110
Thallium	mg/kg	0.032	0.029	0.03	0.028	0.019	0.025	0.016	0.017	0.021	0.019
Thorium	mg/kg	2.4	2.2	2.1	2.1	2.2	2.3	1.4	2 J	1.9	1.8
Uranium	mg/kg	0.99	1.8	2.1	33	1.1	1.9	0.61	0.49	0.49	0.89
Vanadium	mg/kg	9	21	15	80	6.1	9.7	5.8	4.4	5.1	6.5
Zinc	mg/kg	<9.9 U	32	8.5 J	7.3 J	<9.5 U	<10 U	<9.9 U	<9.7 U	<9.7 U	<10 U

Table J1-3. Metals Laboratory Analytical Results for Sediment Samples (31 of 31)

Analyte	Units	Sample ID				
		DM39-SD13-01-081618	DM39-SD14-01-081618	DM39-SD15-01-081618	DM39-SD16-01-081618	DM39-SD17-01-081618
		Result	Result	Result	Result	Result
Drainage Channel ID		Tommy James	Tommy James	Tommy James	Tommy James	Tommy James
Aluminum	mg/kg	5,200	3,300	3,100	3,700	3,500
Antimony	mg/kg	0.098	0.079 J	0.063 J	0.073 J	0.085 J
Arsenic	mg/kg	2.4	1.8	1.8	1.7	2.3
Barium	mg/kg	130	99	100	170 J	52
Beryllium	mg/kg	0.17	0.17	0.15	0.18	0.17
Cadmium	mg/kg	0.07 J	0.053 J	0.048 J	0.048 J	0.034 J
Calcium	mg/kg	51,000	36,000	38,000	35,000 J	26,000
Chromium	mg/kg	3.5	3	2.3	2.7	2.4
Cobalt	mg/kg	2.5	1.8	1.8	2.2	1.9
Copper	mg/kg	3.6	2.3	2.9	2.8	3.6
Iron	mg/kg	5,200	4,100	3,800	4,400	4,500
Lead	mg/kg	4.9	3.5	3.3	4.9 J	3.9
Lithium	mg/kg	5.7	5	4.8	4.6	4.3
Magnesium	mg/kg	8,700	4,100	4,400	5,900 J	4,300
Manganese	mg/kg	260	260	190	540 J	170
Mercury	mg/kg	<0.033 UJ	<0.031 UJ	<0.031 UJ	<0.031 UJ	<0.03 UJ
Molybdenum	mg/kg	0.091 J	0.12 J	0.12 J	0.39	0.13 J
Nickel	mg/kg	4.9	3.4	3.3	3.7	3.7
Selenium	mg/kg	0.56 J	0.5 J	0.43 J	0.56 J	0.36 J
Silver	mg/kg	0.0096 J	<0.049 U	<0.05 U	<0.05 U	<0.048 U
Sodium	mg/kg	2,600	1,100	1,100	1,500	1,700
Thallium	mg/kg	0.04	0.031	0.029	0.035 J	0.03
Thorium	mg/kg	3.2	2.6	2.4	2.9	2.6
Uranium	mg/kg	0.45	0.59	1.3	0.43	0.38
Vanadium	mg/kg	10	7.9	9	8	8.7
Zinc	mg/kg	<9.6 U	<9.8 U	<10 U	<10 U	<9.6 U

Notes:
- Not applicable
ID Identification
J Estimated value
J- Estimated value, may be biased low.
mg/kg Milligrams per kilogram
U Not detected. The associated value is the reporting limit.
UJ Not considered detected. The associated value is the reported concentration, which is estimated

Table J1-4. Radionuclides Laboratory Analytical Results for Sediment Samples (1 of 9)

Field Sample ID	Drainage Channel ID	Analyte																										
		Uranium-238			Uranium-234			Thorium-230			Radium-226			Lead-210			Uranium-235			Thorium-232			Radium-228			Potassium-40		
		Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q
DM1-SD6-01-081918	Tse Tah West	0.46	0.14		0.43	0.13		0.45	0.15	M3	0.42	0.15	J-	<0.51	0.33	U	<0.05	0.032	U	0.21	0.076		<0.5	0.3	UJ	6.1	1.8	J-
DM1-SD7-01-081918	Tse Tah West	-	-		-	-		-	-		0.41	0.14	J-	-	-		-	-		-	-		<0.61	0.31	UJ	8.7	2.2	J-
DM1-SD8-01-081918	Tse Tah West	-	-		-	-		-	-		0.5	0.15	J-	-	-		-	-		-	-		<0.28	0.19	UJ	8.8	1.7	J-
DM1-SD9-01-081918	Tse Tah West	-	-		-	-		-	-		<0.33	0.16	UJ	-	-		-	-		-	-		<0.47	0.28	UJ	8.3	2.1	J-
DM1-SD10-01-081918	Tse Tah West	-	-		-	-		-	-		0.49	0.19	LT	-	-		-	-		-	-		<0.67	0.4	U	9.4	2.5	LT
DM1-SD11-01-081918	Tse Tah West	-	-		-	-		-	-		0.6	0.15	LT	-	-		-	-		-	-		<0.35	0.21	U	9	1.7	LT
DM1-SD12-01-081918	Tse Tah West	-	-		-	-		-	-		<0.36	0.24	UJ	-	-		-	-		-	-		<0.52	0.31	UJ	5.9	2	J-
DM1-SD13-01-081918	Tse Tah West	-	-		-	-		-	-		0.5	0.16	J-	-	-		-	-		-	-		<0.55	0.3	UJ	7.3	1.9	J-
DM1-SD14-01-081918	Tse Tah West	-	-		-	-		-	-		0.98	0.21	J-	-	-		-	-		-	-		<0.46	0.29	UJ	9.8	2.3	J-
DM1-SD15-01-081918	Tse Tah West	-	-		-	-		-	-		0.42	0.15	J-	-	-		-	-		-	-		<0.5	0.32	UJ	5.2	1.7	J-
DM1-SD16-01-081918	Tse Tah West	-	-		-	-		-	-		0.47	0.14	J-	-	-		-	-		-	-		<0.29	0.19	UJ	7.3	1.5	J-
DM1-SD17-01-081918	Tse Tah West	0.39	0.12		0.37	0.12		0.74	0.17	M3	0.39	0.17	J-	0.54	0.35	LT	0.025	0.032	LT	0.245	0.074		<0.42	0.3	UJ	6.6	2.1	J-
DCWN-SD1-01-062418	Cove Wash North	-	-		-	-		-	-		0.43	0.16	J-	-	-		-	-		-	-		<0.45	0.33	UJ	12.7	2.9	J-
DCWN-SD2-01-062418	Cove Wash North	-	-		-	-		-	-		1.4	0.26	J-	-	-		-	-		-	-		<0.58	0.33	UJ	13.4	2.7	J-
DCWN-SD3-01-062418	Cove Wash North	-	-		-	-		-	-		0.63	0.19	J-	-	-		-	-		-	-		<0.67	0.42	UJ	14.1	3.3	J-
DCWN-SD4-01-062418	Cove Wash North	-	-		-	-		-	-		1.17	0.2	J-	-	-		-	-		-	-		0.33	0.15	J-	12.5	2.1	J-
DCWN-SD5-01-062418	Cove Wash North	-	-		-	-		-	-		1.3	0.26	J-	-	-		-	-		-	-		<0.55	0.36	UJ	12.8	2.7	J-
DCWN-SD6-01-062418	Cove Wash North	-	-		-	-		-	-		0.65	0.16	J-	-	-		-	-		-	-		<0.29	0.2	UJ	14.9	2.3	J-
DCWN-SD7-01-062418	Cove Wash North	-	-		-	-		-	-		1.14	0.24	J-	-	-		-	-		-	-		<0.51	0.33	UJ	13.4	2.7	J-
DCWN-SD8-01-062418	Cove Wash North	-	-		-	-		-	-		0.76	0.23	J-	-	-		-	-		-	-		<0.59	0.34	UJ	13.2	3	J-
DCWN-SD9-01-062418	Cove Wash North	-	-		-	-		-	-		0.7	0.21	J-	-	-		-	-		-	-		<0.69	0.42	UJ	12.2	3.3	J-
DCWN-SD10-01-062418	Cove Wash North	-	-		-	-		-	-		0.57	0.2	LT	-	-		-	-		-	-		<0.55	0.38	U	12.6	3.1	
DCWN-SD11-01-062418	Cove Wash North	-	-		-	-		-	-		<0.43	0.25	UJ	-	-		-	-		-	-		<0.66	0.38	U	10.9	2.6	
DCWN-SD12-01-062418	Cove Wash North	-	-		-	-		-	-		0.76	0.21	J-	-	-		-	-		-	-		<0.53	0.45	UJ	11.1	3.2	J-
DCWN-SD13-01-062418	Cove Wash North	-	-		-	-		-	-		1.32	0.26	J-	-	-		-	-		-	-		<0.46	0.29	UJ	10.6	2.4	J-
DCWN-SD14-01-062418	Cove Wash North	-	-		-	-		-	-		1.05	0.23	J-	-	-		-	-		-	-		<0.55	0.31	UJ	12	2.7	J-
DCWN-SD15-01-062418	Cove Wash North	-	-		-	-		-	-		0.74	0.22	LT	-	-		-	-		-	-		<0.57	0.4	U	13	3.2	
DCWN-SD16-01-062418	Cove Wash North	-	-		-	-		-	-		1.59	0.34		-	-		-	-		-	-		<0.82	0.51	U	12.3	3.2	
DCWN-SD17-01-062418	Cove Wash North	-	-		-	-		-	-		3.05	0.49		-	-		-	-		-	-		<0.78	0.45	U	13.2	3.5	
DCWN-SD18-01-062418	Cove Wash North	-	-		-	-		-	-		0.44	0.16	LT	-	-		-	-		-	-		<0.52	0.31	U	12.1	2.6	
DCWN-SD19-01-062418	Cove Wash North	-	-		-	-		-	-		<0.34	0.2	UJ	-	-		-	-		-	-		<0.56	0.4	UJ	10.7	2.6	
DCWN-SD20-01-062418	Cove Wash North	-	-		-	-		-	-		0.71	0.2	J-	-	-		-	-		-	-		<0.59	0.38	UJ	11.5	2.8	J-
DCWN-SD21-01-062418	Cove Wash North	-	-		-	-		-	-		0.86	0.22	J-	-	-		-	-		-	-		<0.67	0.39	UJ	12.5	3	J-
DCWN-SD22-01-062418	Cove Wash North	-	-		-	-		-	-		0.53	0.18	LT	-	-		-	-		-	-		<0.51	0.34	U	12.6	2.7	
DCWN-SD23-01-062418	Cove Wash North	-	-		-	-		-	-		<0.41	0.22	UJ	-	-		-	-		-	-		<0.57	0.32	U	14.6	3.3	
DCWN-SD24-01-062418	Cove Wash North	-	-		-	-		-	-		1.22	0.26	J-	-	-		-	-		-	-		<0.51	0.28	UJ	12.8	2.7	J-

Table J1-4. Radionuclides Laboratory Analytical Results for Sediment Samples (2 of 9)

Field Sample ID	Drainage Channel ID	Analyte																								
		Uranium-238			Uranium-234			Thorium-230			Radium-226			Lead-210			Uranium-235			Thorium-232			Radium-228			Potassium-40		
		Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q
DCWN-SD25-01-062418	Cove Wash North	-	-		-	-		-	-		0.67	0.17	LT	-	-		-	-		-	-		<0.4	0.18	U	15.6	2.5	
DCWN-SD26-01-062418	Cove Wash North	-	-		-	-		-	-		0.71	0.19	J-	-	-		-	-		-	-		<0.47	0.28	UJ	13.3	2.7	J-
DCWN-SD27-01-062418	Cove Wash North	-	-		-	-		-	-		0.72	0.21	LT	-	-		-	-		-	-		<0.65	0.43	U	13.3	3.1	
DCWN-SD28-01-062418	Cove Wash North	0.71	0.18		0.67	0.18		1.06	0.21	M3	1.49	0.33		1.37	0.51		<0.05	0.036	U	0.351	0.086		<0.74	0.47	U	18.8	4.4	
DCWN-SD28A-01-062418	Cove Wash North	0.39	0.12		0.32	0.11		0.53	0.14	M3	<0.29	0.17	UJ	0.57	0.37	LT	<0.048	0.035	U	0.284	0.077		<0.57	0.35	U	12.7	2.8	
DCWN-SD28B-01-062418	Cove Wash North	-	-		-	-		-	-		0.94	0.22	J+	-	-		-	-		-	-		<0.57	0.35	UJ	17.3	2.9	J+
DCWN-SD29-01-062418	Cove Wash North	-	-		-	-		-	-		1.14	0.25		-	-		-	-		-	-		<0.63	0.4	U	14.8	3	
DCWN-SD30-01-062418	Cove Wash North	-	-		-	-		-	-		1.33	0.29	J-	-	-		-	-		-	-		<0.76	0.47	UJ	14.8	3.5	J-
DC1-SD1-01-062118	Middle 1	-	-		-	-		-	-		6.59	0.89	J-	-	-		-	-		-	-		<0.62	0.36	UJ	12	2.8	J-
DC1-SD2-01-062118	Middle 1	-	-		-	-		-	-		5.17	0.72	J-	-	-		-	-		-	-		<0.55	0.37	UJ	12.5	3	J-
DC1-SD3-01-062118	Middle 1	-	-		-	-		-	-		2.03	0.37	J-	-	-		-	-		-	-		<0.73	0.46	UJ	17.8	4.1	J-
DC1-SD4-01-062118	Middle 1	-	-		-	-		-	-		2.33	0.37		-	-		-	-		-	-		<0.52	0.32	U	13.4	2.8	
DC1-SD5-01-062118	Middle 1	-	-		-	-		-	-		4.3	0.63		-	-		-	-		-	-		<0.91	0.53	U	13.1	3.6	
DC1-SD6-01-062118	Middle 1	-	-		-	-		-	-		6.6	0.86		-	-		-	-		-	-		<0.61	0.4	U	14.9	3.1	
DC1-SD7-01-062118	Middle 1	-	-		-	-		-	-		5.38	0.73		-	-		-	-		-	-		<0.8	0.45	U	11	2.8	
DC1-SD8-01-062118	Middle 1	-	-		-	-		-	-		3.77	0.56		-	-		-	-		-	-		<0.66	0.41	U	10.4	2.7	
DC1-SD8A-01-062118	Middle 1	4.21	0.73		4.55	0.79		10.6	1.7	M3	8.2	1	J-	7.3	1.9		0.19	0.081		0.292	0.078		<0.38	0.23	UJ	13.7	2.2	J-
DC1-SD9-01-062118	Middle 1	-	-		-	-		-	-		8.3	1.1		-	-		-	-		-	-		<0.95	0.56	U	13.9	3.5	
DC1-SD10-01-062118	Middle 1	-	-		-	-		-	-		6.49	0.85		-	-		-	-		-	-		<0.61	0.33	U	10.6	2.5	
DC1-SD11-01-062118	Middle 1	-	-		-	-		-	-		6.1	0.84		-	-		-	-		-	-		<0.76	0.41	U	13	3.2	
DC1-SD12-01-062118	Middle 1	-	-		-	-		-	-		5.39	0.68		-	-		-	-		-	-		<0.51	0.27	U	15.4	2.5	
DC1-SD13-01-062118	Middle 1	-	-		-	-		-	-		11	1.4	J-	-	-		-	-		-	-		<0.91	0.49	UJ	14.1	3.3	J-
DC1-SD14-01-062118	Middle 1	-	-		-	-		-	-		10.2	1.3		-	-		-	-		-	-		<0.76	0.47	U	11	2.7	
DC1-SD15-01-062118	Middle 1	-	-		-	-		-	-		16.5	2		-	-		-	-		-	-		<0.99	0.62	U	10.8	3.5	
DC1-SD16-01-062118	Middle 1	-	-		-	-		-	-		5.65	0.8		-	-		-	-		-	-		<1.03	0.65	UJ	14.6	3.9	
DC1-SD17-01-062118	Middle 1	-	-		-	-		-	-		6.27	0.86		-	-		-	-		-	-		<0.67	0.4	U	12.7	2.8	
DC1-SD18-01-062118	Middle 1	-	-		-	-		-	-		6.34	0.85	J-	-	-		-	-		-	-		<0.68	0.41	UJ	11.3	2.7	J-
DC1-SD19-01-062118	Middle 1	-	-		-	-		-	-		5.69	0.79		-	-		-	-		-	-		<0.78	0.48	U	11.7	3.1	
DC1-SD20-01-062118	Middle 1	-	-		-	-		-	-		4.98	0.64		-	-		-	-		-	-		<0.45	0.28	U	13.5	2.3	
DC1-SD21-01-062118	Middle 1	-	-		-	-		-	-		13.1	1.6		-	-		-	-		-	-		<0.71	0.46	U	12.9	3	
DC1-SD22-01-062118	Middle 1	-	-		-	-		-	-		6.41	0.87		-	-		-	-		-	-		<0.79	0.45	U	12.6	3.2	
DC1-SD23-01-062318	Middle 1	-	-		-	-		-	-		15.1	1.9		-	-		-	-		-	-		<1.18	0.74	UJ	12.9	4	
DC1-SD24-01-062318	Middle 1	2.28	0.45		2.21	0.44		3.1	0.52	M3	3.97	0.59		2.29	0.71		0.068	0.053	LT	0.249	0.071		<0.75	0.4	U	11.9	2.9	
DC1-SD25-01-062318	Middle 1	-	-		-	-		-	-		18.2	2.3		-	-		-	-		-	-		<0.92	0.53	U	13.6	3.1	
DC1-SD26-01-062318	Middle 1	-	-		-	-		-	-		8.9	1.2		-	-		-	-		-	-		<0.87	0.53	U	10.4	3.1	
DC1-SD27-01-062318	Middle 1	-	-		-	-		-	-		14.3	1.7		-	-		-	-		-	-		<0.43	0.28	U	13.1	2.3	

Table J1-4. Radionuclides Laboratory Analytical Results for Sediment Samples (3 of 9)

Field Sample ID	Drainage Channel ID	Analyte																								
		Uranium-238			Uranium-234			Thorium-230			Radium-226			Lead-210			Uranium-235			Thorium-232			Radium-228			Potassium-40		
		Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q
DC1-SD28-01-062318	Middle 1	-	-		-	-		-	-		1.17	0.26		-	-		-	-		-	-		<0.53	0.38	UJ	18.1	3.4	
DC1-SD29-01-062318	Middle 1	-	-		-	-		-	-		1.02	0.25		-	-		-	-		-	-		<0.6	0.37	U	11	2.8	
DC1-SD30-01-062318	Middle 1	-	-		-	-		-	-		1.09	0.29		-	-		-	-		-	-		<0.66	0.43	U	9.9	3	LT
DC1-SD31-01-062318	Middle 1	-	-		-	-		-	-		2.04	0.34		-	-		-	-		-	-		<0.33	0.26	UJ	13.3	2.9	
DC1-SD32-01-062318	Middle 1	-	-		-	-		-	-		0.8	0.21	LT	-	-		-	-		-	-		<0.63	0.35	U	12.7	2.8	
DC1A-SD1-01-062018	Middle 1A	-	-		-	-		-	-		5.26	0.74		-	-		-	-		-	-		<0.64	0.45	U	9.3	2.6	LT
DC1A-SD2-01-062018	Middle 1A	-	-		-	-		-	-		18.4	2.3	J	-	-		-	-		-	-		<0.86	0.48	UJ	9.5	2.4	J-
DC1A-SD3-01-062018	Middle 1A	8.8	1.5		9.1	1.6		11.8	1.9	M3	17.4	2.1	J-	7.2	1.8		0.41	0.14		0.275	0.085		<1.12	0.64	UJ	12.6	3.1	J-
DC1A-SD4-01-062018	Middle 1A	-	-		-	-		-	-		9.2	1.2		-	-		-	-		-	-		<0.7	0.36	U	15.3	3.2	
DC1A-SD5-01-062018	Middle 1A	-	-		-	-		-	-		37.4	4.5		-	-		-	-		-	-		<1.3	0.77	UJ	13.2	3.7	
DC1A-SD6-01-062018	Middle 1A	-	-		-	-		-	-		31.1	3.8	J-	-	-		-	-		-	-		<1.12	0.51	UJ	9.7	3.1	J-
DC1A-SD7-01-062018	Middle 1A	-	-		-	-		-	-		8.9	1.1		-	-		-	-		-	-		<0.42	0.22	U	12.6	2.2	
DC1A-SD7A-01-062018	Middle 1A	55.2	9		54	8.8		63.7	9.9	M3	72	8.5	J-	48	12		2.19	0.46		0.47	0.11		<1.39	0.72	UJ	14.4	3.9	J-
DC1A-SD7A-0612-01-062018	Middle 1A	39.6	6.6		39.3	6.5		39.5	6.1	M3	47.6	5.7	M3	30.8	7.5		1.66	0.39		0.404	0.096		<1.47	0.89	UJ	14.3	3.9	
DC1B-SD1-01-062118	Middle 1B	-	-		-	-		-	-		7.16	0.96		-	-		-	-		-	-		<0.9	0.57	U	12.9	3.3	
DC1B-SD2-01-062118	Middle 1B	-	-		-	-		-	-		6.51	0.86	J	-	-		-	-		-	-		<0.72	0.45	U	12.9	2.8	
DC1B-SD3-01-062118	Middle 1B	3.6	0.66		3.26	0.6		5.41	0.88	M3	6.12	0.83		3.34	0.94		0.122	0.068		0.308	0.081		<0.64	0.43	U	10.3	2.8	
DC1B-SD4-01-062218	Middle 1B	-	-		-	-		-	-		4.48	0.64		-	-		-	-		-	-		<0.7	0.44	U	14.5	3.3	
DC1B-SD5-01-062218	Middle 1B	-	-		-	-		-	-		18.3	2.3		-	-		-	-		-	-		<0.97	0.63	U	15.2	3.7	
DC1B-SD5A-01-062218	Middle 1B	-	-		-	-		-	-		10.4	1.3		-	-		-	-		-	-		<0.67	0.43	U	14.2	2.9	
DC1B-SD6-01-062218	Middle 1B	-	-		-	-		-	-		11.1	1.4		-	-		-	-		-	-		<0.92	0.58	U	11.9	2.9	
DC1B-SD7-01-062218	Middle 1B	-	-		-	-		-	-		8.5	1.1		-	-		-	-		-	-		<0.92	0.59	U	10.8	3	
DC1B-SD7A-01-062218	Middle 1B	-	-		-	-		-	-		15.3	2		-	-		-	-		-	-		<1.28	0.75	UJ	13.5	4.3	
DC1B-SD8-01-062218	Middle 1B	-	-		-	-		-	-		14.7	1.8		-	-		-	-		-	-		<0.85	0.53	U	14.3	3.2	
DC1B-SD8A-01-062218	Middle 1B	-	-		-	-		-	-		33.1	4		-	-		-	-		-	-		<1.01	0.66	UJ	15.2	3.4	
DC1B-SD9-01-062218	Middle 1B	-	-		-	-		-	-		0.64	0.2	LT	-	-		-	-		-	-		<0.57	0.37	U	13.3	3.2	
DC1G-SD1-01-062118	Middle 1G	-	-		-	-		-	-		5.2	0.73	J-	-	-		-	-		-	-		<0.94	0.56	UJ	10.3	3.1	J-
DC1G-SD2-01-062118	Middle 1G	-	-		-	-		-	-		3.53	0.53	J+	-	-		-	-		-	-		<0.75	0.46	UJ	15.7	3.6	J+
DC1G-SD3-01-062118	Middle 1G	0.43	0.13		0.41	0.13		0.65	0.15	M3	0.67	0.21	J-	0.92	0.43	LT	0.035	0.036	LT	0.323	0.079		<0.61	0.43	UJ	10.9	3.2	J-
DT9-SD1-01-062418	Cove Transfer Station	-	-		-	-		-	-		1.42	0.28	J-	-	-		-	-		-	-		<0.43	0.22	UJ	7.7	2.2	J
DT9-SD2-01-062418	Cove Transfer Station	-	-		-	-		-	-		6.51	0.86		-	-		-	-		-	-		<0.6	0.41	UJ	14.3	3	
DT9-SD3-01-062418	Cove Transfer Station	1.44	0.3		1.31	0.28		2.31	0.4	M3	3.03	0.46	J-	2.27	0.69		<0.058	0.046	U	0.5	0.11		<0.51	0.34	UJ	10.4	2.6	J-
DT9-SD4-01-062418	Cove Transfer Station	-	-		-	-		-	-		1.96	0.37		-	-		-	-		-	-		<0.77	0.46	U	14.8	3.4	
DT9-SD5-01-062418	Cove Transfer Station	-	-		-	-		-	-		2.1	0.34	J-	-	-		-	-		-	-		<0.55	0.34	UJ	11.4	2.5	J-
DT9-SD6-01-062418	Cove Transfer Station	-	-		-	-		-	-		2.97	0.47	J-	-	-		-	-		-	-		<0.72	0.39	UJ	12.2	2.9	J-
DT9-SD7-01-062418	Cove Transfer Station	-	-		-	-		-	-		1.41	0.28	J-	-	-		-	-		-	-		<0.47	0.36	UJ	12.3	2.9	J-

Table J1-4. Radionuclides Laboratory Analytical Results for Sediment Samples (4 of 9)

Field Sample ID	Drainage Channel ID	Analyte																								
		Uranium-238			Uranium-234			Thorium-230			Radium-226			Lead-210			Uranium-235			Thorium-232			Radium-228			Potassium-40		
		Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q
DT9-SD8-01-062418	Cove Transfer Station	-	-		-	-		-	-		2.73	0.37	J-	-	-		-	-		-	-		<0.35	0.21	UJ	13.8	2.2	J-
DT9-SD9-01-062418	Cove Transfer Station	-	-		-	-		-	-		1.77	0.3		-	-		-	-		-	-		<0.62	0.36	U	12.4	2.7	
DT9-SD10-01-062418	Cove Transfer Station	-	-		-	-		-	-		5.42	0.72		-	-		-	-		-	-		<0.51	0.34	U	15.1	3.1	
DT9-SD11-01-062418	Cove Transfer Station	-	-		-	-		-	-		2.14	0.38		-	-		-	-		-	-		<0.6	0.46	UJ	13.8	3.1	
DT9-SD12-01-062418	Cove Transfer Station	-	-		-	-		-	-		10.9	1.4		-	-		-	-		-	-		<0.86	0.56	U	18.7	4.2	
DT9-SD13-01-062418	Cove Transfer Station	-	-		-	-		-	-		2.48	0.35		-	-		-	-		-	-		<0.34	0.19	U	13.1	2.2	
DT9-SD14-01-062418	Cove Transfer Station	-	-		-	-		-	-		1.89	0.36		-	-		-	-		-	-		<0.78	0.47	U	12	3.6	
DT9-SD15-01-062418	Cove Transfer Station	-	-		-	-		-	-		2.25	0.36	J-	-	-		-	-		-	-		<0.56	0.31	UJ	12.7	2.7	J-
DT9-SD16-01-062418	Cove Transfer Station	-	-		-	-		-	-		4.61	0.64		-	-		-	-		-	-		<0.64	0.4	U	11.9	2.6	
DT9-SD17-01-062418	Cove Transfer Station	-	-		-	-		-	-		1.83	0.32	J-	-	-		-	-		-	-		<0.71	0.45	UJ	10.6	2.7	J-
DT9-SD18-01-062418	Cove Transfer Station	-	-		-	-		-	-		1.82	0.34	J-	-	-		-	-		-	-		<0.63	0.32	UJ	12.6	2.9	J-
DT9-SD19-01-062418	Cove Transfer Station	-	-		-	-		-	-		1.37	0.23	J-	-	-		-	-		-	-		0.34	0.17	J-	14.4	2.3	J-
DT9-SD20-01-062418	Cove Transfer Station	-	-		-	-		-	-		1.63	0.33		-	-		-	-		-	-		<0.71	0.45	U	9.6	2.9	LT
DT9-SD21-01-062418	Cove Transfer Station	-	-		-	-		-	-		1.4	0.28		-	-		-	-		-	-		<0.66	0.37	U	15	3.1	
DC2-SD1-01-062118	Middle 2	-	-		-	-		-	-		3.75	0.53	J-	-	-		-	-		-	-		<0.67	0.4	UJ	10.7	2.5	J-
DC2-SD2-01-062118	Middle 2	-	-		-	-		-	-		4.71	0.69		-	-		-	-		-	-		<0.79	0.5	U	12.4	3.3	
DC2-SD3-01-062118	Middle 2	-	-		-	-		-	-		5.11	0.65	J-	-	-		-	-		-	-		<0.38	0.19	UJ	12.1	2	J-
DC2-SD4-01-062118	Middle 2	-	-		-	-		-	-		4.37	0.62	J-	-	-		-	-		-	-		<0.69	0.43	UJ	11.4	2.8	J-
DC2-SD5-01-062118	Middle 2	-	-		-	-		-	-		3.56	0.5	J-	-	-		-	-		-	-		<0.56	0.34	UJ	9.4	2.2	J-
DC2-SD6-01-062118	Middle 2	-	-		-	-		-	-		4.64	0.65	J-	-	-		-	-		-	-		<0.73	0.42	UJ	7.9	2.3	J-
DC2-SD7-01-062118	Middle 2	-	-		-	-		-	-		4.64	0.67	J-	-	-		-	-		-	-		<0.71	0.47	UJ	11.9	3.1	J-
DC2-SD8-01-062118	Middle 2	1.31	0.3		1.21	0.29		3.46	0.58	M3	4.73	0.64	J	2.79	0.79		0.084	0.061	LT	0.286	0.078		<0.61	0.4	UJ	9.8	2.3	J-
DC2-SD9-01-062118	Middle 2	-	-		-	-		-	-		7.9	1	J-	-	-		-	-		-	-		<0.61	0.38	UJ	9.9	2.5	J-
DC2-SD10-01-062118	Middle 2	-	-		-	-		-	-		3.94	0.6		-	-		-	-		-	-		<0.92	0.58	U	12.3	3.3	
DC2-SD11-01-062118	Middle 2	-	-		-	-		-	-		3.65	0.56		-	-		-	-		-	-		<0.76	0.49	U	12.4	3.2	
DC2-SD12-01-062118	Middle 2	-	-		-	-		-	-		5.49	0.77		-	-		-	-		-	-		<0.88	0.51	U	14.7	3.4	
DC2-SD13-01-062118	Middle 2	2.43	0.5		2.19	0.46		2.01	0.38	M3	2.85	0.46		3	0.85		0.083	0.064	LT	0.243	0.08		<0.82	0.5	U	14.6	4.1	
DC2-SD14-01-062118	Middle 2	-	-		-	-		-	-		3.22	0.48		-	-		-	-		-	-		<0.69	0.37	U	10.1	2.4	
DC2-SD15-01-062118	Middle 2	-	-		-	-		-	-		7.8	1	J-	-	-		-	-		-	-		<0.74	0.47	UJ	10	2.6	J-
DC2-SD16-01-062118	Middle 2	-	-		-	-		-	-		6.48	0.88	J	-	-		-	-		-	-		<0.99	0.61	UJ	11.3	3.4	J-
DC2-SD17-01-062118	Middle 2	-	-		-	-		-	-		0.86	0.23	LT	-	-		-	-		-	-		<0.72	0.38	U	12.8	2.9	
DC2-SD18-01-062118	Middle 2	-	-		-	-		-	-		8.1	1		-	-		-	-		-	-		<0.42	0.27	U	11.8	2.1	
M21-SD1-01-091218	Middle 2	-	-		-	-		-	-		49.8	5.9		-	-		-	-		-	-		<1.27	0.75	UJ	11.5	3.1	
M21-SD2-01-091218	Middle 2	13.1	2.2		14.2	2.4		17.4	2.7	M3	42.5	5.1		17.1	4.2		0.77	0.22		0.42	0.1		<1.36	0.75	UJ	10.5	3.2	
DC2A-SD19-01-062118	Middle 2A	-	-		-	-		-	-		6.81	0.9	J-	-	-		-	-		-	-		<0.84	0.49	UJ	10.5	2.7	J-
DC2A-SD20-01-062118	Middle 2A	-	-		-	-		-	-		6.03	0.84		-	-		-	-		-	-		<0.75	0.47	U	14.7	3.5	

Table J1-4. Radionuclides Laboratory Analytical Results for Sediment Samples (5 of 9)

Field Sample ID	Drainage Channel ID	Analyte																								
		Uranium-238			Uranium-234			Thorium-230			Radium-226			Lead-210			Uranium-235			Thorium-232			Radium-228			Potassium-40		
		Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q
DC2A-SD21-01-062118	Middle 2A	-	-		-	-		-	-		0.9	0.23	LT	-	-		-	-		-	-		<0.58	0.37	U	11.5	2.7	
DC2A-SD22-01-062118	Middle 2A	0.62	0.17		0.45	0.14		0.85	0.18	M3	0.7	0.21	LT	0.9	0.43	LT	<0.025	0.034	U	0.395	0.092		<0.57	0.41	U	12.2	3.1	
DC2A-SD23-01-062118	Middle 2A	-	-		-	-		-	-		<0.36	0.2	UJ	-	-		-	-		-	-		<0.64	0.36	U	10.9	2.9	
DC2B-SD2-01-062218	Middle 2B	-	-		-	-		-	-		7.74	0.98		-	-		-	-		-	-		<0.4	0.22	U	16.4	2.6	
DC2B-SD3-01-062218	Middle 2B	-	-		-	-		-	-		4.04	0.6		-	-		-	-		-	-		<0.68	0.45	U	10.6	2.9	
DC2B-SD4-01-062218	Middle 2B	-	-		-	-		-	-		8.4	1.1		-	-		-	-		-	-		<0.79	0.45	U	12.5	2.7	
DC2B-SD5-01-062218	Middle 2B	-	-		-	-		-	-		10.4	1.4		-	-		-	-		-	-		<0.86	0.55	U	12	3.2	
DC2B-SD6-01-062218	Middle 2B	-	-		-	-		-	-		17.5	2.2		-	-		-	-		-	-		<1.3	0.76	UJ	14.1	4.4	
DC2B-SD7-01-062218	Middle 2B	-	-		-	-		-	-		47.1	5.6	J-	-	-		-	-		-	-		<1.17	0.7	UJ	12.4	3	J-
DC2B-SD8-01-062218	Middle 2B	43.6	7.1		42.4	6.9		45.1	7	M3	18	2.2		13.3	3.3		2.25	0.46		0.44	0.1		<0.95	0.6	U	12.5	3	
DC2B-SD8A-01-062218	Middle 2B	-	-		-	-		-	-		26.4	3.2		-	-		-	-		-	-		<1.2	0.7	UJ	11.5	3.3	
DC2B-SD9-01-062218	Middle 2B	-	-		-	-		-	-		58.6	7	J	-	-		-	-		-	-		<1.7	0.96	UJ	12.9	3.9	
M32-SD1-01-092918	Middle 2B	-	-		-	-		-	-		84.3	10	J-	-	-		-	-		-	-		<2.1	1.3	UJ	14.7	4.8	J-
DC3-SD1-01-062318	Middle 3	-	-		-	-		-	-		2.33	0.38		-	-		-	-		-	-		<0.62	0.36	U	12.8	2.8	
DC3-SD2-01-062318	Middle 3	-	-		-	-		-	-		1.84	0.35		-	-		-	-		-	-		<0.67	0.41	U	11.1	2.8	
DC3-SD3-01-062318	Middle 3	-	-		-	-		-	-		2.82	0.45	J-	-	-		-	-		-	-		<0.77	0.48	UJ	12.1	3.1	J-
DC3-SD4-01-062318	Middle 3	-	-		-	-		-	-		3.09	0.44	J-	-	-		-	-		-	-		<0.43	0.26	UJ	14.4	2.3	J-
DC3-SD5-01-062318	Middle 3	-	-		-	-		-	-		4.3	0.64		-	-		-	-		-	-		<0.79	0.56	UJ	15.8	3.7	
DC3-SD6-01-062318	Middle 3	-	-		-	-		-	-		3.14	0.5	J+	-	-		-	-		-	-		<0.65	0.44	UJ	21.5	3.8	J+
DC3-SD7-01-062318	Middle 3	-	-		-	-		-	-		0.85	0.23	LT	-	-		-	-		-	-		<0.67	0.37	U	12.1	2.9	
DC3-SD8-01-062318	Middle 3	-	-		-	-		-	-		5.04	0.68	J-	-	-		-	-		-	-		<0.68	0.43	UJ	11.4	2.5	J-
DC3-SD9-01-062318	Middle 3	-	-		-	-		-	-		3.28	0.45		-	-		-	-		-	-		<0.37	0.21	U	15.6	2.5	
DC3-SD10-01-062318	Middle 3	-	-		-	-		-	-		2.1	0.32		-	-		-	-		-	-		<0.45	0.2	U	17.7	2.8	
DC3-SD10-01-082118	Middle 3	-	-		-	-		-	-		1.89	0.35		-	-		-	-		-	-		<0.79	0.42	U	13.2	3.1	
DC3-SD11-01-062318	Middle 3	-	-		-	-		-	-		8.3	1.1		-	-		-	-		-	-		<1	0.53	U,M	9.6	3.1	LT
DC3-SD12-01-062318	Middle 3	-	-		-	-		-	-		11.9	1.6		-	-		-	-		-	-		<1.14	0.69	UJ	11.9	3.7	
DC3-SD13-01-062318	Middle 3	-	-		-	-		-	-		7.52	0.96	J-	-	-		-	-		-	-		<0.41	0.29	UJ	15.7	3.1	J-
DC3-SD14-01-062318	Middle 3	-	-		-	-		-	-		3.06	0.47		-	-		-	-		-	-		<0.72	0.47	U	13.9	3.1	
DC3-SD15-01-062318	Middle 3	-	-		-	-		-	-		3.48	0.53		-	-		-	-		-	-		<0.78	0.49	U	12.8	3.6	
DC3-SD16-01-062318	Middle 3	0.37	0.13		0.39	0.13		0.35	0.11	M3	0.92	0.26	LT	0.69	0.4	LT	<0.055	0.036	U	0.225	0.066		<0.69	0.39	U	16.7	3.7	
DC3-SD17-01-062318	Middle 3	-	-		-	-		-	-		1.38	0.26		-	-		-	-		-	-		<0.47	0.34	UJ	13.6	2.9	
DC3-SD18-01-062318	Middle 3	-	-		-	-		-	-		1.21	0.26		-	-		-	-		-	-		<0.76	0.44	U	15.9	3.3	
DC3-SD18A-01-082118	Middle 3	-	-		-	-		-	-		2.75	0.43	J	-	-		-	-		-	-		<0.57	0.39	UJ	15.8	3.2	
M25-SD1-01-092818	Middle 3	-	-		-	-		-	-		6.51	0.87		-	-		-	-		-	-		<0.71	0.49	UJ	16.9	3.5	
M28-SD1-01-092618	Middle 3	5.27	0.95		4.62	0.85		5.13	0.84	M3	12.3	1.6		3.36	0.94		0.24	0.11		0.32	0.085		<0.82	0.56	U	10.7	2.9	
M28-SD2-01-092618	Middle 3	-	-		-	-		-	-		5.37	0.76		-	-		-	-		-	-		<0.95	0.56	U	18.3	4.1	

Table J1-4. Radionuclides Laboratory Analytical Results for Sediment Samples (6 of 9)

Field Sample ID	Drainage Channel ID	Analyte																								
		Uranium-238			Uranium-234			Thorium-230			Radium-226			Lead-210			Uranium-235			Thorium-232			Radium-228			Potassium-40		
		Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q
DC3A-SD1-01-062318	Middle 3A	-	-		-	-		-	-		1.9	0.28	J-	-	-		-	-		-	-		<0.28	0.21	UJ	14.9	2.3	J-
DC3A-SD2-01-062318	Middle 3A	-	-		-	-		-	-		1.69	0.32		-	-		-	-		-	-		<0.66	0.39	U	13.8	3.1	
DC3A-SD3-01-062318	Middle 3A	-	-		-	-		-	-		0.74	0.21	LT	-	-		-	-		-	-		<0.63	0.35	U	12.8	2.8	
DC3A-SD4-01-062318	Middle 3A	-	-		-	-		-	-		1.78	0.33		-	-		-	-		-	-		<0.62	0.48	UJ	12.8	3	
DC3A-SD5-01-062318	Middle 3A	-	-		-	-		-	-		9	1.2		-	-		-	-		-	-		<0.99	0.58	U	12.8	3.6	
DC3A-SD6-01-062318	Middle 3A	-	-		-	-		-	-		1.26	0.25		-	-		-	-		-	-		<0.59	0.28	U	14.4	2.9	
DC3A-SD7-01-062318	Middle 3A	-	-		-	-		-	-		3.99	0.57	J-	-	-		-	-		-	-		<0.63	0.37	UJ	11.6	2.7	J-
DC3A-SD8-01-062318	Middle 3A	-	-		-	-		-	-		0.95	0.25	LT	-	-		-	-		-	-		<0.73	0.4	U	12.1	3	
DC3A-SD9-01-061818	Middle 3A	-	-		-	-		-	-		2.54	0.41		-	-		-	-		-	-		<0.68	0.42	U	15	3.2	
DC3A-SD10-01-061818	Middle 3A	-	-		-	-		-	-		2.17	0.37		-	-		-	-		-	-		<0.53	0.4	UJ	14.6	3.3	
DC3A-SD11-01-061818	Middle 3A	-	-		-	-		-	-		0.78	0.22	LT	-	-		-	-		-	-		<0.47	0.3	U	15.3	3	
DC3A-SD12-01-061818	Middle 3A	-	-		-	-		-	-		0.71	0.21	J-	-	-		-	-		-	-		<0.67	0.45	UJ	12.8	3	J-
DC3A-SD13-01-061818	Middle 3A	-	-		-	-		-	-		10.6	1.3	J-	-	-		-	-		-	-		<0.72	0.47	UJ	13.3	3	J-
DC3A-SD14-01-061818	Middle 3A	-	-		-	-		-	-		1.13	0.25		-	-		-	-		-	-		<0.51	0.35	U	15.7	3.2	
DC3A-SD15-01-061818	Middle 3A	-	-		-	-		-	-		1.91	0.28		-	-		-	-		-	-		<0.38	0.24	U	14.4	2.3	
DC3A-SD16-01-061818	Middle 3A	-	-		-	-		-	-		1.29	0.28	J-	-	-		-	-		-	-		<0.53	0.37	UJ	13.1	3.1	J-
DC3A-SD17-01-061818	Middle 3A	-	-		-	-		-	-		0.76	0.21	J-	-	-		-	-		-	-		<0.55	0.35	UJ	14.3	2.9	J-
DC3B-SD1-01-061918	Middle 3B	-	-		-	-		-	-		2.41	0.41		-	-		-	-		-	-		<0.73	0.43	U	14.2	3.4	
DC3B-SD2-01-061918	Middle 3B	-	-		-	-		-	-		7.14	0.96		-	-		-	-		-	-		<0.78	0.47	U	13.1	2.8	
DC3B-SD3-01-061918	Middle 3B	-	-		-	-		-	-		3.88	0.58	J-	-	-		-	-		-	-		<0.68	0.46	UJ	10.5	2.9	J-
DC3B-SD4-01-061918	Middle 3B	-	-		-	-		-	-		3.61	0.54	J-	-	-		-	-		-	-		<0.69	0.44	UJ	14.1	3.7	J-
DC3B-SD5-01-061918	Middle 3B	3.56	0.67		3.2	0.62		4.03	0.67	M3	4.74	0.67	J	3.9	1.1		0.096	0.068	LT	0.44	0.11		<0.88	0.52	UJ	14.6	3.7	J-
DC3B-SD6-01-061918	Middle 3B	-	-		-	-		-	-		2.28	0.38		-	-		-	-		-	-		<0.73	0.44	U	13.1	3.1	
DC3C-SD1-01-061818	Middle 3C	-	-		-	-		-	-		4.49	0.62	J-	-	-		-	-		-	-		<0.67	0.38	UJ	15.4	3.2	J-
DC3C-SD2-01-061818	Middle 3C	-	-		-	-		-	-		1.17	0.21	J-	-	-		-	-		-	-		<0.4	0.2	UJ	16.7	2.6	J-
DC3C-SD3-01-061818	Middle 3C	-	-		-	-		-	-		1.52	0.25		-	-		-	-		-	-		<0.37	0.2	U	16.1	2.6	
DC3C-SD3A-01-061818	Middle 3C	-	-		-	-		-	-		0.91	0.22	J-	-	-		-	-		-	-		<0.5	0.33	UJ	13.9	2.9	J-
DC3C-SD4-01-061818	Middle 3C	-	-		-	-		-	-		1.49	0.3		-	-		-	-		-	-		<0.61	0.4	U	11.2	2.9	
DC3C-SD5-01-061818	Middle 3C	-	-		-	-		-	-		1.37	0.25	J-	-	-		-	-		-	-		<0.51	0.32	UJ	14.1	2.8	J-
DC3D-SD1-01-061918	Middle 3D	-	-		-	-		-	-		2.69	0.44	J-	-	-		-	-		-	-		<0.63	0.44	UJ	14.5	3.2	J-
DC3D-SD1A-01-061918	Middle 3D	-	-		-	-		-	-		2.83	0.45	J-	-	-		-	-		-	-		<0.79	0.51	UJ	12.3	2.9	J-
DC3D-SD2-01-061918	Middle 3D	-	-		-	-		-	-		0.76	0.21	LT	-	-		-	-		-	-		<0.52	0.34	U	15.3	3.1	
DC3E-SD1-01-062318	Middle 3E	-	-		-	-		-	-		3.11	0.48		-	-		-	-		-	-		<0.62	0.41	U	14.6	3.1	
DC3E-SD1-01-082118	Middle 3E	-	-		-	-		-	-		7.7	1	J-	-	-		-	-		-	-		<0.81	0.46	UJ	14	3.4	J-
DC3E-SD2-01-062318	Middle 3E	-	-		-	-		-	-		5.43	0.74		-	-		-	-		-	-		<0.66	0.42	U	14.1	3.1	
DC3E-SD3-01-062318	Middle 3E	-	-		-	-		-	-		3.54	0.55		-	-		-	-		-	-		<0.75	0.38	U	15.9	3.6	

Table J1-4. Radionuclides Laboratory Analytical Results for Sediment Samples (7 of 9)

Field Sample ID	Drainage Channel ID	Analyte																									
		Uranium-238			Uranium-234			Thorium-230			Radium-226			Lead-210			Uranium-235			Thorium-232			Radium-228			Potassium-40		
		Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q
DC3E-SD4-01-062318	Middle 3E	6.5	1.1		6.5	1.1		7.9	1.2	M3	6.56	0.87		6	1.6		0.31	0.12		0.46	0.11		<0.85	0.46	U	14.3	3.2	
DC3E-SD5-01-062318	Middle 3E	-	-		-	-		-	-		1.59	0.29		-	-		-	-		-	-		<0.74	0.38	U	11.9	2.7	
DC3E-SD5A-01-062318	Middle 3E	-	-		-	-		-	-		2.94	0.45		-	-		-	-		-	-		<0.62	0.42	U	14.7	3.1	
DC3E-SD5A-01-082118	Middle 3E	-	-		-	-		-	-		0.72	0.22	LT	-	-		-	-		-	-		<0.48	0.45	UJ	13.1	3.1	
DC3E-SD6-01-081718	Middle 3E	-	-		-	-		-	-		13.5	1.7		-	-		-	-		-	-		<0.83	0.54	U	15.4	3.4	
DC3E-SD7-01-081718	Middle 3E	-	-		-	-		-	-		9.2	1.2		-	-		-	-		-	-		<0.73	0.49	U	10	2.7	
DC3E-SD8-01-081718	Middle 3E	-	-		-	-		-	-		2.5	0.39		-	-		-	-		-	-		<0.67	0.38	U	16.1	3.3	
DC3E-SD9-01-081718	Middle 3E	0.67	0.17		0.6	0.16		0.72	0.19	M3	0.64	0.21	LT	0.94	0.42	LT	0.072	0.05	LT	0.47	0.12		<0.74	0.46	U	17	3.7	
DC3E-SD10-01-081718	Middle 3E	-	-		-	-		-	-		<0.32	0.19	UJ	-	-		-	-		-	-		<0.45	0.3	U	15.1	3.1	
DC3E-SD10-01-093018	Middle 3E	-	-		-	-		-	-		0.51	0.2	LT	-	-		-	-		-	-		<0.61	0.34	U	12.4	3.1	
DC3E-SD11-01-081718	Middle 3E	-	-		-	-		-	-		0.82	0.2	LT	-	-		-	-		-	-		<0.49	0.37	UJ	13	2.8	
DC3E-SD12-01-081718	Middle 3E	-	-		-	-		-	-		0.62	0.17	LT	-	-		-	-		-	-		<0.37	0.19	U	14.6	2.4	
DC3E-SD13-01-081718	Middle 3E	-	-		-	-		-	-		<0.52	0.26	U	-	-		-	-		-	-		<0.56	0.37	U	12	3	
DC3E-SD14-01-081718	Middle 3E	-	-		-	-		-	-		0.5	0.18	LT	-	-		-	-		-	-		<0.66	0.4	U	10.5	2.5	
DC3E-SD14-01-093018	Middle 3E	-	-		-	-		-	-		0.53	0.15	LT	-	-		-	-		-	-		<0.46	0.29	U	14.6	2.3	
DC3E-SD15-01-081718	Middle 3E	-	-		-	-		-	-		0.5	0.21	LT	-	-		-	-		-	-		<0.72	0.44	U	14	3.2	
M10-SD1-01-081718	Middle 3E	21.1	3.4		18.8	3.1		23.8	3.7	M3	55.4	6.6		19.3	4.7		0.99	0.23		0.373	0.092		<1.45	0.89	UJ	17.2	4.3	
M10-SD2-01-081718	Middle 3E	-	-		-	-		-	-		27.7	3.3		-	-		-	-		-	-		<1.03	0.53	UJ	12.7	3.1	
M5-SD1-01-062318	Middle 3E	37.1	6		36.5	5.9		47.2	7.3	M3	64.4	7.6		33.3	8.1		1.62	0.35		0.357	0.086		<0.79	0.5	U	15.8	2.8	
M7-SD1-01-062318	Middle 3E	-	-		-	-		-	-		27.4	3.3	J-	-	-		-	-		-	-		<1.25	0.69	UJ	15.2	3.7	J-
M7-SD2-01-081418	Middle 3E	0.32	0.11		0.229	0.089		0.21	0.11	M3	<0.36	0.2	U	<0.49	0.31	U	<0.047	0.031	U	0.177	0.068		<0.52	0.36	U	8.4	2.6	LT
M7-SD3-01-081418	Middle 3E	-	-		-	-		-	-		3.17	0.5		-	-		-	-		-	-		<0.86	0.48	U	11.8	2.9	
DC3F-SD1-01-062318	Middle 3F	-	-		-	-		-	-		4.12	0.53	J-	-	-		-	-		-	-		<0.37	0.22	UJ	12.8	2.2	J-
DC3F-SD2-01-062318	Middle 3F	2.19	0.44		2.08	0.42		3.1	0.53	M3	5.81	0.73		2.74	0.78		0.067	0.055	LT	0.349	0.09		<0.36	0.25	UJ	16.2	2.6	
DC3F-SD3-01-062318	Middle 3F	-	-		-	-		-	-		3.38	0.52		-	-		-	-		-	-		<0.57	0.38	U	15	3.4	
DC3F-SD4-01-062318	Middle 3F	-	-		-	-		-	-		2.41	0.39		-	-		-	-		-	-		<0.73	0.41	U	15.8	3.2	
DC3F-SD5-01-062318	Middle 3F	-	-		-	-		-	-		2.54	0.43		-	-		-	-		-	-		<0.65	0.41	U	13.1	3.3	
DC3F-SD6-01-062318	Middle 3F	-	-		-	-		-	-		2.65	0.46		-	-		-	-		-	-		<0.77	0.46	U	15.1	3.8	
DC3F-SD7-01-062318	Middle 3F	-	-		-	-		-	-		6.01	0.79		-	-		-	-		-	-		<0.61	0.33	U	14.4	3	
DC3F-SD8-01-062318	Middle 3F	-	-		-	-		-	-		11.5	1.5		-	-		-	-		-	-		<0.97	0.54	U	14.1	3.6	
DC3F-SD8A-01-062318	Middle 3F	-	-		-	-		-	-		6.59	0.84	J-	-	-		-	-		-	-		<0.43	0.26	UJ	16.2	2.5	J-
DC3F-SD9-01-062318	Middle 3F	-	-		-	-		-	-		3.31	0.51		-	-		-	-		-	-		<0.75	0.4	U	12.8	3.1	
DC3F-SD10-01-062318	Middle 3F	-	-		-	-		-	-		2.24	0.39		-	-		-	-		-	-		<0.81	0.42	U	11.9	3.1	
M6-SD1-01-091618	Middle 3F	-	-		-	-		-	-		15.5	2		-	-		-	-		-	-		<1.19	0.74	UJ	21.8	4.7	
M6-SD2-01-091618	Middle 3F	-	-		-	-		-	-		5.78	0.81		-	-		-	-		-	-		<0.66	0.45	U	14.8	3.5	
M6-SD3-01-091618	Middle 3F	-	-		-	-		-	-		2.57	0.43		-	-		-	-		-	-		<0.62	0.43	UJ	17.7	3.8	

Table J1-4. Radionuclides Laboratory Analytical Results for Sediment Samples (8 of 9)

Field Sample ID	Drainage Channel ID	Analyte																								
		Uranium-238			Uranium-234			Thorium-230			Radium-226			Lead-210			Uranium-235			Thorium-232			Radium-228			Potassium-40		
		Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q
DC3G-SD1-01-062318	Middle 3G	-	-		-	-		-	-		1.35	0.28	J	-	-		-	-		-	-		<0.58	0.43	UJ	12.1	2.8	J-
DC3G-SD2-01-062318	Middle 3G	0.69	0.19		0.63	0.17		0.69	0.15	M3	1.62	0.31	J-	1.15	0.43		<0.082	0.041	U	0.46	0.1		<0.67	0.38	UJ	10.4	2.7	J-
DC3G-SD3-01-062318	Middle 3G	-	-		-	-		-	-		1.02	0.24	J-	-	-		-	-		-	-		<0.56	0.37	UJ	12.8	3	J-
DC3G-SD4-01-062318	Middle 3G	-	-		-	-		-	-		1.54	0.24	J-	-	-		-	-		-	-		<0.38	0.25	UJ	12.2	2	J-
DC3G-SD5-01-062318	Middle 3G	-	-		-	-		-	-		2.21	0.32	J-	-	-		-	-		-	-		0.39	0.19	J-	15	2.4	J-
DC3G-SD6-01-062318	Middle 3G	-	-		-	-		-	-		0.57	0.17	LT	-	-		-	-		-	-		<0.53	0.39	UJ	14	2.9	
DM33-SD1-01-081818	Knife Edge	-	-		-	-		-	-		0.84	0.22	J-	-	-		-	-		-	-		<0.54	0.4	UJ	10	2.5	J-
DM33-SD2-01-081818	Knife Edge	-	-		-	-		-	-		0.94	0.23	J-	-	-		-	-		-	-		<0.55	0.42	UJ	14.3	3.1	J-
DM33-SD3-01-081818	Knife Edge	-	-		-	-		-	-		0.86	0.22	LT	-	-		-	-		-	-		<0.69	0.35	UJ	11.4	2.9	
DM33-SD4-01-081818	Knife Edge	-	-		-	-		-	-		1.23	0.29		-	-		-	-		-	-		<0.66	0.62	UJ	13.5	3.2	
DM33-SD5-01-081818	Knife Edge	-	-		-	-		-	-		0.58	0.2	J-	-	-		-	-		-	-		<0.51	0.3	UJ	13.6	3	J-
DM33-SD6-01-081818	Knife Edge	-	-		-	-		-	-		0.62	0.18	J-	-	-		-	-		-	-		<0.45	0.29	UJ	13	2.6	J-
DM33-SD7-01-081818	Knife Edge	-	-		-	-		-	-		0.84	0.26	LT	-	-		-	-		-	-		<0.8	0.44	UJ	14.9	3.6	
DM33-SD8-01-081818	Knife Edge	-	-		-	-		-	-		0.59	0.19	J-	-	-		-	-		-	-		<0.55	0.33	UJ	16.5	3.5	J-
DM33-SD9-01-081818	Knife Edge	-	-		-	-		-	-		0.99	0.22	LT	-	-		-	-		-	-		<0.42	0.34	UJ	15.6	3.2	
DM33-SD10-01-081818	Knife Edge	-	-		-	-		-	-		0.68	0.19	J-	-	-		-	-		-	-		<0.47	0.34	UJ	13.8	2.9	J-
DM33-SD11-01-081818	Knife Edge	-	-		-	-		-	-		0.63	0.16	J-	-	-		-	-		-	-		0.63	0.18	J-	14.3	2.3	J-
DM33-SD12-01-081818	Knife Edge	-	-		-	-		-	-		0.69	0.22	J-	-	-		-	-		-	-		0.6	0.32	J-	17.1	3.5	J-
DM33-SD13-01-081818	Knife Edge	-	-		-	-		-	-		0.49	0.17	J-	-	-		-	-		-	-		<0.48	0.33	UJ	12.5	2.6	J-
DM33-SD14-01-081818	Knife Edge	0.64	0.19		0.41	0.14		0.67	0.17	M3	0.65	0.19	LT	<0.52	0.35	U	<0.065	0.047	U	0.67	0.15		<0.65	0.37	UJ	11.5	2.7	
DM33-SD15-01-081818	Knife Edge	-	-		-	-		-	-		0.58	0.22	J-	-	-		-	-		-	-		<0.6	0.34	UJ	10.7	2.7	J-
DM33-SD16-01-081818	Knife Edge	-	-		-	-		-	-		0.55	0.19	J-	-	-		-	-		-	-		<0.61	0.37	UJ	9.9	2.7	J-
DM35-SD7-01-082018	Black Mesa	-	-		-	-		-	-		2.26	0.39		-	-		-	-		-	-		<0.6	0.42	U	15.2	3.4	
DM35-SD8-01-082018	Black Mesa	-	-		-	-		-	-		1.96	0.35		-	-		-	-		-	-		<0.58	0.42	UJ	12.9	3.1	
DM35-SD9-01-082018	Black Mesa	-	-		-	-		-	-		2.11	0.34	J-	-	-		-	-		-	-		<0.55	0.3	UJ	13	2.7	J-
DM35-SD10-01-082018	Black Mesa	-	-		-	-		-	-		2.73	0.37	J-	-	-		-	-		-	-		<0.43	0.18	UJ	13.6	2.2	J-
DM35-SD11-01-082018	Black Mesa	-	-		-	-		-	-		2.38	0.4	J-	-	-		-	-		-	-		<0.47	0.35	UJ	13.3	3	J-
DM35-SD12-01-082018	Black Mesa	-	-		-	-		-	-		1.66	0.32	J-	-	-		-	-		-	-		<0.6	0.43	UJ	10.7	2.6	J-
DM35-SD13-01-082018	Black Mesa	-	-		-	-		-	-		1.66	0.3		-	-		-	-		-	-		<0.6	0.37	U	15.4	3.1	
DM35-SD14-01-082018	Black Mesa	-	-		-	-		-	-		2.23	0.39		-	-		-	-		-	-		<0.86	0.52	U	9.1	2.6	LT
DM35-SD15-01-082018	Black Mesa	-	-		-	-		-	-		1.3	0.25	J-	-	-		-	-		-	-		<0.36	0.26	UJ	13	2.7	J-
DM35-SD16-01-082018	Black Mesa	-	-		-	-		-	-		1.62	0.29		-	-		-	-		-	-		<0.6	0.41	U	14.5	3	
DM35-SD17-01-082018	Black Mesa	0.89	0.22		1.02	0.24		1.06	0.22	M3	2.26	0.32	J-	1.02	0.42		<0.051	0.036	U	0.44	0.11		<0.42	0.24	UJ	15	2.4	J-
DM35-SD18-01-082018	Black Mesa	-	-		-	-		-	-		1.94	0.35	J-	-	-		-	-		-	-		<0.69	0.46	UJ	12.4	2.9	J-
DM35-SD19-01-082018	Black Mesa	-	-		-	-		-	-		1.25	0.21	J-	-	-		-	-		-	-		<0.3	0.18	UJ	15.6	2.4	J-
DM35-SD20-01-081818	Black Mesa	-	-		-	-		-	-		1.49	0.3	J-	-	-		-	-		-	-		<0.66	0.44	UJ	14.5	3.1	J-

Table J1-4. Radionuclides Laboratory Analytical Results for Sediment Samples (9 of 9)

Field Sample ID	Drainage Channel ID	Analyte																								
		Uranium-238			Uranium-234			Thorium-230			Radium-226			Lead-210			Uranium-235			Thorium-232			Radium-228			Potassium-40		
		Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q	Activity (pCi/g)	TPU	Q
DM35-SD21-01-081818	Black Mesa	-	-		-	-		-	-		1.29	0.25	J-	-	-		-	-		-	-		<0.4	0.24	UJ	13.1	2.8	J-
DM39-SD7-01-081618	Tommy James	-	-		-	-		-	-		0.99	0.25	LT	-	-		-	-		-	-		<0.66	0.37	U	15.3	3.4	
DM39-SD8-01-081618	Tommy James	-	-		-	-		-	-		1.31	0.27		-	-		-	-		-	-		<0.68	0.39	U	17.3	3.3	
DM39-SD9-01-081618	Tommy James	-	-		-	-		-	-		0.52	0.2	J-	-	-		-	-		-	-		<0.83	0.45	UJ	12	3	J-
DM39-SD10-01-081618	Tommy James	-	-		-	-		-	-		0.68	0.17	LT	-	-		-	-		-	-		<0.36	0.2	U	17.2	2.7	
DM39-SD11-01-081618	Tommy James	-	-		-	-		-	-		0.45	0.16	J-	-	-		-	-		-	-		<0.47	0.32	UJ	17.6	3.3	J-
DM39-SD12-01-081618	Tommy James	0.46	0.14		0.46	0.14		0.96	0.21	M3	0.67	0.21	LT	<0.5	0.33	U	<0.023	0.032	U	0.337	0.09		<0.67	0.39	U	13.9	3.3	
DM39-SD13-01-081618	Tommy James	-	-		-	-		-	-		0.9	0.23	J-	-	-		-	-		-	-		<0.73	0.34	UJ	13.3	3	J-
DM39-SD14-01-081618	Tommy James	-	-		-	-		-	-		0.75	0.19	J-	-	-		-	-		-	-		<0.44	0.36	UJ	13.9	2.7	J-
DM39-SD15-01-081618	Tommy James	0.45	0.13		0.54	0.15		0.96	0.21	M3	0.81	0.2	J-	0.59	0.37	LT	<0.043	0.034	U	0.65	0.14		<0.47	0.31	UJ	13.8	3	J-
DM39-SD16-01-081618	Tommy James	-	-		-	-		-	-		0.81	0.19	J-	-	-		-	-		-	-		<0.55	0.27	UJ	16.9	3.2	J-
DM39-SD17-01-081618	Tommy James	0.44	0.14		0.3	0.11		0.68	0.16	M3	0.76	0.19	J-	0.72	0.38	LT	<0.076	0.04	U	0.383	0.094		<0.53	0.31	UJ	14.5	3	J-

Notes:

-	Not analyzed
<	The analyte was analyzed for, but was not detected. The reporting limit is shown in the result column.
J	Estimated value
J-	Estimated value, may be biased low.
J+	Estimated value, may be biased high.
LT	Result less than requested minimum detectable concentration, but greater than sample-specific minimum detectable concentration.
M	Requested minimum detectable concentration not met.
M3	The requested minimum detected concentration was not met, but the reported activity is greater than the reported minimum detected concentration.
pCi/g	PicoCuries per gram
TPU	Total propagated uncertainty
U	Not detected. The associated value is the reporting limit.
UJ	Not considered detected. The associated value is the reported concentration, which is estimated.

Table J1-5. Dissolved Metals Laboratory Analytical Results for Surface Water Samples

Analyte	Units	Field Sample ID															
		DC3-SW10-01-082118		DC3-SW10-02-082118		DC3-SW18A-01-082118		DC3E-SW1-01-082118		DC3E-SW5A-01-082118		DC3E-SW10-01-093018		DC3E-SW10-02-093018		DC3E-SW14-01-093018	
		Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Drainage Channel ID		Middle 3		Middle 3		Middle 3		Middle 3E/DC3E		Middle 3E/DC3E		Middle 3E/DC3E		Middle 3E/DC3E		Middle 3E/DC3E	
Aluminum	µg/L	<100	U	<100	U	10	J	12	J	17	J	110		<100	U	400	
Antimony	µg/L	0.19	J	0.21	J	0.21	J	0.19	J	0.4	J	<1	U	<1	U	<1	U
Arsenic	µg/L	4.8		5.2		4.3		3.9		3.8		3.1		3.7		2.8	
Barium	µg/L	230		230		280		320		310		480		480		430	
Beryllium	µg/L	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U
Boron	µg/L	<150	U	<150	U	<150	U	<150	U	<150	U	<150	U	<150	U	<150	U
Cadmium	µg/L	<2	U	<2	U	<2	U	<2	U	<2	U	<2	U	<2	U	<2	U
Calcium	µg/L	73,000		75,000		72,000		71,000		58,000		72,000		73,000		74,000	
Chromium	µg/L	<10	U	<10	U	<10	U	<10	U	<10	U	<10	U	<10	U	<10	U
Cobalt	µg/L	0.56	J	0.67	J	0.73	J	0.7	J	0.29	J	<5	U	<5	U	<5	U
Copper	µg/L	<20	U	<20	U	<20	U	<20	U	0.51	J	<20	U	<20	U	<20	U
Iron	µg/L	<100	U	<100	U	<100	U	<100	U	<100	U	<100	U	<100	U	270	
Lead	µg/L	<2	UJ	<2	UJ	<2	UJ	<2	UJ	<2	UJ	<2	U	<2	U	0.24	J
Lithium	µg/L	34		34		33		25		22		29		30		29	
Magnesium	µg/L	11,000		11,000		10,000		9,200		8,500		9,000		9,300		9,200	
Manganese	µg/L	25		27		33		11		4.4	J	11	J	6.6	J	32	
Mercury	µg/L	<0.2	U	<0.2	U	<0.2	U	<0.2	U	<0.2	U	<0.2	U	<0.2	U	<0.2	U
Molybdenum	µg/L	8.3		8.4		7.7		<2	U	<2	U	<2	U	<2	U	<2	U
Nickel	µg/L	<20	U	<20	U	<20	U	<20	U	<20	U	<20	U	<20	U	<20	U
Selenium	µg/L	1.2	J	1.1	J	1.800	J	1.200	J	1.2	J	2.200	J	1.8	J	0.900	J
Silver	µg/L	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U
Sodium	µg/L	19,000		20,000		17,000		7,100		5,800		6,500		6,600		7,000	
Strontium	µg/L	1,000		1,000		1,100		970		880		1,000		1,000		1,000	
Thallium	µg/L	<0.1	UJ	<0.1	UJ	<0.1	UJ	<0.1	UJ	<0.1	UJ	<0.1	UJ	<0.1	UJ	<0.1	UJ
Thorium	µg/L	<0.2	U	<0.2	U	<0.2	U	<0.2	U	<0.2	U	0.05	J	0.02	J	0.11	J
Uranium	µg/L	65		67		69		24		13		20		20		12	
Vanadium	µg/L	8.1		8.2		6.8		7.1		5.7		7		6.6		5.2	
Zinc	µg/L	<100	UJ	<100	UJ	<100	UJ	<100	UJ	<100	UJ	2.1	J	5.1	J	3.8	J

Notes:

J	Estimated value.
µG/L	Micrograms per liter
Q	Qualifier
U	Not detected. The associated value is the reporting limit.
UJ	Not considered detected. The associated value is the reported concentration, which is estimated.

Table J1-6. Total Metals Laboratory Analytical Results for Surface Water Samples

Analyte	Units	Field Sample ID															
		DC3-SW10-01-082118		DC3-SW10-02-082118		DC3-SW18A-01-082118		DC3E-SW1-01-082118		DC3E-SW5A-01-082118		DC3E-SW10-01-093018		DC3E-SW10-02-093018		DC3E-SW14-01-093018	
		Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Drainage Channel ID		Middle 3		Middle 3		Middle 3		Middle 3E/DC3E		Middle 3E/DC3E		Middle 3E/DC3E		Middle 3E/DC3E		Middle 3E/DC3E	
Aluminum	µg/L	570		580		1300		1300	J	4100		<100	U	<100	U	590	J
Antimony	µg/L	<1	U	<1	U	<1	U	<1	U	<1	U	<1	U	<1	U	<1	U
Arsenic	µg/L	5.1		4.9		4.8		4.3		5.2		3		3.2		3.1	
Barium	µg/L	240		230		300		330	J	420		480		480		430	
Beryllium	µg/L	<0.5	U	<0.5	U	<0.5	U	0.07	J	0.23	J	<0.5	U	<0.5	U	<0.5	U
Boron	µg/L	<150	U	<150	U	<150	U	<150	U	<150	U	<150	U	<150	U	<150	U
Cadmium	µg/L	<2	U	<2	U	<2	U	<2	U	<2	U	<2	U	<2	U	<2	U
Calcium	µg/L	78,000		73,000		78,000		74,000	J	80,000		71,000		72,000		74,000	
Chromium	µg/L	<10	U	<10	U	<10	U	1.3	J	<10	U	<10	U	<10	U	<10	U
Cobalt	µg/L	0.24	J	0.22	J	0.48	J	0.46	J	1.2	J	<5	U	<5	U	<5	U
Copper	µg/L	0.52	J	<20	U	0.83	J	0.7	J	2.4	J	<20	U	<20	U	<20	U
Iron	µg/L	400		380		860		780	J	2600		<100	U	<100	U	430	
Lead	µg/L	0.24	J-	0.13	J-	0.45	J-	0.51	J-	2	J-	<2	U	<2	U	<2	U
Lithium	µg/L	37		34		36		30	J	32		29		29		29	
Magnesium	µg/L	11,000		10,000		11,000		9,700	J	11,000		9,000		9,100		9,500	
Manganese	µg/L	40		36		64		41		150		12		13		59	
Mercury	µg/L	<0.2	U	<0.2	U	<0.2	U	<0.2	U	<0.2	U	<0.2	U	<0.2	U	<0.2	U
Mercury, Total	µg/L	0.00233		0.00223		0.00281		0.00295		0.026		<0.0005	U	<0.0005	U	0.0017	
Methyl Mercury	µg/L	0.00034		0.00041		0.00031		0.0003		0.00088		<0.0001	U	<0.0001	U	0.00	
Molybdenum	µg/L	8.6		7.9		8.300		<2	U	<2	U	<2	U	<2	U	<2	U
Nickel	µg/L	<20	U	<20	U	0.92	J	<20	U	2.1	J	<20	U	<20	U	<20	U
Selenium	µg/L	1.3	J	0.97	J	1.9	J	1.2	J	1.8	J	1.7	J	2.3	J	0.95	J
Silver	µg/L	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U	<0.5	U
Sodium	µg/L	20,000		19,000		18,000		7,200	J	6,800		6,500		6,400		6,900	
Strontium	µg/L	1,000		950		1,100		970	J	1,100		1,000		1,000		1,000	
Thallium	µg/L	<0.1	UJ	<0.1	UJ	<0.1	UJ	<0.1	UJ	0.01	J-	<0.1	UJ	<0.1	UJ	<0.1	UJ
Thorium	µg/L	0.21		<0.2	U	0.37		0.35		0.8		0.03	J	0.02	J	0.15	J
Uranium	µg/L	69		64		72		23	J	16		20		20		12	
Vanadium	µg/L	9.8		9		10		9.6	J	14		6.8		6.8		5.9	
Zinc	µg/L	<100	UJ	<100	UJ	<100	UJ	<100	UJ	7.2	J-	3.8	J	40	J	5.9	J

Notes:

<	The analyte was analyzed for, but was not detected. The reporting limit is shown in the result column.
J	Estimated value
J-	Estimated value, may be biased low.
µg/L	Micrograms per liter
Q	Qualifier
U	Not detected. The associated value is the reporting limit.
UJ	Not considered detected. The associated value is the reported concentration, which is estimated.

Table J1-7. Radionuclides Laboratory Analytical Results for Surface Water Samples

Analyte	Field Sample ID																							
	DC3-SW10-01-082118			DC3-SW10-02-082118			DC3-SW18A-01-082118			DC3E-SW1-01-082118			DC3E-SW5A-01-082118			DC3E-SW10-01-093018			DC3E-SW10-02-093018			DC3E-SW14-01-093018		
	Activity (pCi/L)	TPU	Q	Activity (pCi/L)	TPU	Q	Activity (pCi/L)	TPU	Q	Activity (pCi/L)	TPU	Q	Activity (pCi/L)	TPU	Q	Activity (pCi/L)	TPU	Q	Activity (pCi/L)	TPU	Q	Activity (pCi/L)	TPU	Q
Drainage Channel ID	Middle 3			Middle 3			Middle 3			Middle 3E/DC3E			Middle 3E/DC3E			Middle 3E/DC3E			Middle 3E/DC3E			Middle 3E/DC3E		
Radium-226	2.46	0.8		1.44	0.58		2	0.67		1.6	0.64		1.53	0.55		<0.33	0.33	U	<0.29	0.24	U	0.47	0.31	LT
Radium-228	<0.36	0.48	UJ	<0.56	0.68	UJ	<0.84	0.46	U	<0.48	0.43	U	<1.4	1.7	UJ	0.92	0.46	LT	0.87	0.44	LT	<0.68	0.5	U
Potassium-40	<32	43	U	<-30	100	U	<28	94	U	<-27	63	U	<35	74	U	<10	100	U	<-10	82	U	<-30	100	U
Uranium-238a	26.3	4.3		25.1	4.1		23.7	3.8		9	1.5		5.8	1		6.7	1.2		7.4	1.3		4.08	0.77	
Uranium-238g	<61	60	U	<10	130	U	<15	90	U	<-19	85	U	<23	51	U	<-55	81	U	<-20	150	U	<-10	110	U
Uranium-235	0.93	0.24		1.23	0.29		1.07	0.25		0.49	0.15		0.36	0.12		0.28	0.12		0.35	0.14		0.164	0.089	LT
Uranium-234	26.9	4.4		25	4.1		26	4.2		9.5	1.6		7.5	1.3		8.9	1.5		9.1	1.6		5.38	0.98	
Thorium-232a	<0.015	0.012	U	0.024	0.015	LT	0.074	0.029	LT	0.057	0.022	LT	0.272	0.06		<-0.003	0.016	U	<0.012	0.012	U	0.048	0.023	LT
Thorium-232g	<-8	12	U	<-2	30	U	<15	13	U	<-6	18	U	<-4	22	U	<-2	16	U	<24	15	UJ	<33	18	UJ
Thorium-230	<0.066	0.045	U	0.086	0.048	LT	0.169	0.061	LT	0.235	0.066		0.66	0.13		<0.042	0.075	U	<0.024	0.053	U	<0.014	0.05	U
Thorium-228	<0.012	0.028	U	0.058	0.034	LT	0.159	0.057	LT	0.117	0.043	LT	0.386	0.083		<0.04	0.063	U	<0.007	0.034	U	<0.06	0.046	U
Radon-222	82	26	J-	88	26	J-	339	50	J-	54	23	J-	<3	20	UJ	<22	32	UJ	<17	32	UJ	<20	33	UJ
Lead-210	<0.14	0.39	U	<0.19	0.41	U	<0.69	0.47	U	<0.59	0.55	U	<1.9	1.3	UJ	<0.38	0.39	U	<0.23	0.35	U	<0.4	0.39	U
Gross Alpha	34.1	6.5		36.6	6.9		46.8	8.6	M3	12.6	3.2		18.7	3.7		8.8	2.1		8.9	2.2		8	2.1	

Notes:

<	The analyte was analyzed for, but was not detected. The reporting limit is shown in the result column.
J	Estimated value
J-	Estimated value, may be biased low.
LT	Result less than requested minimum detectable concentration, but greater than sample-specific detectable concentration.
M3	The requested minimum detected concentration was not met, but the reported activity is greater than the reported minimum
pCi/L	Picocuries per liter
Q	Qualifier
TPU	Total propagated uncertainty
U	Not detected. The associated value is the reporting limit.
UJ	Not considered detected. The associated value is the reported concentration, which is estimated.

Table J1-8. Water Quality Laboratory Analytical Results for Surface Water Samples

Analyte	Units	Field Sample ID															
		DC3-SW10-01-082118		DC3-SW10-02-082118		DC3-SW18A-01-082118		DC3E-SW1-01-082118		DC3E-SW5A-01-082118		DC3E-SW10-01-093018		DC3E-SW10-02-093018		DC3E-SW14-01-093018	
		Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Drainage Channel ID		Middle 3		Middle 3		Middle 3		Middle 3E/DC3E		Middle 3E/DC3E		Middle 3E/DC3E		Middle 3E/DC3E		Middle 3E/DC3E	
Orthophosphate as Phosphate	mg/L	<0.05	U	<0.05	U	<0.05	U	<0.05	U	<0.05	U	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Sulfate	mg/L	23		22		24		2.4		2.3		2.7		2.7		2	
Chloride	mg/L	6.8		6.7		5.9		4.5		4.3		4.4		4.4		3.7	
Nitrate/ nitrite as Nitrogen	mg/L	<0.01	U	<0.01	U	<0.01	U	<0.01	U	<0.01	U	0.019		0.023		<0.01	U
Total Dissolved Solids	mg/L	330		330		320		280		270		260		280		260	
Sulfide	mg/L	<2	U	<2	U	<2	U	<2	U	<2	U	<2	U	<2	U	<2	U
Total Organic Carbon	mg/L	5.6		5.5		4.7		3		6.2		1.5		1.5		2	
Total Suspended Solids	mg/L	<20	U	<20	U	33		32		140		<20	U	<20	U	31	
Total Alkalinity as CaCO3	mg/L	250		250		240		230		220		220		220		240	
Carbonate as CaCo3	mg/L	<20	U	<20	U	<20	U	<20	U	<20	U	<20	U	<20	U	<20	U
Bicarbonate as CaCO3	mg/L	250		250		240		230		220		220		220		240	
Ammonia as Nitrogen	mg/L	<0.1	U	<0.1	U	<0.1	U	<0.1	U	<0.1	U	<0.1	U	<0.1	U	<0.1	U
Nitrogen, Total Kjeldahl (TKN)	mg/L	0.41		0.08	J	<0.07	U	0.12	J	0.38		<0.2	U	<0.2	U	<0.2	U
Hardness (as CaCO3)	mg/L	240		230		240		220		250		210		220		220	

Notes:

<	The analyte was analyzed for, but was not detected. The reporting limit is shown in the result column.
J	Estimated value
mg/L	Milligrams per liter
Q	Qualifier
U	Not detected. The associated value is the reporting limit.
#N/A	Not collected/not analyzed by the lab

Table J1-9. Field Measured Water Quality Parameter Results for Surface Water Samples

Drainage/Drainage ID	Date	Time	Lab Sample ID	Field Measurements						Notes
				pH	Temperature (C)	Specific Conductance (µmhos/cm)	Turbidity (NTU)	Dissolved Oxygen (DO) (mg/L)	Oxidation-Reduction Potential (ORP) (mV)	
Middle 3/DC3	8/21/2018	9:55	DC3-SW10-01-082118	8.6	15.99	447.5	26.2	7.86	194.2	ST:1000
Middle 3/DC3	8/21/2018	9:55	DC3-SW10-02-082118	8.6	15.99	447.5	26.2	7.86	194.2	
Middle 3/DC3	8/21/2018	11:21	DC3-SW18A-01-082118	8.31	16.43	502.4	185.9	7.44	239.3	ST: 1145 Slightly downstream of CW13
Middle 3E/DC3E	8/21/2018	11:58	DC3E-SW1-01-082118	8.58	16.65	394.1	50.5	7.80	285.3	ST:1215
Middle 3E/DC3E	8/21/2018	12:30	DC3E-SW5A-01-082118	8.55	16.4	440.9	136.5	7.74	218.7	ST:1245
Middle 3E/DC3E	9/30/2018	13:40	DC3E-SW-10-01-093018	--	--	--	--	--	--	Sample collected from water flowing off rocks.
Middle 3E/DC3E	9/30/2018	13:40	DC3E-SW-10-02-093018	--	--	--	--	--	--	Duplicate of sample SW10.
Middle 3E/DC3E	9/30/2018	13:00	DC3E-SW-14-01-093018	--	--	--	--	--	--	Sample collected below M9 from water flowing over rock.

Notes:
Before waste sampling took place, a water quality meter was submerged in the waterbody to obtain field measurements. Measurements were recorded once all parameters had stabilized.

--	Not recorded - no water quality meter was available during sample collection.
µmhos/cm	micromhos per centimeter
C	Celsius
ID	Identification
mg/L	milligrams per liter
mV	Millivolt
NTU	Nephelometric turbidity units
ST	Sample time

Table J1-10. Laboratory Analytical Results for Toxicity Characteristic Leaching Procedure

Analyte	TCLP Permissible Limit	Units	Sample ID	
			M21-SD2-01-091218	
			Result	Q
Depth (inches)			0-6	
Drainage Channel ID			Middle 2	
Arsenic	5	mg/L	0.0097	J
Barium	100	mg/L	1.1	
Cadmium	1	mg/L	<0.05	U
Chromium	5	mg/L	<0.1	UJ
Lead	5	mg/L	0.0043	J
Selenium	1	mg/L	<0.06	U
Silver	5	mg/L	<0.1	UJ

Notes:
J Estimated value
mg/L Milligrams per liter
Q Qualifier
TCLP Toxicity characteristic leaching procedure
U Not detected. The associated value is the reporting limit.
UJ Not considered detected. The associated value is the reported concentration, which is estimated.

Table J1-11. Metals Laboratory Analytical Results for Synthetic Precipitation Leaching Procedure

Analyte	Range of Background Concentrations within the Cove Wash[1]	Units	Sample ID	
			M21-SD2-01-091218	
			Result	Q
Depth (inches)			0-6	
Drainage Channel ID			Middle 2	
Aluminum	-	mg/L	<1	U
Antimony	-	mg/L	<0.01	U
Arsenic	<0.003 to 0.018	mg/L	0.0041	J
Barium	-	mg/L	0.037	J
Beryllium	-	mg/L	<0.005	U
Cadmium	-	mg/L	<0.02	U
Calcium	-	mg/L	7.8	J
Chromium	-	mg/L	<0.1	U
Cobalt	-	mg/L	<0.05	U
Copper	-	mg/L	<0.2	UJ
Iron	-	mg/L	<1	U
Lead	< 0.0022 to 0.0074	mg/L	<0.02	U
Lithium	-	mg/L	<0.2	U
Magnesium	-	mg/L	0.61	J
Manganese	-	mg/L	<0.05	U
Molybdenum	< 0.0003 to 0.0033	mg/L	<0.02	U
Nickel	-	mg/L	<0.2	U
Selenium	<0.0015 to 0.015	mg/L	<0.1	U
Silver	-	mg/L	<0.005	U
Sodium	-	mg/L	<10	U
Thallium	-	mg/L	<0.001	U
Thorium	-	mg/L	0.0001	J
Uranium	0.0015 to 0.18	mg/L	0.0068	
Vanadium	0.0027 to 0.13	mg/L	0.12	
Zinc	-	mg/L	<1	U

Notes:

- Not applicable
[1] The range of primary analyte concentrations observed in surface water and groundwater as reported in the Cove Wash Watershed Assessment (Weston 2018). No background concentrations were reported for thorium.
J Estimated value
mg/L Milligrams per liter
Q Qualifier
U Not detected. The associated value is the reporting limit.
UJ Not considered detected. The associated value is the reported concentration, which is estimated.

Table J1-12. Radionuclides Laboratory Analytical Results for Synthetic Precipitation Leaching Procedure

Decay Series	Analyte	Units	Sample ID		
			M21-SD2-01-091218		
			Result	TPU	Q
Depth (inches)			0-6		
Drainage Channel ID			Middle 2		
Uranium	Uranium-238[1]	pCi/L	1.27	0.39	J
	Uranium-234	pCi/L	1.05	0.34	J
	Thorium-230	pCi/L	0.94	0.21	J
	Radium-226[2]	pCi/L	2.13	0.84	
	Lead-210	pCi/L	<0.64	0.42	U
	Polonium-210	pCi/L	3.65	0.81	
Actinide	Uranium-235	pCi/L	<0.138	0.073	UJ
Thorium	Thorium-232[1]	pCi/L	<0.012	0.024	UJ
	Radium-228	pCi/L	<0.79	0.38	U
	Thorium-228	pCi/L	<0.147	0.075	UJ

Notes:

[1] Measured via alpha spectroscopy.
[2] The range of combined radium-226/228 concentrations observed in surface water and groundwater in the Cove Wash Watershed assessment is 0.21 pCi/L to 2.1 pCi/L.
J Estimated value
pCi/L Picocuries per liter
Q Qualifier
TPU Total propagated uncertainty
U Not detected. The associated value is the reporting limit.
UJ Not considered detected. The associated value is the reported concentration, which is estimated.

Table J1-13. Laboratory Analytical Results for Acid-Base Accounting

Analyte	Units	Sample ID
		M21-SD2-01-091218
		Result
Depth (inches)		0-6
Drainage Channel ID		Middle 2
Paste pH	pH	7.9
Total Moisture	Weight Percent	1.42
Total Sulfur	Moisture Free Weight Percent	<0 U
Acid Potential	ppt $CaCO_3$	<0 U
Neutralization Potential	ppt $CaCO_3$	74
Acid-Base Accounting	ppt $CaCO_3$	74

Notes:

ppt CaCO3	Tons of calcium carbonate equivalent per 1,000 tons of material
U	Not detected. The associated value is the reporting limit.

ATTACHMENT J2

SEDIMENT BACKGROUND STUDY AREA SUPPORTING TABLE AND FIGURES

Table J2-1. Gamma Radiation Survey Results for Drainage Background Areas BSA-34 and BSA-35

Summary Statistic	Units	Gamma Radiation Survey Results		
		BSA-34	BSA-35	Combined Background Drainages 34 and 35
# of Measurements	#	1,130	2,075	3,205
Minimum	cpm	6,515	7,604	6,515
Maximum	cpm	13,906	15,313	15,313
Average	cpm	9,642	10,630	10,282
Median	cpm	9,565	10,548	10,206
Standard Deviation	cpm	1,149	1,149	1,242
90th Percentile	cpm	11,206	12,199	11,909
95th Percentile	cpm	11,669	12,617	12,416
99th Percentile	cpm	12,675	13,689	13,480

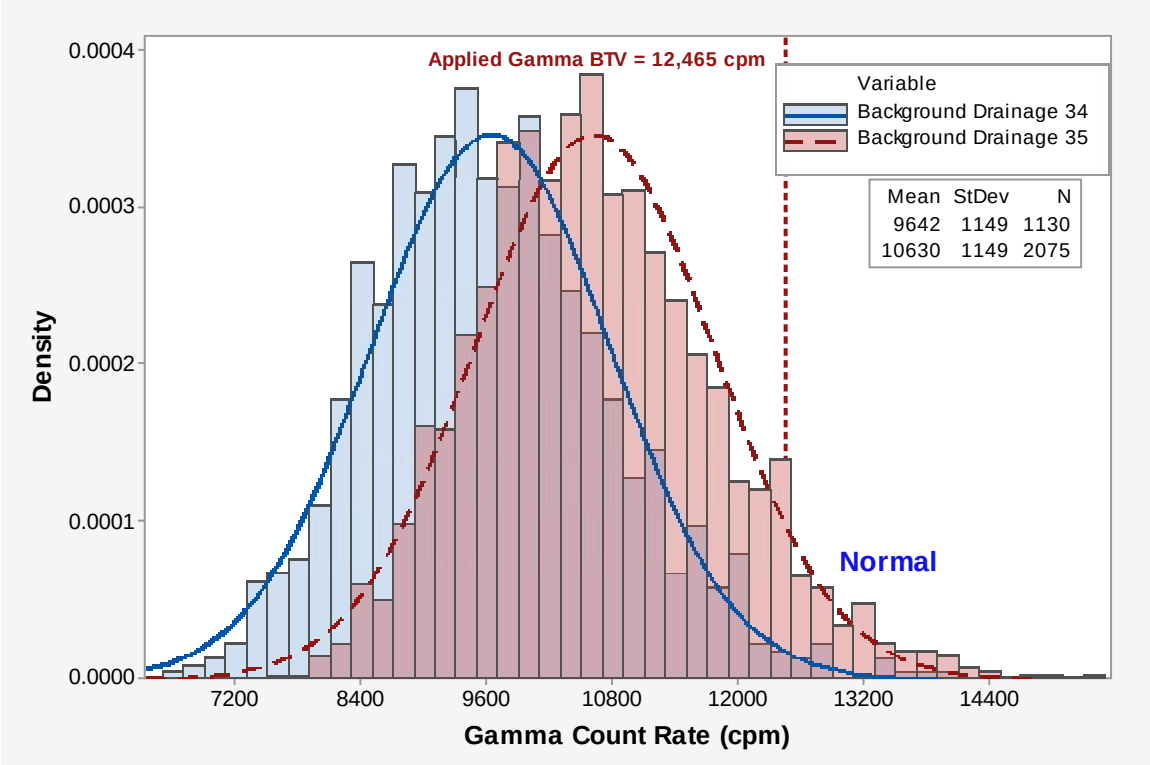


Figure J2-1. Comparison of Gamma Count Rates for BSA-34 and BSA-35

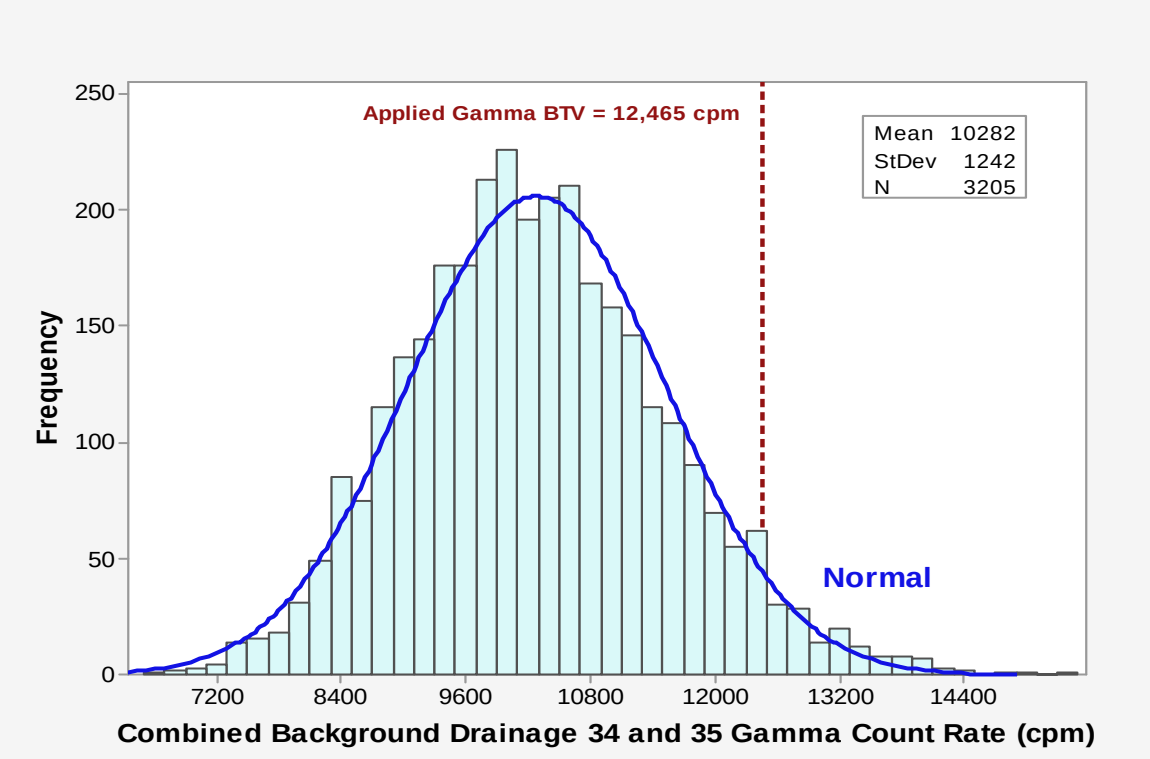


Figure J2-2. Gamma Count Rate for BSA-34 and BSA-35 Combined

ATTACHMENT J3

DRAINAGE-SPECIFIC GAMMA AND SEDIMENT RESULTS FIGURES

LIST OF FIGURES

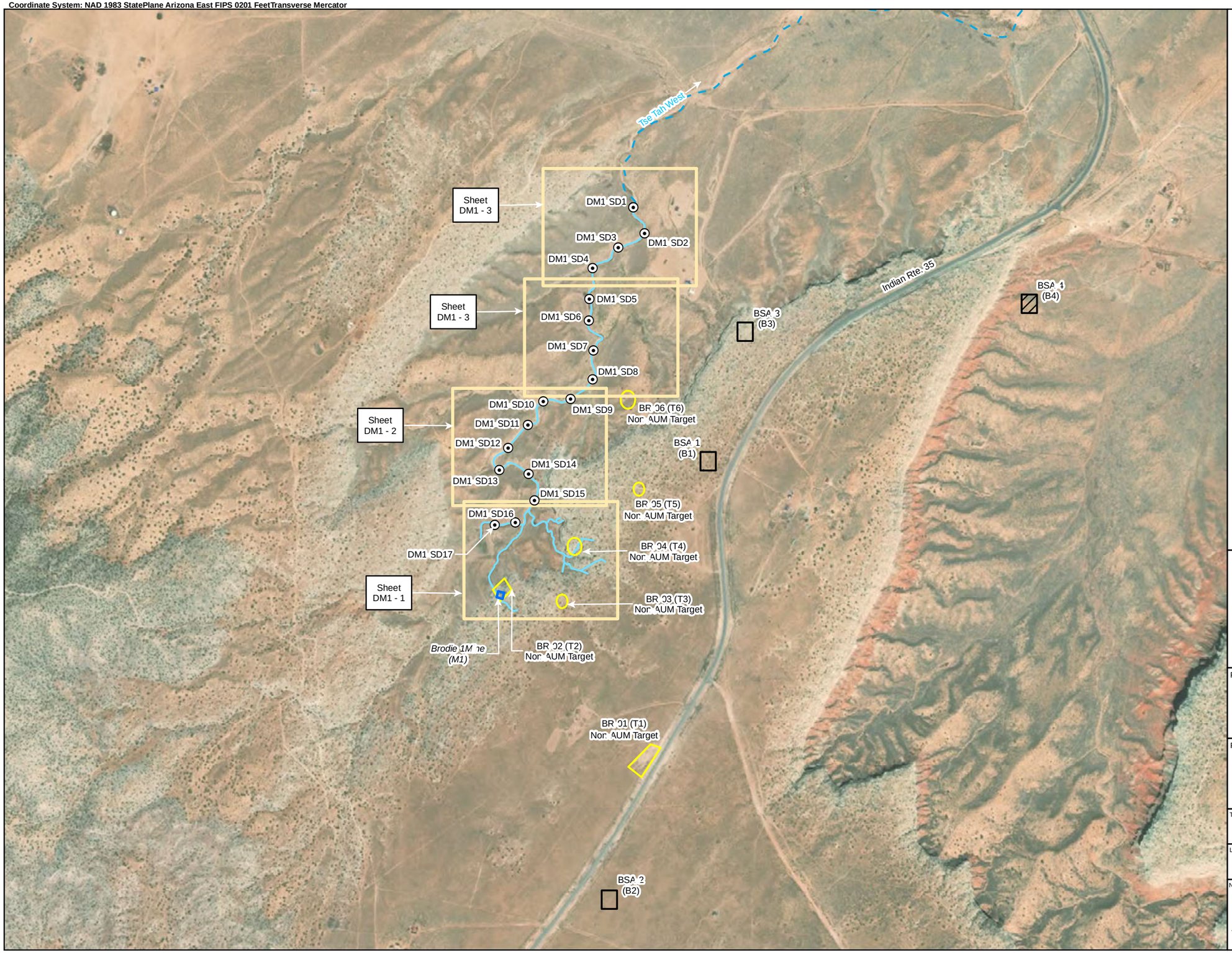
LIST OF FIGURES (CONTINUED)

LIST OF FIGURES (CONTINUED)

LIST OF FIGURES (CONTINUED)

LIST OF FIGURES (CONTINUED)

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



- Sediment Sample Locations
- Survey Index Sheet
- AUM Site Boundary
- Non-AUM Target Site Boundary
- Background Location - *Applied to Drainage*
- Background Location
- Drainage*
- Drainage - Field Mapped

1 in = 1,000 ft

1:12,000

N W E S

0 500 1,000 2,000 Feet

TSE TAH WEST
DRAINAGE SURVEY INDEX MAP

Prepared For:

Prepared By:

1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: SWEETWATER CHAPTER NAVAJO NATION	**Date:** 7/8/2019

Note:
*U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DM1 - I**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

SHEET DM1 - 2
SHEET DM1 - 1

DM1-SD16-01-081918
Arsenic (1.3 mg/kg)
Lead (2.2 mg/kg)
Molybdenum (0.15 mg/kg)
Radium-226 (0.47 pCi/g)
Selenium (<0.94 mg/kg)
Thorium (1.2 mg/kg)
Uranium (0.39 mg/kg)
Vanadium (4.3 mg/kg)

DM1-SD17-01-081918
Arsenic (0.93 mg/kg)
Lead (2.3 mg/kg)
Molybdenum (0.13 mg/kg)
Radium-226 (0.39 pCi/g)
Selenium (<0.99 mg/kg)
Thorium (1.2 mg/kg)
Uranium (0.3 mg/kg)
Vanadium (4 mg/kg)

Tse Tah West (DM1)

BR-04 (T4)
Non-AUM Target

BR-02 (T2)
Non-AUM Target

Burial Cell 41

Brodie 1
(M1)

Portal 41

BR-03 (T3)
Non-AUM Target

Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 7,231	≤ Avg. BG
7,231 - 8,673	Avg. BG - 1 x BTV
8,673 - 17,346	1 x BTV - 2 x BTV
17,346 - 26,019	2 x BTV - 3 x BTV
26,019 - 34,692	3 x BTV - 4 x BTV
34,692 - 86,730	4 x BTV - 10 x BTV
≥ 86,730	≥ 10 x BTV

AUM Site Boundary
Survey Area Boundary
Non-AUM Target Site Boundary
Closed Portal
Burial Cell
Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte. '<' indicates less than limit of detection laboratory non-detect.
[2]The applied gamma background threshold value (BTV) is 8,673 cpm derived from the background area BSA-4.
Avg. BG: Average value of the background data set.

1 in = 125 ft

1:1,500

N
W E
S

0 62.5 125 250 Feet

TSE TAH WEST DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

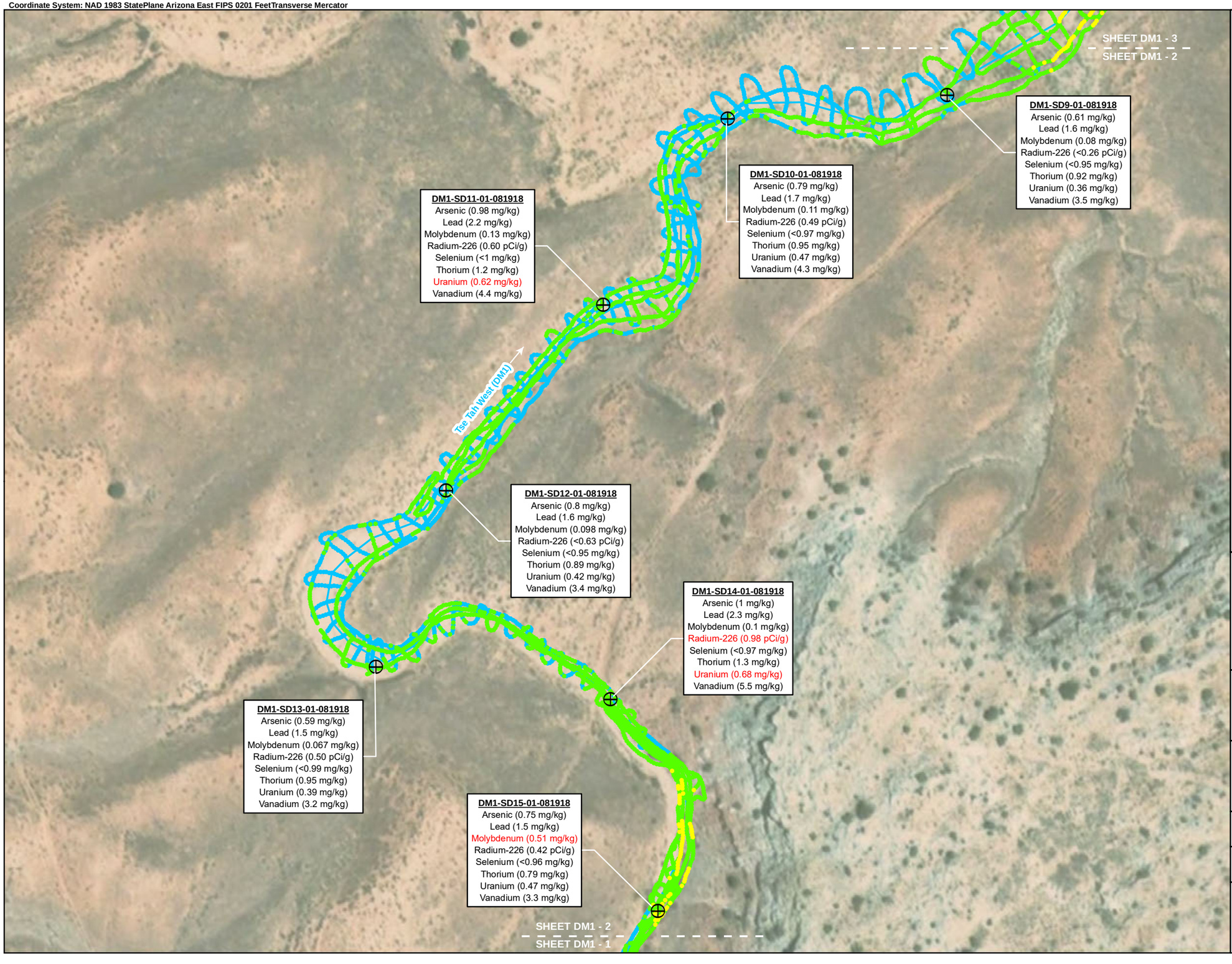
TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: SWEETWATER CHAPTER NAVAJO NATION	**Date:** 5/6/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DM1 - 1**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 7,231	≤ Avg. BG
7,231 - 8,673	Avg. BG - 1 x BTV
8,673 - 17,346	1 x BTV - 2 x BTV
17,346 - 26,019	2 x BTV - 3 x BTV
26,019 - 34,692	3 x BTV - 4 x BTV
34,692 - 86,730	4 x BTV - 10 x BTV
≥ 86,730	≥ 10 x BTV

Non-AUM Target Site Boundary

Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte. '<' indicates less than limit of detection laboratory non-detect.
[2]The applied gamma background threshold value (BTV) is 8,673 cpm derived from the background area BSA-4.
Avg. BG: Average value of the background data set.

1 in = 125 ft

1:1,500

N W E S

0 62.5 125 250 Feet

TSE TAH WEST DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: SWEETWATER CHAPTER NAVAJO NATION	Date: 5/6/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DM1 - 2**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

SHEET DM1 - 4

SHEET DM1 - 3

DM1-SD5-01-081918
Arsenic (1.1 mg/kg)
Lead (3.1 mg/kg)
Molybdenum (0.18 mg/kg)
Radium-226 (0.57 pCi/g)
Selenium (<0.96 mg/kg)
Thorium (1.2 mg/kg)
Uranium (0.42 mg/kg)
Vanadium (4.8 mg/kg)

DM1-SD6-01-081918
Arsenic (0.73 mg/kg)
Lead (1.3 mg/kg)
Molybdenum (0.14 mg/kg)
Radium-226 (0.42 pCi/g)
Selenium (<0.97 mg/kg)
Thorium (0.74 mg/kg)
Uranium (0.31 mg/kg)
Vanadium (3 mg/kg)

DM1-SD7-01-081918
Arsenic (0.65 mg/kg)
Lead (1.5 mg/kg)
Molybdenum (0.072 mg/kg)
Radium-226 (0.41 pCi/g)
Selenium (<0.99 mg/kg)
Thorium (1 mg/kg)
Uranium (0.46 mg/kg)
Vanadium (3.5 mg/kg)

Tse Tah West (DM1)

DM1-SD8-01-081918
Arsenic (0.71 mg/kg)
Lead (1.9 mg/kg)
Molybdenum (0.083 mg/kg)
Radium-226 (0.50 pCi/g)
Selenium (<0.98 mg/kg)
Thorium (1.1 mg/kg)
Uranium (0.49 mg/kg)
Vanadium (4 mg/kg)

SHEET DM1 - 3

SHEET DM1 - 2

BR-06 (T6)
Non-AUM Target

Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 7,231	≤ Avg. BG
7,231 - 8,673	Avg. BG - 1 x BTV
8,673 - 17,346	1 x BTV - 2 x BTV
17,346 - 26,019	2 x BTV - 3 x BTV
26,019 - 34,692	3 x BTV - 4 x BTV
34,692 - 86,730	4 x BTV - 10 x BTV
≥ 86,730	≥ 10 x BTV

Survey Area Boundary

Non-AUM Target Site Boundary

Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte. '<' indicates less than limit of detection laboratory non-detect.
[2]The applied gamma background threshold value (BTV) is 8,673 cpm derived from the background area BSA-4.
Avg. BG: Average value of the background data set.

1 in = 125 ft

1:1,500

N W E S

0 62.5 125 250 Feet

TSE TAH WEST DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: SWEETWATER CHAPTER NAVAJO NATION	**Date:** 5/6/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DM1 - 3**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

DM1-SD1-01-081918
Arsenic (0.94 mg/kg)
Lead (2 mg/kg)
Molybdenum (0.1 mg/kg)
Radium-226 (0.57 pCi/g)
Selenium (<0.99 mg/kg)
Thorium (1.1 mg/kg)
Uranium (0.45 mg/kg)
Vanadium (4.1 mg/kg)

DM1-SD2-01-081918
Arsenic (0.99 mg/kg)
Lead (1.7 mg/kg)
Molybdenum (0.14 mg/kg)
Radium-226 (<0.66 pCi/g)
Selenium (<0.97 mg/kg)
Thorium (0.94 mg/kg)
Uranium (0.7 mg/kg)
Vanadium (4.4 mg/kg)

DM1-SD3-01-081918
Arsenic (0.92 mg/kg)
Lead (2.3 mg/kg)
Molybdenum (0.12 mg/kg)
Radium-226 (0.49 pCi/g)
Selenium (<0.93 mg/kg)
Thorium (1.3 mg/kg)
Uranium (0.56 mg/kg)
Vanadium (4.6 mg/kg)

DM1-SD4-01-081918
Arsenic (0.71 mg/kg)
Lead (1.8 mg/kg)
Molybdenum (0.082 mg/kg)
Radium-226 (0.64 pCi/g)
Selenium (<0.94 mg/kg)
Thorium (1 mg/kg)
Uranium (0.51 mg/kg)
Vanadium (3.7 mg/kg)

DM1-SD5-01-081918

Tse Tah West (DM1)

SHEET DM1 - 4
SHEET DM1 - 3

⊕ Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 7,231	≤ Avg. BG
7,231 - 8,673	Avg. BG - 1 x BTV
8,673 - 17,346	1 x BTV - 2 x BTV
17,346 - 26,019	2 x BTV - 3 x BTV
26,019 - 34,692	3 x BTV - 4 x BTV
34,692 - 86,730	4 x BTV - 10 x BTV
≥ 86,730	≥ 10 x BTV

Non-AUM Target Site Boundary
Drainage[3]
Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte. '<' indicates less than limit of detection laboratory non-detect.
[2]The applied gamma background threshold value (BTV) is 8,673 cpm derived from the background area BSA-4. Avg. BG: Average value of the background data set.

1 in = 125 ft

1:1,500

N W E S

0 62.5 125 250 Feet

TSE TAH WEST DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

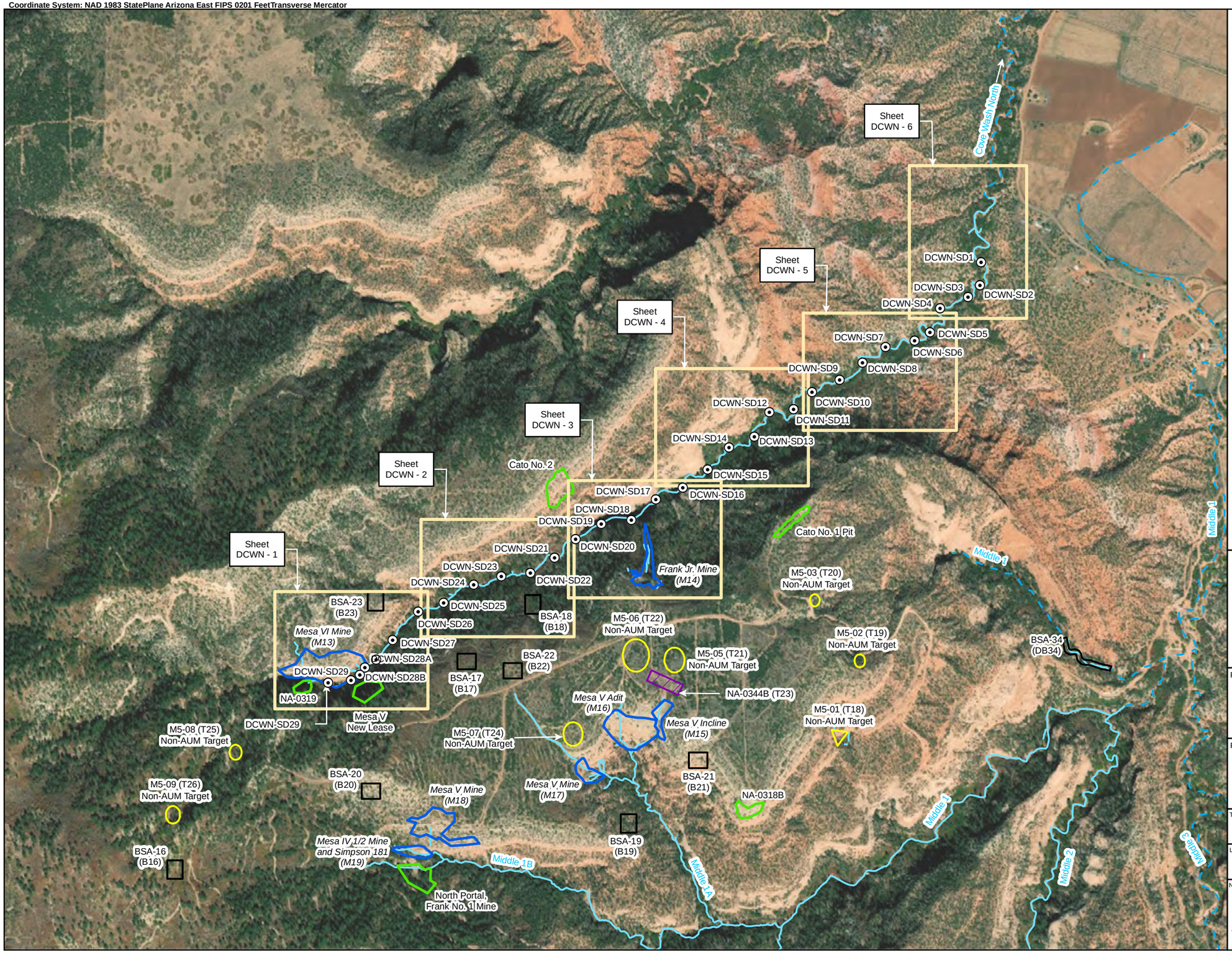
TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: SWEETWATER CHAPTER NAVAJO NATION	**Date:** 5/6/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DM1 - 4**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



- Sediment Sample Locations
- Survey Index Sheet
- AUM Site Boundary
- Non-AUM Target Site Boundary
- AUM Related Site Boundary
- Background Location
- Non-Tronox AUM Site
- Drainage*
- Drainage - Field Mapped

1 in = 1,000 ft

1:12,000

N W E S

0 500 1,000 2,000 Feet

COVE WASH NORTH DRAINAGE SURVEY INDEX MAP

Prepared For:

Prepared By:

1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 7/8/2019

Note:
*U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DCWN - I**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

BSA-23
(B23)

DCWN-SD26-01-062418
Arsenic (2.6 mg/kg)
Lead (2.5 mg/kg)
Molybdenum (0.43 mg/kg)
Radium-226 (0.71 pCi/g)
Selenium (<0.97 mg/kg)
Thorium (1 mg/kg)
Uranium (0.41 mg/kg)
Vanadium (8.6 mg/kg)

SHEET DCWN - 2
SHEET DCWN - 1

DCWN-SD28-01-062418
Arsenic (2.4 mg/kg)
Lead (3.7 mg/kg)
Molybdenum (0.41 mg/kg)
Radium-226 (1.49 pCi/g)
Selenium (0.48 mg/kg)
Thorium (1.7 mg/kg)
Uranium (0.94 mg/kg)
Vanadium (11 mg/kg)

DCWN-SD27-01-062418
Arsenic (2 mg/kg)
Lead (3 mg/kg)
Molybdenum (0.43 mg/kg)
Radium-226 (0.72 pCi/g)
Selenium (0.36 mg/kg)
Thorium (1.9 mg/kg)
Uranium (0.74 mg/kg)
Vanadium (8.8 mg/kg)

Cove Wash North (DCWN)

Rimstrip 103

Waste Pile M13A

DCWN-SD28B-01-062418
Arsenic (3.4 mg/kg)
Lead (4.2 mg/kg)
Molybdenum (0.62 mg/kg)
Radium-226 (0.94 pCi/g)
Selenium (0.75 mg/kg)
Thorium (2.2 mg/kg)
Uranium (1.3 mg/kg)
Vanadium (11 mg/kg)

Waste Pile M13B

DCWN-SD30-01-062418
Arsenic (8.3 mg/kg)
Lead (3.6 mg/kg)
Molybdenum (0.22 mg/kg)
Radium-226 (1.33 pCi/g)
Selenium (0.32 mg/kg)
Thorium (1.6 mg/kg)
Uranium (0.77 mg/kg)
Vanadium (17 mg/kg)

Portal 102a
Portal 102b
Portal 102c
Waste Pile M13C

Mesa VI Mine
(M13)

DCWN-SD28A-01-062418
Arsenic (1.6 mg/kg)
Lead (2.7 mg/kg)
Molybdenum (0.32 mg/kg)
Radium-226 (<0.38 pCi/g)
Selenium (<0.99 mg/kg)
Thorium (1.2 mg/kg)
Uranium (0.44 mg/kg)
Vanadium (5.2 mg/kg)

NA-0319
NA-0319

Mesa V New Lease
Mesa V New Lease 14-20-0603-6475

DCWN-SD29-01-062418
Arsenic (1.7 mg/kg)
Lead (3.3 mg/kg)
Molybdenum (0.26 mg/kg)
Radium-226 (1.14 pCi/g)
Selenium (0.39 mg/kg)
Thorium (1.6 mg/kg)
Uranium (0.82 mg/kg)
Vanadium (29 mg/kg)

Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

AUM Site Boundary
Survey Area Boundary
Background Location
Non-Tronox AUM Site
Closed Portal
Open Portal
Rimstrip - Unreclaimed
Waste Pile - Unreclaimed
Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte. '<' indicates less than limit of detection laboratory non-detect.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

1 in = 125 ft

1:1,500

N
W E
S

0 62.5 125 250 Feet

COVE WASH NORTH DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

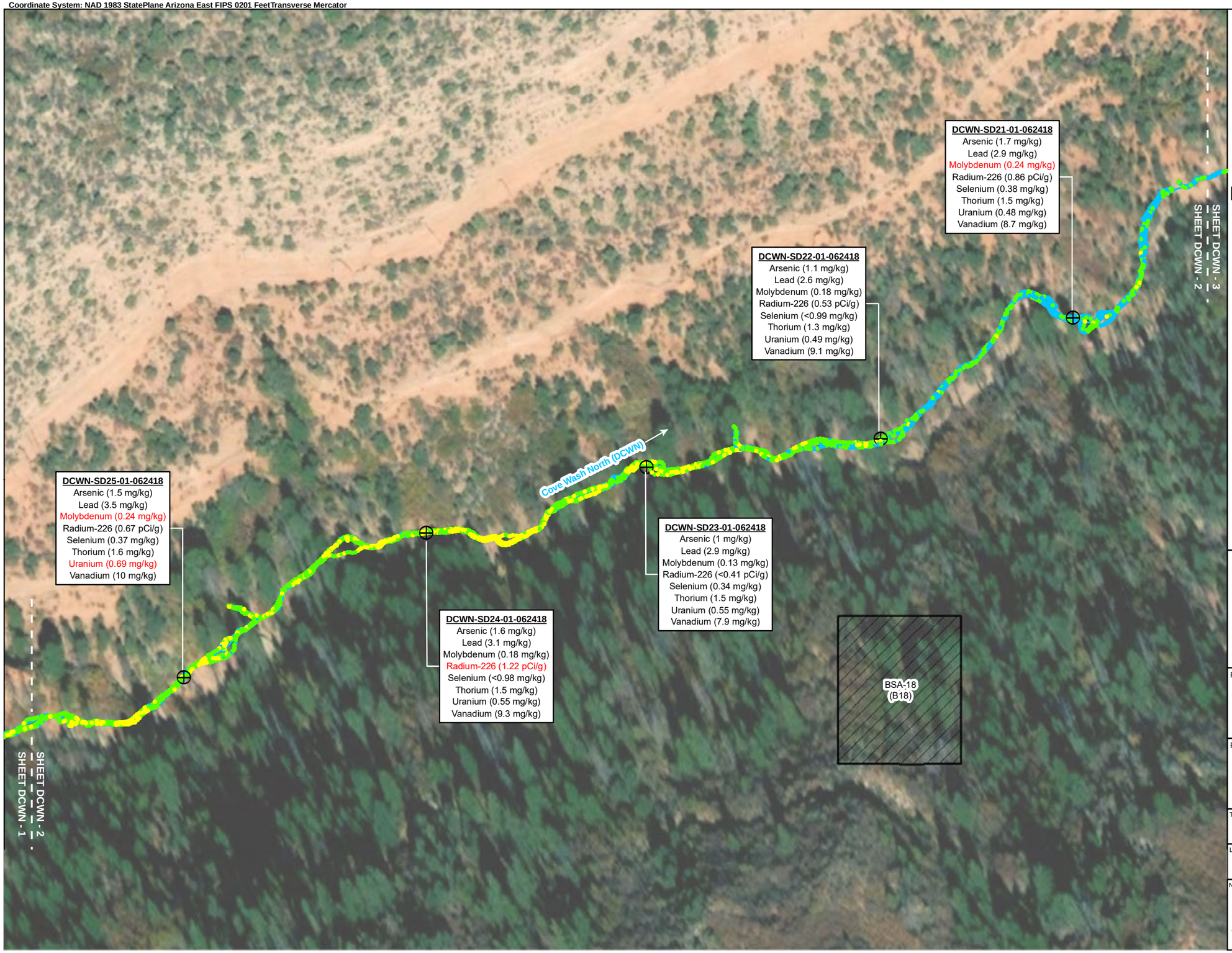
TETRA TECH

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 5/6/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DCWN - 1**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

Background Location

Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte. '<' indicates less than limit of detection laboratory non-detect.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

1 in = 125 ft

1:1,500

N W E S

0 62.5 125 250 Feet

COVE WASH NORTH DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 5/6/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DCWN - 2**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

Cato No. 2

SHEET DCWN - 4

SHEET DCWN - 3

SHEET DCWN - 2

DCWN-SD17-01-062418
Arsenic (1.2 mg/kg)
Lead (2.9 mg/kg)
Molybdenum (0.3 mg/kg)
Radium-226 (3.05 pCi/g)
Selenium (0.44 mg/kg)
Thorium (1.1 mg/kg)
Uranium (1.2 mg/kg)
Vanadium (41 mg/kg)

DCWN-SD16-01-062418
Arsenic (1.4 mg/kg)
Lead (2.6 mg/kg)
Molybdenum (0.18 mg/kg)
Radium-226 (1.59 pCi/g)
Selenium (0.42 mg/kg)
Thorium (1.4 mg/kg)
Uranium (0.71 mg/kg)
Vanadium (19 mg/kg)

DCWN-SD19-01-062418
Arsenic (1.4 mg/kg)
Lead (3 mg/kg)
Molybdenum (0.22 mg/kg)
Radium-226 (<0.51 pCi/g)
Selenium (<0.98 mg/kg)
Thorium (1.3 mg/kg)
Uranium (0.38 mg/kg)
Vanadium (47 mg/kg)

Poor GPS Signal

Cove Wash North (DCWN)

DCWN-SD18-01-062418
Arsenic (0.82 mg/kg)
Lead (1.9 mg/kg)
Molybdenum (0.13 mg/kg)
Radium-226 (0.44 pCi/g)
Selenium (<0.95 mg/kg)
Thorium (1 mg/kg)
Uranium (0.29 mg/kg)
Vanadium (6.4 mg/kg)

DCWN-SD20-01-062418
Arsenic (1.3 mg/kg)
Lead (2.8 mg/kg)
Molybdenum (0.2 mg/kg)
Radium-226 (0.71 pCi/g)
Selenium (<0.96 mg/kg)
Thorium (1.3 mg/kg)
Uranium (0.59 mg/kg)
Vanadium (8.8 mg/kg)

Waste Pile M14

Portal 99

Frank Jr. Mine (M14)

Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

AUM Site Boundary
Survey Area Boundary
Non-Tronox AUM Site
Open Portal
Highwall - Unreclaimed
Waste Pile - Unreclaimed
Drainage - Estimated Path
Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte. '<' indicates less than limit of detection laboratory non-detect.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

1 in = 125 ft

1:1,500

N
W E
S

0 62.5 125 250 Feet

COVE WASH NORTH DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 5/6/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DCWN - 3**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

DCWN-SD11-01-062418
Arsenic (2 mg/kg)
Lead (6.5 mg/kg)
Molybdenum (0.28 mg/kg)
Radium-226 (<0.83 pCi/g)
Selenium (0.57 mg/kg)
Thorium (2.7 mg/kg)
Uranium (2.4 mg/kg)
Vanadium (15 mg/kg)

DCWN-SD12-01-062418
Arsenic (1.7 mg/kg)
Lead (3.4 mg/kg)
Molybdenum (0.21 mg/kg)
Radium-226 (0.76 pCi/g)
Selenium (0.37 mg/kg)
Thorium (1.4 mg/kg)
Uranium (1.2 mg/kg)
Vanadium (12 mg/kg)

DCWN-SD13-01-062418
Arsenic (1.5 mg/kg)
Lead (2.1 mg/kg)
Molybdenum (0.12 mg/kg)
Radium-226 (1.32 pCi/g)
Selenium (<1.1 mg/kg)
Thorium (0.91 mg/kg)
Uranium (0.42 mg/kg)
Vanadium (22 mg/kg)

DCWN-SD14-01-062418
Arsenic (0.85 mg/kg)
Lead (1.9 mg/kg)
Molybdenum (0.09 mg/kg)
Radium-226 (1.05 pCi/g)
Selenium (<1 mg/kg)
Thorium (1.1 mg/kg)
Uranium (0.3 mg/kg)
Vanadium (19 mg/kg)

DCWN-SD15-01-062418
Arsenic (1.1 mg/kg)
Lead (2.7 mg/kg)
Molybdenum (0.14 mg/kg)
Radium-226 (0.74 pCi/g)
Selenium (<1.1 mg/kg)
Thorium (1.1 mg/kg)
Uranium (0.82 mg/kg)
Vanadium (19 mg/kg)

Cove Wash North (DCWN)

Drains From Cato No.2 Non-Tronox Mine Site

SHEET DCWN - 5
SHEET DCWN - 4
SHEET DCWN - 4
SHEET DCWN - 3

⊕ Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte. '<' indicates less than limit of detection laboratory non-detect.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

1 in = 125 ft

1:1,500

N
W E
S

0 62.5 125 250 Feet

COVE WASH NORTH DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

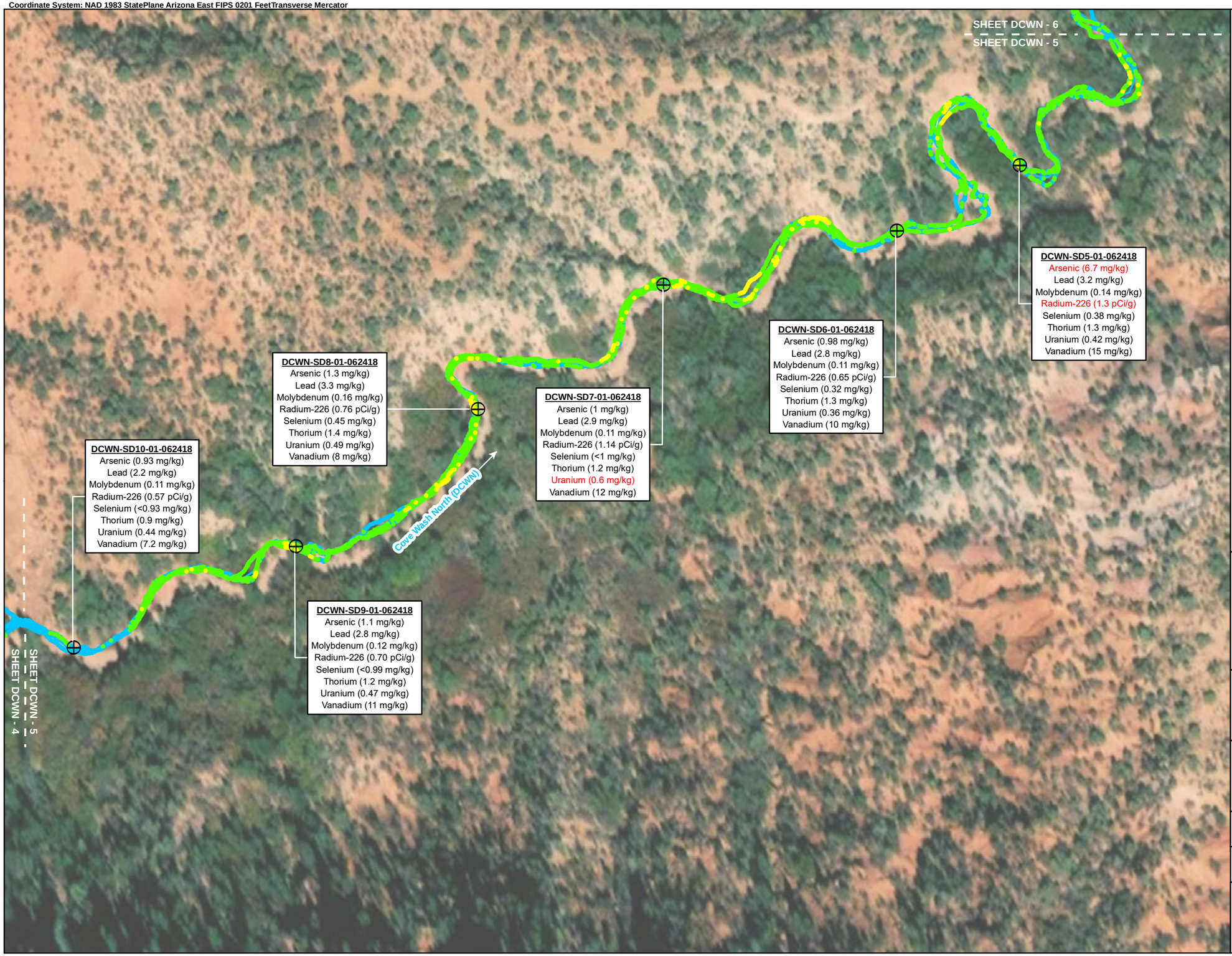
Prepared By:
TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 5/6/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.:
DCWN - 4

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



⊕ Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte. '<' indicates less than limit of detection laboratory non-detect.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

1 in = 125 ft

1:1,500

N W E S

0 62.5 125 250 Feet

COVE WASH NORTH DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

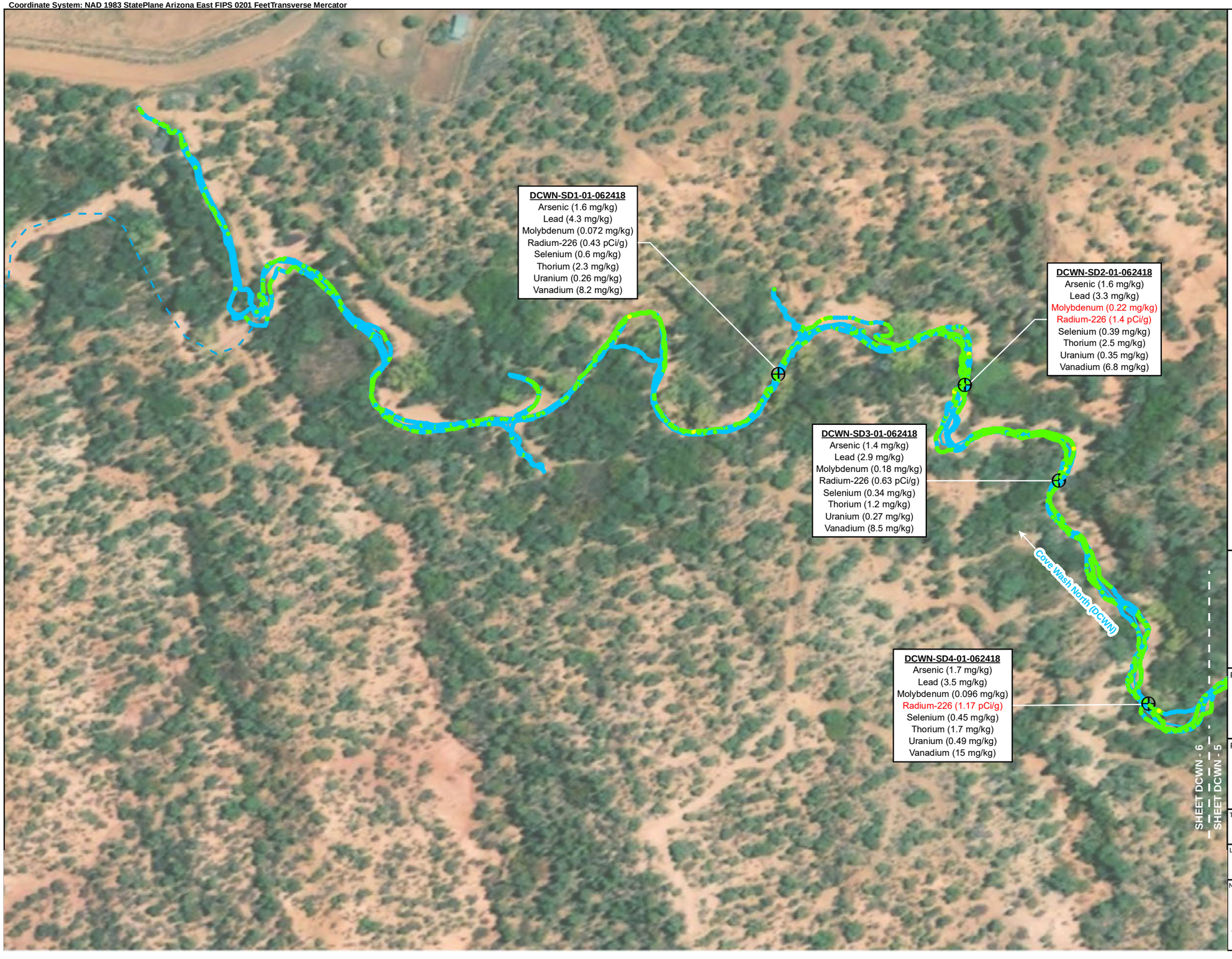
TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 5/6/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DCWN - 5**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

Drainage[3]

Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte. '<' indicates less than limit of detection laboratory non-detect.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

1 in = 125 ft

1:1,500

0 62.5 125 250 Feet

N E S W

COVE WASH NORTH DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

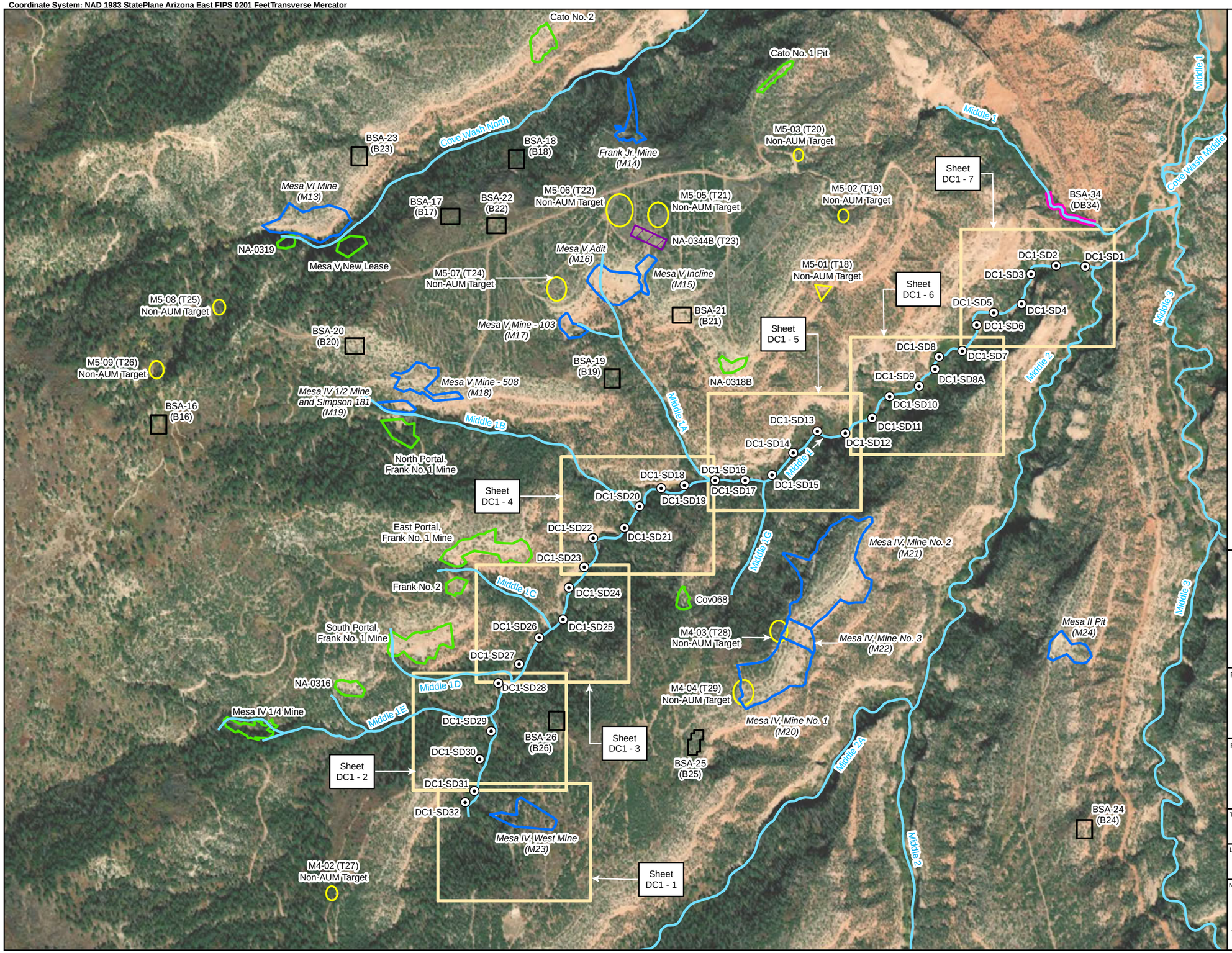
TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 5/6/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DCWN - 6**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



- Sediment Sample Locations
- Survey Index Sheet
- AUM Site Boundary
- Non-AUM Target Site Boundary
- AUM Related Site Boundary
- Drainage Background Location
- Background Location
- Non-Tronox AUM Site

1 in = 1,000 ft

1:12,000

N W E S

0 500 1,000 2,000 Feet

COVE WASH MIDDLE 1 DRAINAGE SURVEY INDEX MAP

Prepared For:

Prepared By:

1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 7/8/2019

Note:
*U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DC1 - I**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

Middle 1D

Drains From South Portal Frank No. 1 Non-Tronox Mine

SHEET DC1 - 3

SHEET DC1 - 2

DC1-SD28-01-062318
Arsenic (1 mg/kg)
Lead (2.6 mg/kg)
Molybdenum (0.087 mg/kg)
Radium-226 (1.17 pCi/g)
Selenium (0.36 mg/kg)
Thorium (1.9 mg/kg)
Uranium (1.1 mg/kg)
Vanadium (9.5 mg/kg)

Middle 1E

Drains From Mesa IV 1/4 Mine and NA-0316 Non-Tronox Mines

BSA-26 (B26)

DC1-SD29-01-062318
Arsenic (0.89 mg/kg)
Lead (2.1 mg/kg)
Molybdenum (0.07 mg/kg)
Radium-226 (1.02 pCi/g)
Selenium (<0.95 mg/kg)
Thorium (1 mg/kg)
Uranium (0.68 mg/kg)
Vanadium (11 mg/kg)

Middle 1 (DC1)

DC1-SD30-01-062318
Arsenic (1 mg/kg)
Lead (2.6 mg/kg)
Molybdenum (0.091 mg/kg)
Radium-226 (1.09 pCi/g)
Selenium (0.34 mg/kg)
Thorium (1.2 mg/kg)
Uranium (0.85 mg/kg)
Vanadium (12 mg/kg)

SHEET DC1 - 2

SHEET DC1 - 1

⊕ Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

Background Location

Drainage[3]

Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte. '<' indicates less than limit of detection laboratory non-detect.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

1 in = 125 ft

1:1,500

N W E S

0 62.5 125 250 Feet

COVE WASH MIDDLE 1 DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

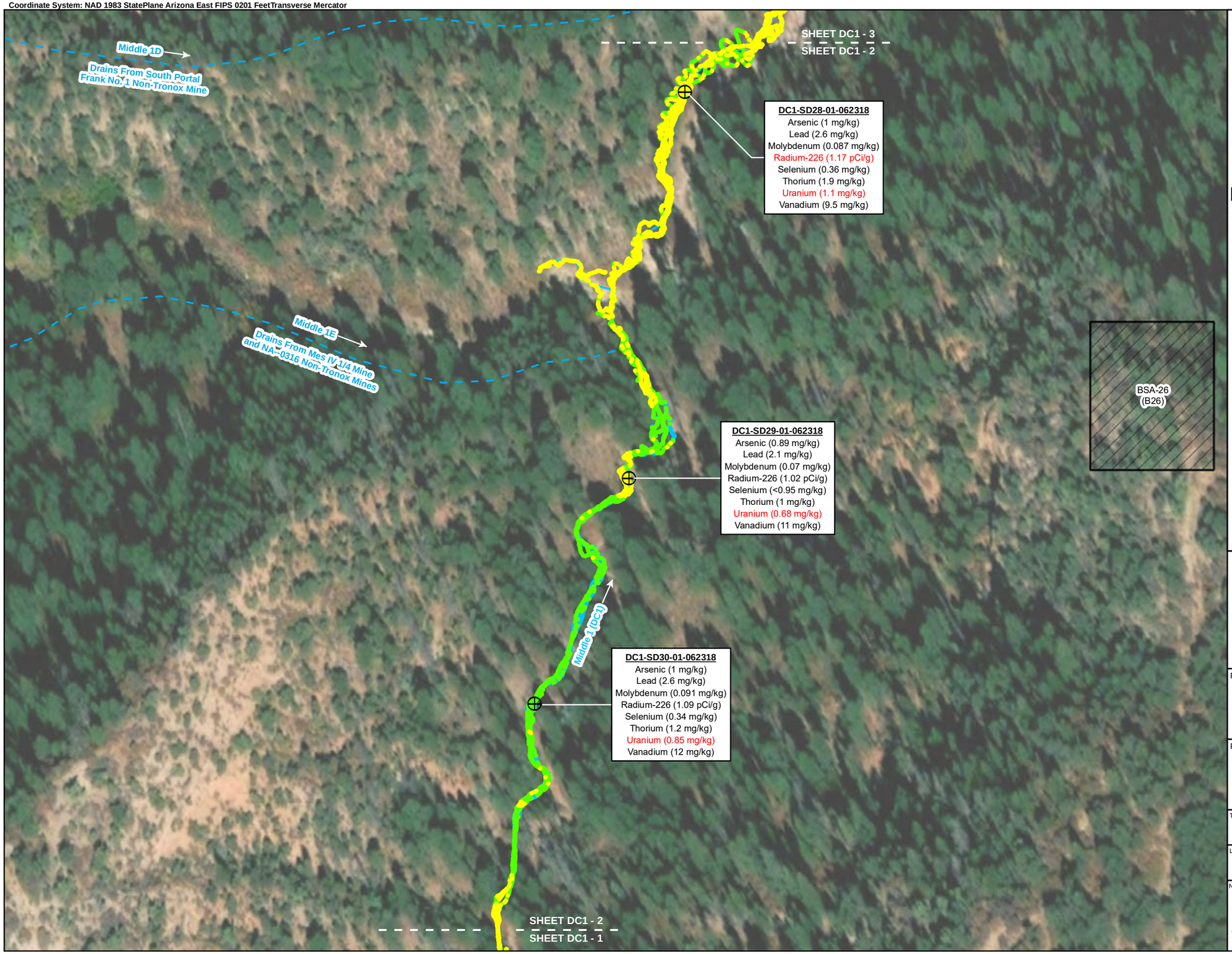
TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 7/12/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DC1 - 1**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

Background Location

Drainage[3]

Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte. '<' indicates less than limit of detection laboratory non-detect.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

1 in = 125 ft

1:1,500

N W E S

0 62.5 125 250 Feet

COVE WASH MIDDLE 1 DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

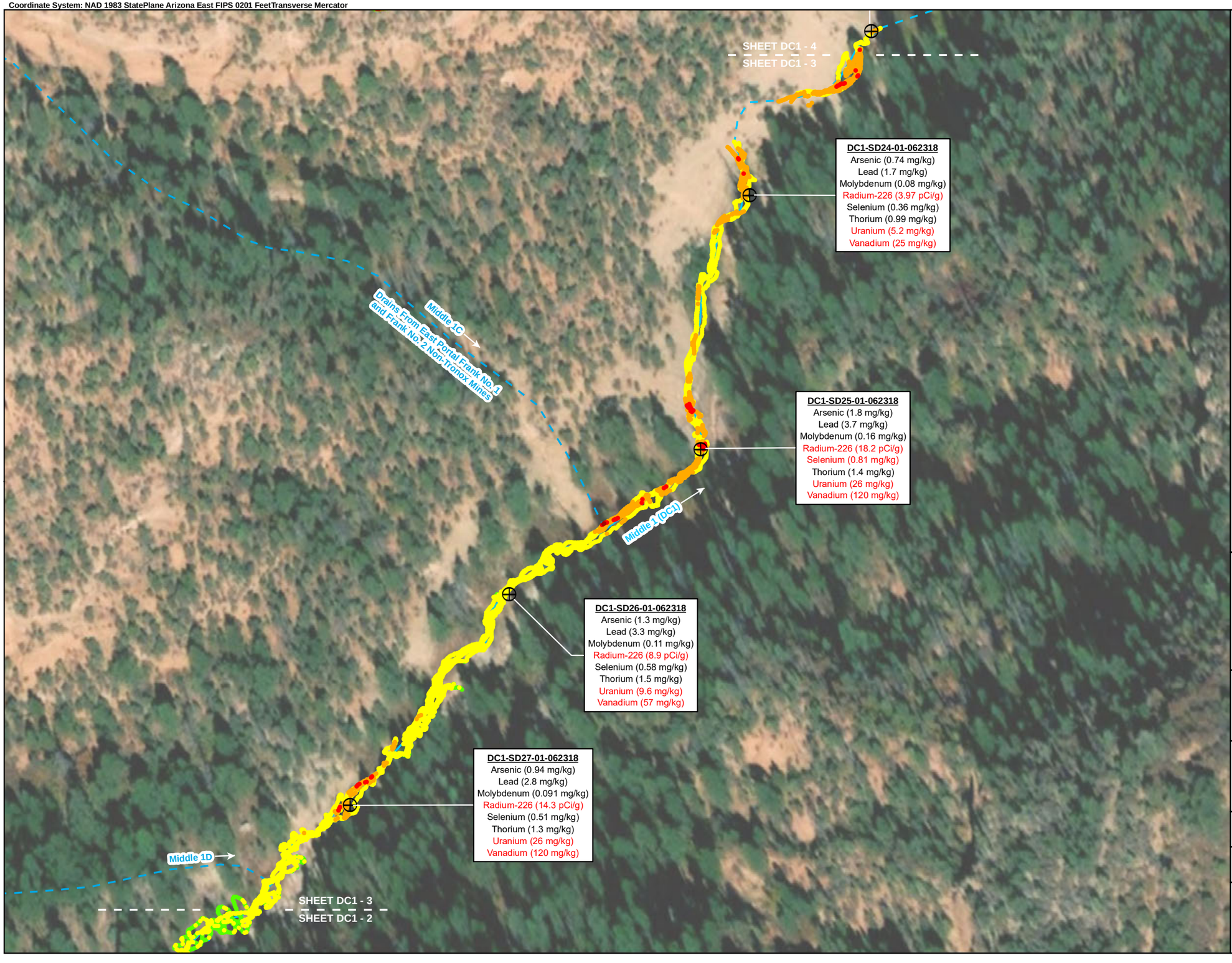
TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 5/6/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DC1 - 2**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

Non-Tronox AUM Site

Waste Pile - Unreclaimed

Drainage[3]

Drainage - Estimated Path

Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte. '<' indicates less than limit of detection laboratory non-detect.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

1 in = 125 ft

1:1,500

N W E S

0 62.5 125 250 Feet

COVE WASH MIDDLE 1 DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.: TO0001	Contract No.: EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	Date: 5/6/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DC1 - 3**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

Middle 1B (DC1B)

Drains From Mesa V Mine - 508 And Mesa IV 1/2 and Simpson 181 Mines

Poor GPS Signal

Middle 1A (DC1A)

Drains From Mesa V Adit, Incline and 508 Mines

SHEET DC1 - 5

SHEET DC1 - 4

DC1-SD18-01-062118
Arsenic (1.1 mg/kg)
Lead (2.2 mg/kg)
Molybdenum (0.19 mg/kg)
Radium-226 (6.34 pCi/g)
Selenium (0.55 mg/kg)
Thorium (0.93 mg/kg)
Uranium (8.9 mg/kg)
Vanadium (79 mg/kg)

DC1-SD19-01-062118
Arsenic (1.2 mg/kg)
Lead (2.9 mg/kg)
Molybdenum (0.11 mg/kg)
Radium-226 (5.69 pCi/g)
Selenium (0.69 mg/kg)
Thorium (1.2 mg/kg)
Uranium (9.2 mg/kg)
Vanadium (55 mg/kg)

DC1-SD20-01-062118
Arsenic (1.3 mg/kg)
Lead (2.7 mg/kg)
Molybdenum (0.16 mg/kg)
Radium-226 (4.98 pCi/g)
Selenium (0.74 mg/kg)
Thorium (1.3 mg/kg)
Uranium (5.8 mg/kg)
Vanadium (29 mg/kg)

Middle 1 (DC1)

DC1-SD21-01-062118
Arsenic (1.3 mg/kg)
Lead (4.4 mg/kg)
Molybdenum (0.11 mg/kg)
Radium-226 (13.1 pCi/g)
Selenium (2.1 mg/kg)
Thorium (1.7 mg/kg)
Uranium (7.7 mg/kg)
Vanadium (85 mg/kg)

DC1-SD22-01-062118
Arsenic (1 mg/kg)
Lead (2.9 mg/kg)
Molybdenum (0.073 mg/kg)
Radium-226 (6.41 pCi/g)
Selenium (0.73 mg/kg)
Thorium (1.4 mg/kg)
Uranium (6.6 mg/kg)
Vanadium (35 mg/kg)

DC1-SD23-01-062318
Arsenic (1 mg/kg)
Lead (3 mg/kg)
Molybdenum (0.12 mg/kg)
Radium-226 (15.1 pCi/g)
Selenium (1.3 mg/kg)
Thorium (1.2 mg/kg)
Uranium (27 mg/kg)
Vanadium (100 mg/kg)

Poor GPS Signal

SHEET DC1 - 4

SHEET DC1 - 3

⊕ Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

Drainage - Estimated Path

Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte. '<' indicates less than limit of detection laboratory non-detect.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

1 in = 125 ft

1:1,500

N W E S

0 62.5 125 250 Feet

COVE WASH MIDDLE 1 DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

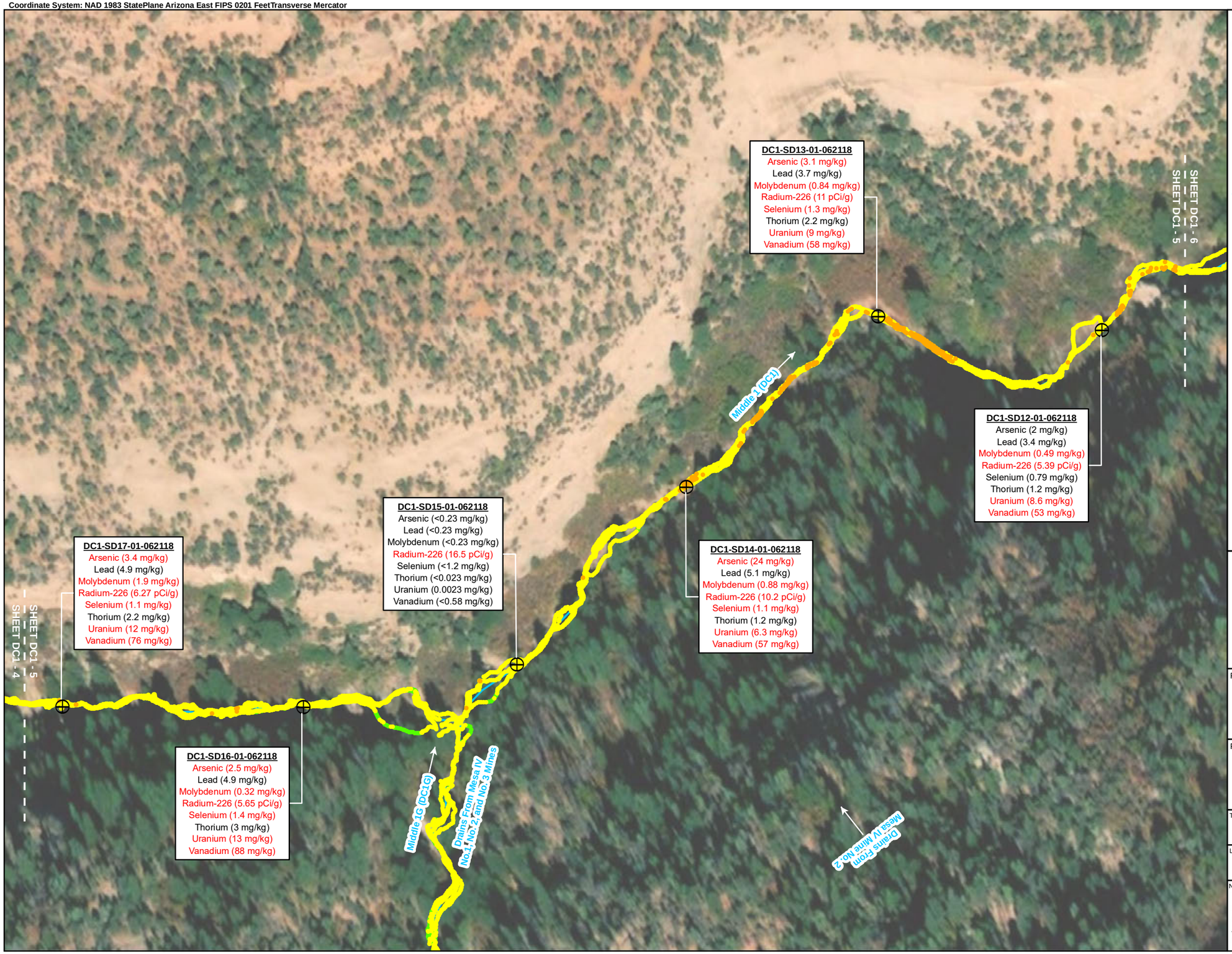
TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 5/6/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DC1 - 4**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte. '<' indicates less than limit of detection laboratory non-detect.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

1 in = 125 ft

1:1,500

N W E S

0 62.5 125 250 Feet

COVE WASH MIDDLE 1 DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

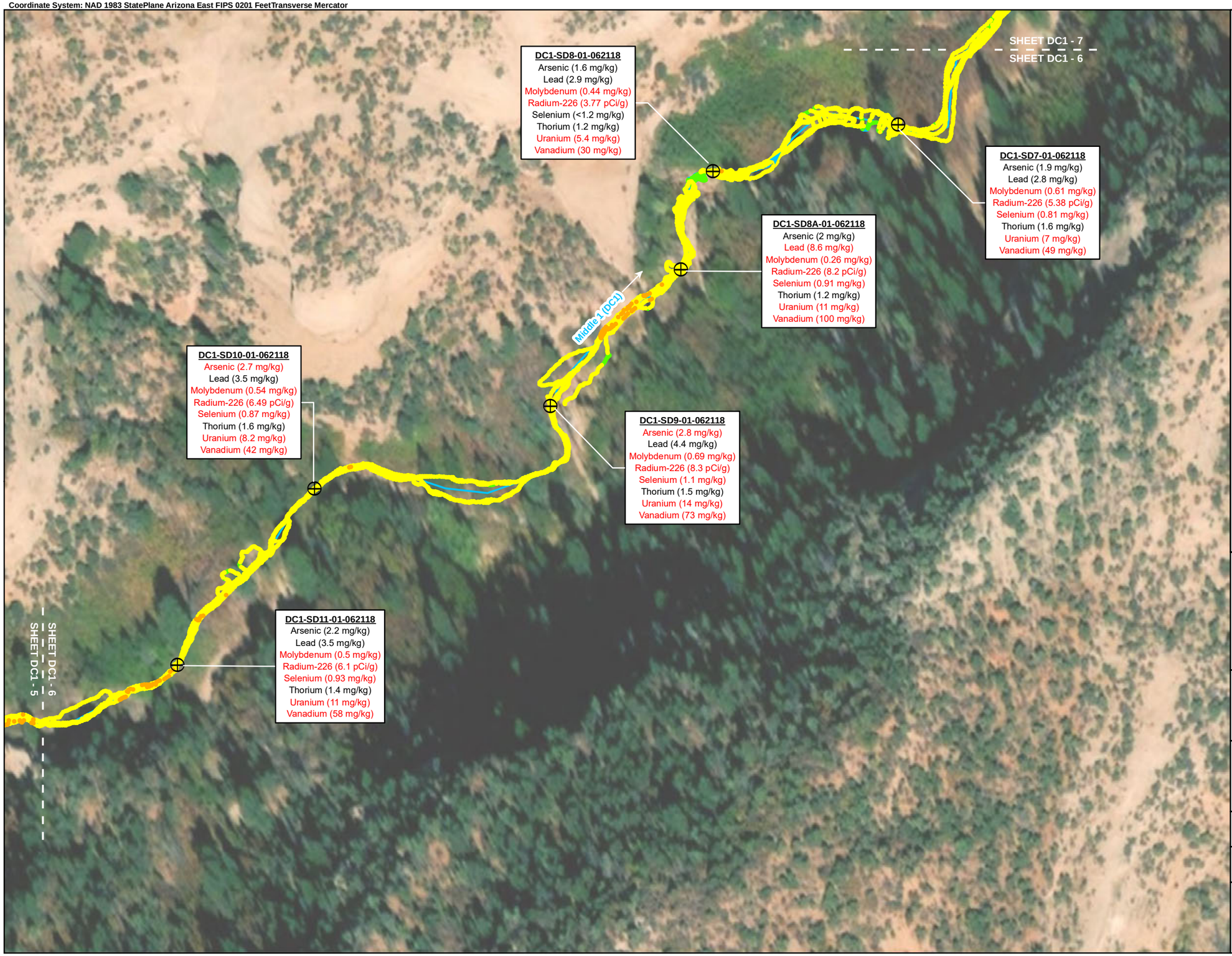
TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 7/12/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DC1 - 5**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte. '<' indicates less than limit of detection laboratory non-detect.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

1 in = 125 ft

1:1,500

N W E S

0 62.5 125 250 Feet

COVE WASH MIDDLE 1 DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

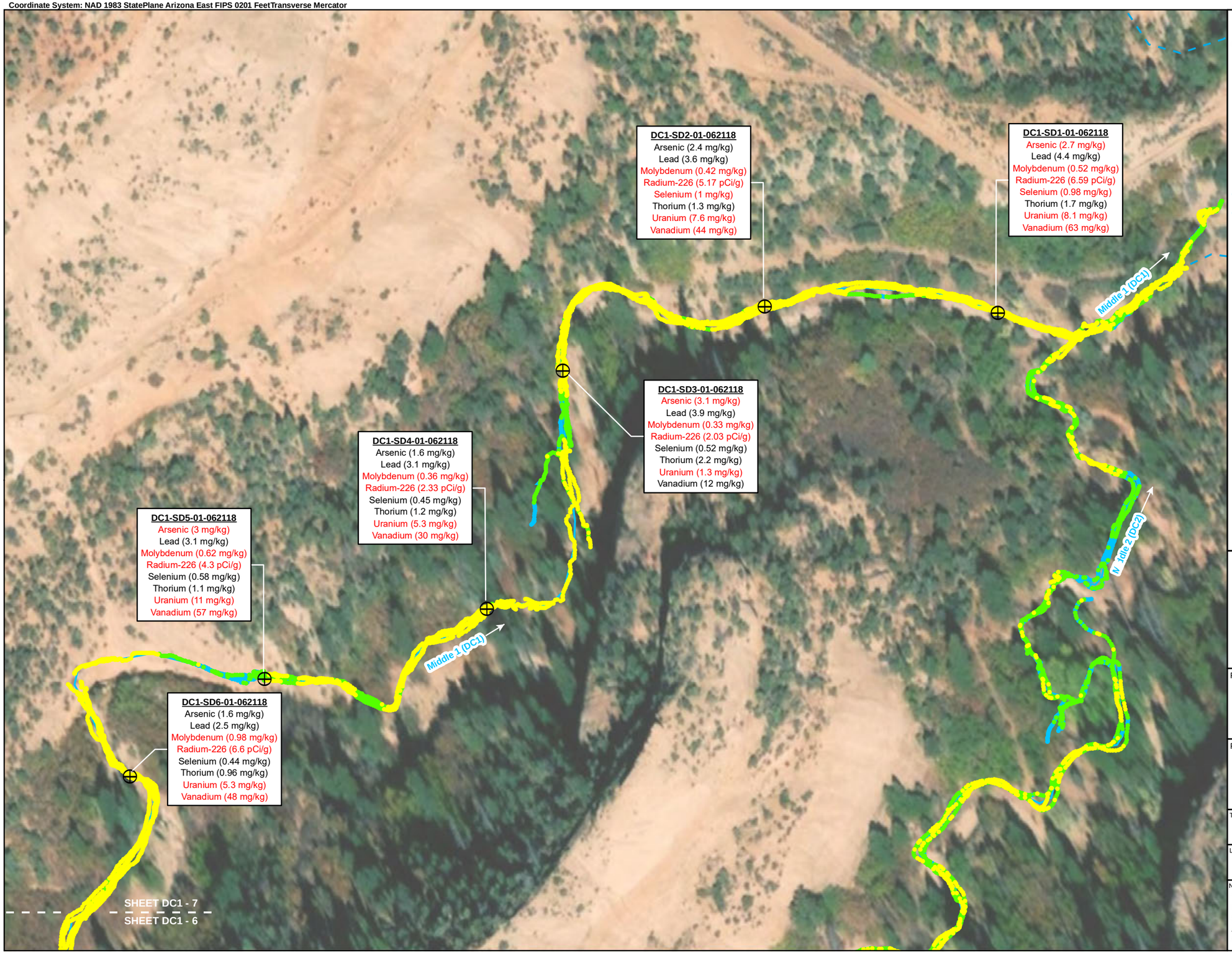
TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 5/6/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DC1 - 6**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

Drainage[3]

Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte. '<' indicates less than limit of detection laboratory non-detect.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

1 in = 125 ft

1:1,500

N W E S

0 62.5 125 250 Feet

COVE WASH MIDDLE 1 DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

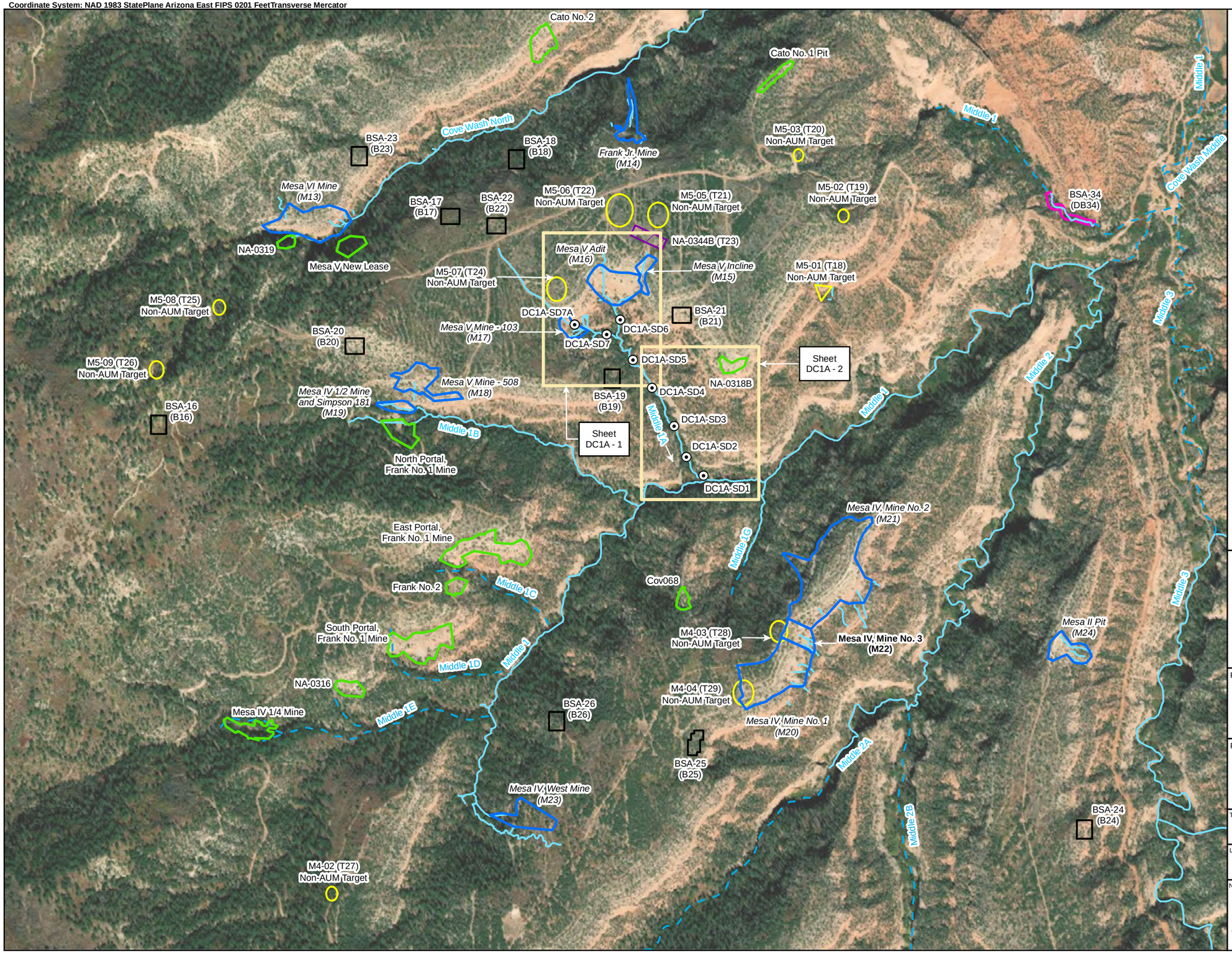
TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	Date: 5/6/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DC1 - 7**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



- Sediment Sample Locations
- Survey Index Sheet
- AUM Site Boundary
- Non-AUM Target Site Boundary
- AUM Related Site Boundary
- Drainage Background Location
- Background Location
- Non-Tronox AUM Site
- Drainage*
- Drainage - Field Mapped

1 in = 1,000 ft

1:12,000

N W E S

0 500 1,000 2,000 Feet

COVE WASH MIDDLE 1A DRAINAGE SURVEY INDEX MAP

Prepared For:

Prepared By:

1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	Date: 7/11/2019

Note:
*U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DC1A - I**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

Burial Cell 344B-2
Mesa V Incline (M15)
Portal 96
Waste Pile M16B
Portal 94
Burial Cell 93
Prospect 93
Portal 93
Prospect 92
Waste Pile M16A
Burial Cell 92
Mesa V Adit (M16)
Burial Cell 91
Portal 91
Haul Shaft Road
Waterfall
SHEET DC1A - 2
SHEET DC1A - 1
Mesa V Mine - 103 (M17)
Portal 88a Haul Shaft
Waste Pile M17
Prospect 90a
Portal 90
Vertical Opening 88
Prospect 88b
Portal 88c
Portal 89
Non-AUM Target

DC1A-SD6-01-062018
Arsenic (7.5 mg/kg)
Lead (5.6 mg/kg)
Molybdenum (2.7 mg/kg)
Radium-226 (31.1 pCi/g)
Selenium (1.2 mg/kg)
Thorium (2.3 mg/kg)
Uranium (24 mg/kg)
Vanadium (180 mg/kg)

DC1A-SD7-01-062018
Arsenic (2.5 mg/kg)
Lead (4.7 mg/kg)
Molybdenum (1 mg/kg)
Radium-226 (8.9 pCi/g)
Selenium (1.3 mg/kg)
Thorium (1.8 mg/kg)
Uranium (26 mg/kg)
Vanadium (59 mg/kg)

DC1A-SD5-01-062018
Arsenic (3.9 mg/kg)
Lead (4.6 mg/kg)
Molybdenum (2.2 mg/kg)
Radium-226 (37.4 pCi/g)
Selenium (2.8 mg/kg)
Thorium (1.7 mg/kg)
Uranium (26 mg/kg)
Vanadium (160 mg/kg)

DC1A-SD7A-01-062018
Arsenic (5.3 mg/kg)
Lead (8 mg/kg)
Molybdenum (3.7 mg/kg)
Radium-226 (72 pCi/g)
Selenium (6.5 mg/kg)
Thorium (2.2 mg/kg)
Uranium (150 mg/kg)
Vanadium (360 mg/kg)

Sediment Sample Location*

Gamma Reading (cpm)**

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

AUM Site Boundary
Survey Area Boundary
Non-AUM Target Site Boundary
Closed Portal
Closed Prospect
Open Portal
Burial Cell
Waste Pile - Unreclaimed
Drainage - Field Mapped
Drainage - Estimated Path

Note:
*Red font indicates sample COPC concentration above BTV value for the relevant analyte.

1 in = 125 ft

1:1,500

0 62.5 125 250 Feet

N E S W

COVE WASH MIDDLE 1A DRAINAGE GAMMA SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	Date: 6/11/2019

Note:
*The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

Figure No.: **DC1A - 1**

S:\EPA_RAES-NAVAJO NATION_103G5440\TASK ORDERS\TO-001_NORTHERN AGENCY RSE\WORKING FILES\GIS\MXD\TO01\FINAL_REPORT\DRAINAGE\SED\DC1A (MIDDLE 1A)\DC1A_DRAINAGE_SAMPLES.MXD 06/11/19

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

NA-0318B
Portal 97b
Portal 97a
Drainage Path
Drainage Path
Haul Shaft Road
Middle 1 (DC1)
Middle 1A (DC1A)
Middle 1 (DC1)
Waterfall
Horseshoe Cut In
SHEET DC1A - 2
SHEET DC1A - 1

DC1A-SD1-01-062018
Arsenic (3.1 mg/kg)
Lead (3.6 mg/kg)
Molybdenum (0.89 mg/kg)
Radium-226 (5.26 pCi/g)
Selenium (0.57 mg/kg)
Thorium (1.5 mg/kg)
Uranium (6.9 mg/kg)
Vanadium (52 mg/kg)

DC1A-SD2-01-062018
Arsenic (4.1 mg/kg)
Lead (4 mg/kg)
Molybdenum (1.1 mg/kg)
Radium-226 (18.4 pCi/g)
Selenium (0.66 mg/kg)
Thorium (1.7 mg/kg)
Uranium (43 mg/kg)
Vanadium (73 mg/kg)

DC1A-SD3-01-062018
Arsenic (7.1 mg/kg)
Lead (6.2 mg/kg)
Molybdenum (1.7 mg/kg)
Radium-226 (17.4 pCi/g)
Selenium (1.4 mg/kg)
Thorium (2.4 mg/kg)
Uranium (14 mg/kg)
Vanadium (79 mg/kg)

DC1A-SD4-01-062018
Arsenic (6 mg/kg)
Lead (5 mg/kg)
Molybdenum (1.6 mg/kg)
Radium-226 (9.2 pCi/g)
Selenium (0.72 mg/kg)
Thorium (2 mg/kg)
Uranium (11 mg/kg)
Vanadium (330 mg/kg)

Sediment Sample Location*

Gamma Reading (cpm)**

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

Non-Tronox AUM Site
Closed Portal
Closed Prospect
Waste Pile - Unreclaimed
Drainage - Field Mapped
Drainage - Estimated Path

Note:
*Red font indicates sample COPC concentration above BTV value for the relevant analyte.

1 in = 125 ft

1:1,500

0 62.5 125 250 Feet

N E S W

COVE WASH MIDDLE 1A DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

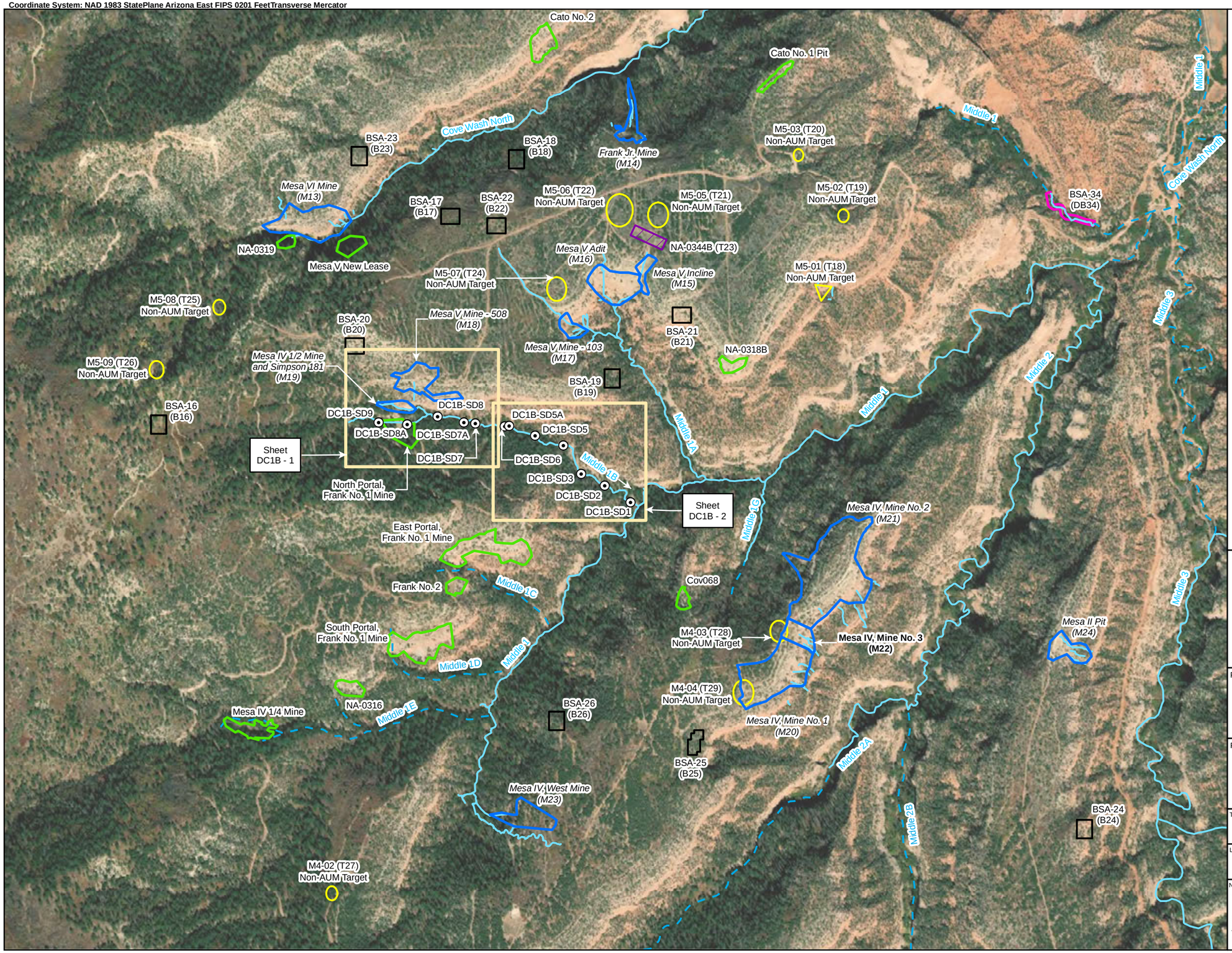
TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 5/6/2019

Note:
*The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

Figure No.:
DC1A - 2

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



- Sediment Sample Locations
- Survey Index Sheet
- AUM Site Boundary
- Non-AUM Target Site Boundary
- AUM Related Site Boundary
- Drainage Background Location
- Background Location
- Non-Tronox AUM Site
- Drainage*
- Drainage - Field Mapped

1 in = 1,000 ft

1:12,000

N W E S

0 500 1,000 2,000 Feet

COVE WASH MIDDLE 1B DRAINAGE SURVEY INDEX MAP

Prepared For:

Prepared By:

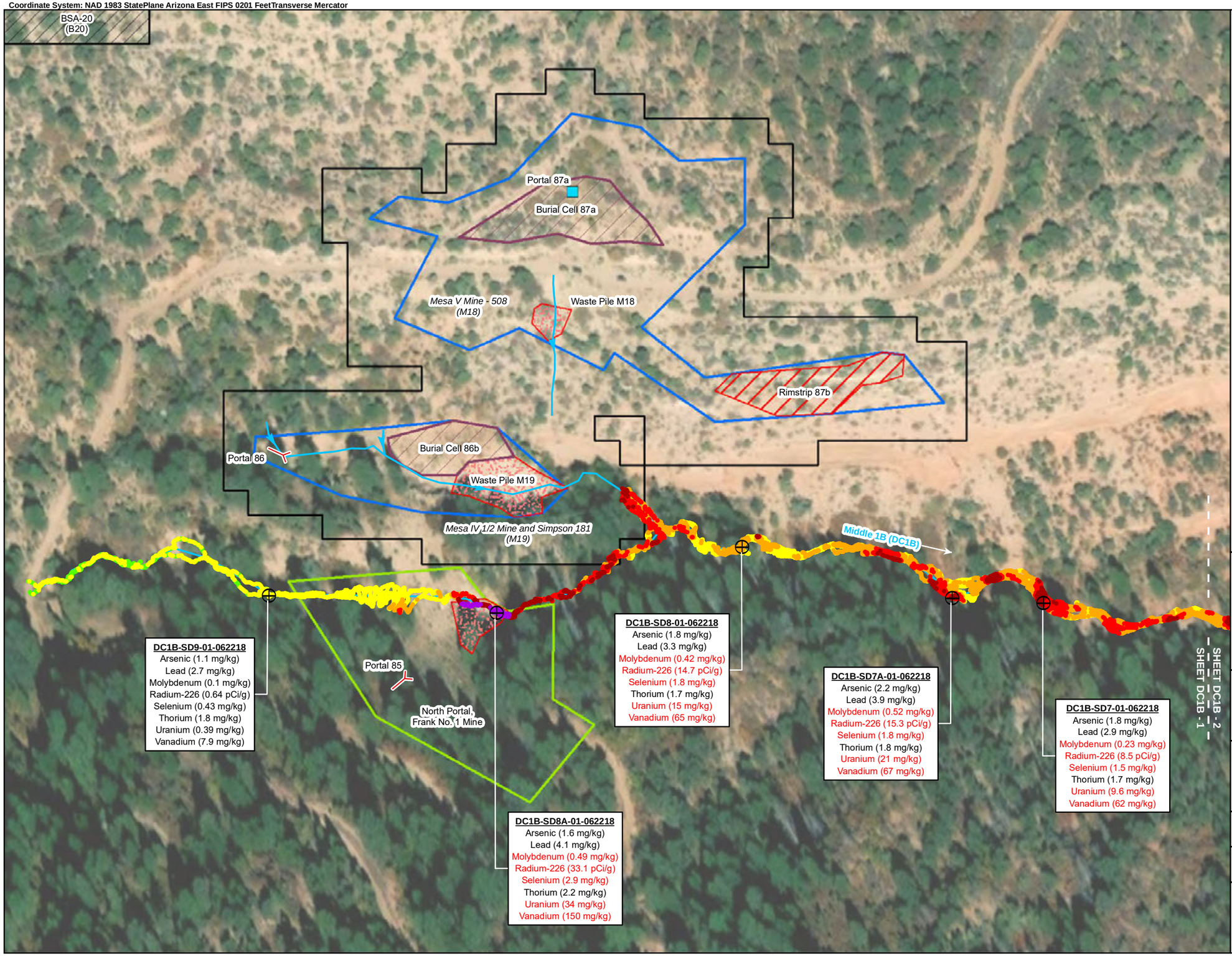
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 7/8/2019

Note:
*U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DC1B - I**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



Sediment Sample Location*

Gamma Reading (cpm)**

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

- AUM Site Boundary
- Survey Area Boundary
- Non-Tronox AUM Site
- Background Location
- Closed Portal
- Closed Prospect
- Open Portal
- Burial Cell
- Rimstrip - Unreclaimed
- Waste Pile - Unreclaimed
- Drainage - Field Mapped

Note:
*Red font indicates sample COPC concentration above BTV value for the relevant analyte.

1 in = 125 ft

1:1,500

N W E S

0 62.5 125 250 Feet

COVE WASH MIDDLE 1B DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

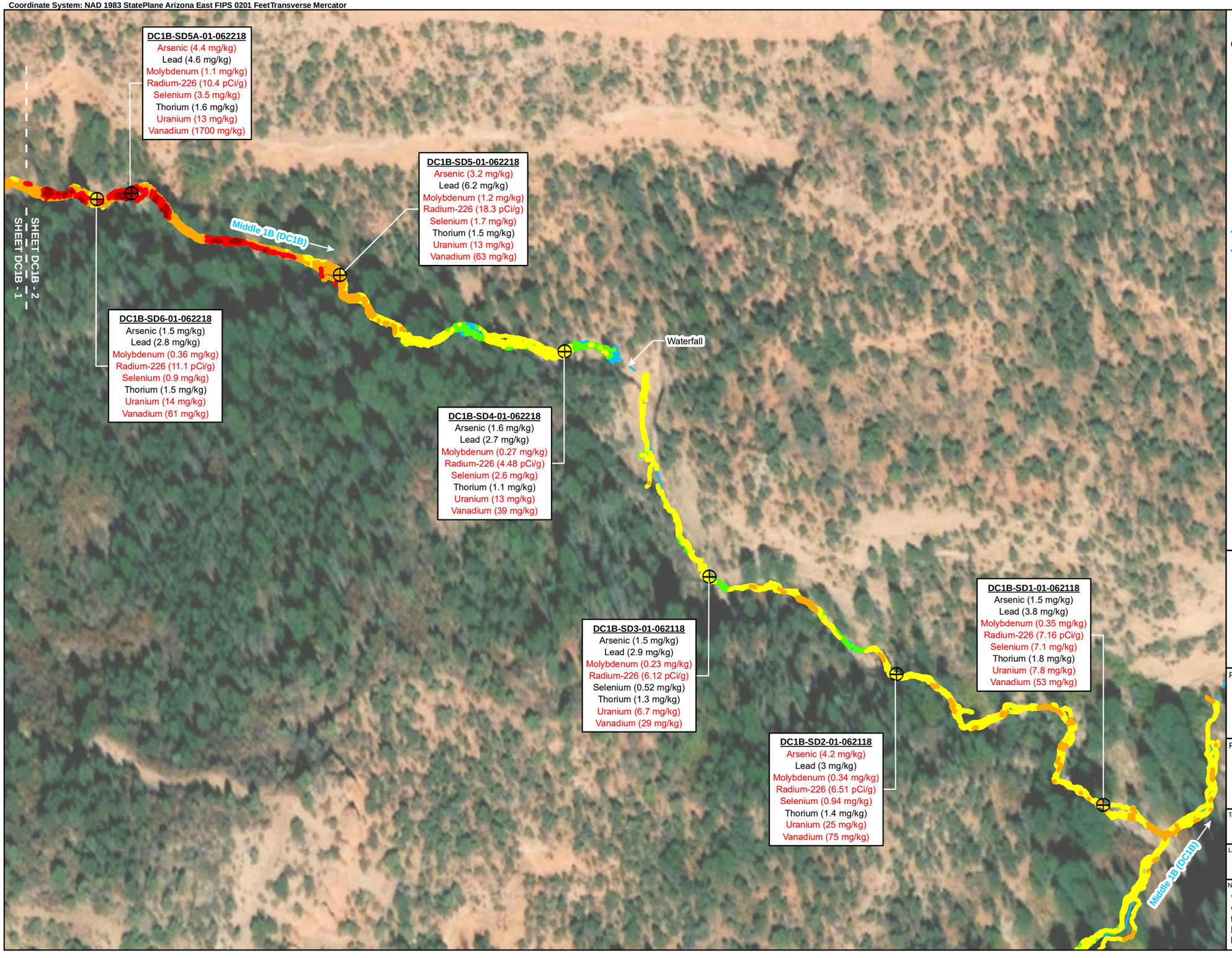
TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 5/6/2019

Note:
*The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

Figure No.: **DC1B - 1**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



Sediment Sample Location*

Gamma Reading (cpm)**

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

Closed Portal

Closed Prospect

Drainage - Field Mapped

Drainage - Estimated Path

Note:
*Red font indicates sample COPC concentration above BTV value for the relevant analyte.

1 in = 125 ft

1:1,500

N W E S

0 62.5 125 250 Feet

COVE WASH MIDDLE 1B DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 5/6/2019

Note:
*The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

Figure No.: **DC1B - 2**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

Cato No. 2
Cato No. 1 Pit
Cove Wash North
BSA-23 (B23)
BSA-18 (B18)
Frank Jr. Mine (M14)
M5-03 (T20) Non-AUM Target
Middle 1
Mesa VI Mine (M13)
BSA-17 (B17)
BSA-22 (B22)
M5-06 (T22) Non-AUM Target
M5-05 (T21) Non-AUM Target
M5-02 (T19) Non-AUM Target
BSA-34 (DB34)
NA-0319
Mesa V New Lease
NA-0344B (T23)
Mesa V Adit (M16)
Mesa V Incline (M15)
M5-07 (T24) Non-AUM Target
M5-01 (T18) Non-AUM Target
M5-08 (T25) Non-AUM Target
Middle 3
Mesa V Mine - 103 (M17)
BSA-21 (B21)
BSA-20 (B20)
NA-0318B
Mesa V Mine - 508 (M18)
Middle 2
M5-09 (T26) Non-AUM Target
BSA-19 (B19)
Sheet DC1G - 1
Mesa IV 1/2 Mine and Simpson 181 (M19)
Middle 1
BSA-16 (B16)
Middle 1A
Middle 1B
North Portal, Frank No. 1 Mine
DC1G-SD1
Mesa IV, Mine No. 2 (M21)
East Portal, Frank No. 1 Mine
DC1G-SD2
Middle 1G
DC1G-SD3
Cov068
Middle 1C
Frank No. 2
Middle 3
M4-03 (T28) Non-AUM Target
Mesa IV, Mine No. 3 (M22)
Mesa II Pit (M24)
South Portal, Frank No. 1 Mine
Middle 1D
Middle 1
NA-0316
M4-04 (T29) Non-AUM Target
Middle 1E
Mesa IV 1/4 Mine
BSA-26 (B26)
Mesa IV, Mine No. 1 (M20)
BSA-25 (B25)
Middle 2A
Mesa IV, West Mine (M23)
Middle 2B
BSA-24 (B24)
M4-02 (T27) Non-AUM Target

- Sediment Sample Locations
- Survey Index Sheet
- AUM Site Boundary
- Non-AUM Target Site Boundary
- AUM Related Site Boundary
- Drainage Background Location
- Background Location
- Non-Tronox AUM Site
- Drainage*
- Drainage - Field Mapped

1 in = 1,000 ft

1:12,000

N W E S

0 500 1,000 2,000 Feet

COVE WASH MIDDLE 1G DRAINAGE SURVEY INDEX MAP

Prepared For:

Prepared By:

1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	Date: 7/8/2019

Note:
*U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navajo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DC1G - I**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

- AUM Site Boundary
- Survey Area Boundary
- Closed Portal
- Closed Prospect
- Waste Pile - Unreclaimed
- Drainage[3]
- Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

1 in = 125 ft

1:1,500

0 62.5 125 250 Feet

N E S W

COVE WASH MIDDLE 1G DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.: TO0001	Contract No.: EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	Date: 5/6/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DC1G - 1**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

Sheet DT9 - 4

Sheet DT9 - 3

Sheet DT9 - 2

Sheet DT9 - 1

DT9-SD1
DT9-SD2
DT9-SD3
DT9-SD4
DT9-SD5
DT9-SD6
DT9-SD7
DT9-SD8
DT9-SD9
DT9-SD10
DT9-SD11
DT9-SD12
DT9-SD13
DT9-SD14
DT9-SD15
DT9-SD16
DT9-SD17
DT9-SD18
DT9-SD19
DT9-SD20
DT9-SD21

Cove Wash North
Cove Wash Middle
Cove Wash South
Middle 1

BSA-7 (B7)
BSA-6 (B6)

CT-01 (T10) Non-AUM Target
CT-02 (T11) Non-AUM Target
CT-03 (T12) Non-AUM Target

Cove Transfer Station (T9)
Cove Transfer Station South (T37)

- Sediment Sample Locations
- Survey Index Sheet
- Non-AUM Target Site Boundary
- AUM Related Site Boundary
- Background Location
- Drainage*
- Drainage - Field Mapped

1 in = 1,000 ft

1:12,000

N W E S

0 500 1,000 2,000 Feet

COVE WASH MIDDLE DRAINAGE SURVEY INDEX MAP

Prepared For:

Prepared By:

1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	Date: 7/8/2019

Note:
*U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DT9 - I**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

Drainage[3]

Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte. '<' indicates less than limit of detection laboratory non-detect.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

1 in = 125 ft

1:1,500

0 62.5 125 250 Feet

N E S W

COVE WASH MIDDLE DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 7/12/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DT9 - 1**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

DT9-SD14-01-062418
Arsenic (1.1 mg/kg)
Lead (2.6 mg/kg)
Molybdenum (0.096 mg/kg)
Radium-226 (1.89 pCi/g)
Selenium (0.34 mg/kg)
Thorium (1.3 mg/kg)
Uranium (2.4 mg/kg)
Vanadium (11 mg/kg)

DT9-SD15-01-062418
Arsenic (1.3 mg/kg)
Lead (3.4 mg/kg)
Molybdenum (0.1 mg/kg)
Radium-226 (2.25 pCi/g)
Selenium (0.52 mg/kg)
Thorium (1.7 mg/kg)
Uranium (3.2 mg/kg)
Vanadium (22 mg/kg)

DT9-SD10-01-062418
Arsenic (2.6 mg/kg)
Lead (4.5 mg/kg)
Molybdenum (0.31 mg/kg)
Radium-226 (5.42 pCi/g)
Selenium (0.8 mg/kg)
Thorium (2 mg/kg)
Uranium (7.7 mg/kg)
Vanadium (34 mg/kg)

Cove Wash Middle (DT9)

DT9-SD16-01-062418
Arsenic (2.4 mg/kg)
Lead (5.1 mg/kg)
Molybdenum (0.2 mg/kg)
Radium-226 (4.61 pCi/g)
Selenium (0.71 mg/kg)
Thorium (2.5 mg/kg)
Uranium (5.7 mg/kg)
Vanadium (23 mg/kg)

DT9-SD12-01-062418
Arsenic (5.7 mg/kg)
Lead (11 mg/kg)
Molybdenum (0.73 mg/kg)
Radium-226 (10.9 pCi/g)
Selenium (2.3 mg/kg)
Thorium (4.5 mg/kg)
Uranium (27 mg/kg)
Vanadium (100 mg/kg)

DT9-SD13-01-062418
Arsenic (1.8 mg/kg)
Lead (3.7 mg/kg)
Molybdenum (0.096 mg/kg)
Radium-226 (2.48 pCi/g)
Selenium (0.42 mg/kg)
Thorium (1.6 mg/kg)
Uranium (1.1 mg/kg)
Vanadium (8.4 mg/kg)

DT9-SD11-01-062418
Arsenic (1.3 mg/kg)
Lead (3.1 mg/kg)
Molybdenum (0.066 mg/kg)
Radium-226 (2.14 pCi/g)
Selenium (0.39 mg/kg)
Thorium (1.6 mg/kg)
Uranium (3 mg/kg)
Vanadium (12 mg/kg)

SHEET DT9 - 2
SHEET DT9 - 3
SHEET DT9 - 1
SHEET DT9 - 2

Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte. '<' indicates less than limit of detection laboratory non-detect.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

1 in = 125 ft

1:1,500

0 62.5 125 250 Feet

N E S W

COVE WASH MIDDLE DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 7/12/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DT9 - 2**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

DT9-SD4-01-062418
Arsenic (1.5 mg/kg)
Lead (3.3 mg/kg)
Molybdenum (0.12 mg/kg)
Radium-226 (1.96 pCi/g)
Selenium (0.47 mg/kg)
Thorium (1.7 mg/kg)
Uranium (2.6 mg/kg)
Vanadium (15 mg/kg)

DT9-SD6-01-062418
Arsenic (1.9 mg/kg)
Lead (5.5 mg/kg)
Molybdenum (0.16 mg/kg)
Radium-226 (2.97 pCi/g)
Selenium (0.44 mg/kg)
Thorium (1.9 mg/kg)
Uranium (1.1 mg/kg)
Vanadium (15 mg/kg)

DT9-SD5-01-062418
Arsenic (1.6 mg/kg)
Lead (3 mg/kg)
Molybdenum (0.12 mg/kg)
Radium-226 (2.1 pCi/g)
Selenium (0.4 mg/kg)
Thorium (2.5 mg/kg)
Uranium (2.2 mg/kg)
Vanadium (12 mg/kg)

DT9-SD7-01-062418
Arsenic (0.99 mg/kg)
Lead (2.8 mg/kg)
Molybdenum (0.11 mg/kg)
Radium-226 (1.41 pCi/g)
Selenium (<0.96 mg/kg)
Thorium (4.6 mg/kg)
Uranium (1.3 mg/kg)
Vanadium (9.3 mg/kg)

DT9-SD8-01-062418
Arsenic (3.8 mg/kg)
Lead (5.1 mg/kg)
Molybdenum (0.26 mg/kg)
Radium-226 (2.73 pCi/g)
Selenium (0.69 mg/kg)
Thorium (2.4 mg/kg)
Uranium (3.9 mg/kg)
Vanadium (19 mg/kg)

DT9-SD9-01-062418
Arsenic (1.1 mg/kg)
Lead (2.7 mg/kg)
Molybdenum (0.13 mg/kg)
Radium-226 (1.77 pCi/g)
Selenium (0.32 mg/kg)
Thorium (1.2 mg/kg)
Uranium (1.9 mg/kg)
Vanadium (13 mg/kg)

Cove Wash Middle (DT9)

SHEET DT9 - 3
SHEET DT9 - 4
SHEET DT9 - 2
SHEET DT9 - 3

Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte. '<' indicates less than limit of detection laboratory non-detect.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

1 in = 125 ft

1:1,500

0 62.5 125 250 Feet

N E S W

COVE WASH MIDDLE DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By: TETRA TECH

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	Date: 7/12/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DT9 - 3**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

Drainage[3]

Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte. '<' indicates less than limit of detection laboratory non-detect.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

1 in = 125 ft

1:1,500

0 62.5 125 250 Feet

N E S W

COVE WASH MIDDLE DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 7/12/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DT9 - 4**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

Cato No. 1 Pit
Cove Wash North
Frank Jr. Mine (M14)
BSA-18 (B18)
M5-03 (T20) Non-AUM Target
Middle 1
Middle 1
Cove Wash North
M5-06 (T22) Non-AUM Target
M5-05 (T21) Non-AUM Target
BSA-17 (B17)
BSA-22 (B22)
BSA-34 (DB34)
M5-02 (T19) Non-AUM Target
NA-0344B (T23)
Sheet DC2 - 4
M5-07 (T24) Non-AUM Target
Mesa V Incline (M15)
DC2-SD1
DC2-SD2
DC2-SD3
DC2-SD4
Mesa V Adit (M16)
M5-01 (T18) Non-AUM Target
Mesa IV 1/2 Mine and Simpson 181 (M19)
BSA-21 (B21)
Mesa V Mine - 103 (M17)
DC2-SD5
DC2-SD6
DC2-SD7
DC2-SD8
DC2-SD9
Mesa V Mine - 508 (M18)
NA-0318B
BSA-19 (B19)
Middle 3
Sheet DC2 - 3
Middle 1A
Middle 1
Middle 1B
Frank No. 2
DC2-SD10
DC2-SD11
DC2-SD12
DC2-SD13
Middle 2
Mesa IV Mine No. 2 (M21)
Sheet DC2 - 2
East Portal, Frank No. 1 Mine
Middle 1C
Middle 3C
Cov068
Mesa IV Mine No. 3 (M22)
DC2-SD14
DC2-SD15
M21-SD2
DC2-SD16
M21-SD1
Middle 3C
BSA-35 (DB35)
Frank No. 2
Middle 1C
Mesa II Pit (M24)
DC2-SD17
DC2-SD18
Middle 3
M4-03 (T28) Non-AUM Target
South Portal, Frank No. 1 Mine
Middle 1
Middle 1D
Middle 3G
M4-04 (T29) Non-AUM Target
Middle 1E
BSA-26 (B26)
Mesa IV Mine No. 1 (M20)
Sheet DC2 - 1
Middle 3F
Middle 3G
BSA-9 (B9)
BSA-25 (B25)
Middle 2A
Mesa IV West Mine (M23)
Mesa I Mine 15 (M8)
BSA-24 (B24)
Mesa I Mine 11 (M4)
M1-01 (T13) Non-AUM Target
BSA-10 (B10)
Mesa I Mine 10 (M3)
Middle 2B
Mesa I Camp (T17)
Mesa I Mine 13 (M6)
Mesa I Mine 12 (M5)
M1-03 (T15) Non-AUM Target
Middle 2B
Middle 2C
M1-04 (T16) Non-AUM Target
Mesa I Mine 14 (M7)

- Sediment Sample Locations
- AUM Site Boundary
- Non-AUM Target Site Boundary
- AUM Related Site Boundary
- Drainage Background Location
- Background Location
- Non-Tronox AUM Site
- Drainage*
- Drainage - Field Mapped

1 in = 1,000 ft

1:12,000

N W E S

0 500 1,000 2,000 Feet

COVE WASH MIDDLE 2 DRAINAGE SURVEY INDEX MAP

Prepared For:

Prepared By:

1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 7/9/2019

Note:
*U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DC2 - I**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

Portal 64
Burial Cell 63
Portal 63
Waste Pile M21F
Waste Pile M21A
Waste P e M21B

M21-SD2-01-091218
Arsenic (4.1 mg/kg)
Lead (8 mg/kg)
Molybdenum (1.3 mg/kg)
Radium-226 (42.5 pCi/g)
Selenium (2.6 mg/kg)
Thorium (1.7 mg/kg)
Uranium (89 mg/kg)
Vanadium (180 mg/kg)

M21-SD1-01-091218
Arsenic (2.9 mg/kg)
Lead (6.4 mg/kg)
Molybdenum (0.56 mg/kg)
Radium-226 (49.8 pCi/g)
Selenium (2.2 mg/kg)
Thorium (1.8 mg/kg)
Uranium (89 mg/kg)
Vanadium (230 mg/kg)

Drains From Mesa IV Mine No. 2

Middle 2 (DC2)

SHEET DC2 - 2
SHEET DC2 - 1

DC2-SD14-01-062118
Arsenic (1.4 mg/kg)
Lead (2.5 mg/kg)
Molybdenum (0.28 mg/kg)
Radium-226 (3.22 pCi/g)
Selenium (0.45 mg/kg)
Thorium (1.2 mg/kg)
Uranium (3.7 mg/kg)
Vanadium (46 mg/kg)

DC2-SD15-01-062118
Arsenic (0.95 mg/kg)
Lead (2.4 mg/kg)
Molybdenum (0.12 mg/kg)
Radium-226 (7.8 pCi/g)
Selenium (0.4 mg/kg)
Thorium (1.1 mg/kg)
Uranium (0.9 mg/kg)
Vanadium (15 mg/kg)

Poor GPS Signal

DC2-SD16-01-062118
Arsenic (2.3 mg/kg)
Lead (2.6 mg/kg)
Molybdenum (0.55 mg/kg)
Radium-226 (6.48 pCi/g)
Selenium (0.34 mg/kg)
Thorium (1.3 mg/kg)
Uranium (3.1 mg/kg)
Vanadium (110 mg/kg)

DC2-SD17-01-062118
Arsenic (0.98 mg/kg)
Lead (2.9 mg/kg)
Molybdenum (0.098 mg/kg)
Radium-226 (0.86 pCi/g)
Selenium (<1.1 mg/kg)
Thorium (1.1 mg/kg)
Uranium (0.91 mg/kg)
Vanadium (3.1 mg/kg)

DC2-SD18-01-062118
Arsenic (1.4 mg/kg)
Lead (2.4 mg/kg)
Molybdenum (0.21 mg/kg)
Radium-226 (8.1 pCi/g)
Selenium (0.37 mg/kg)
Thorium (1.2 mg/kg)
Uranium (2.1 mg/kg)
Vanadium (23 mg/kg)

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte. '<' indicates less than limit of detection laboratory non-detect.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

AUM Site
AUM Survey Area

Site Features
Closed Portal
Burial Cell
Waste Pile - Unreclaimed
Drainage - Estimated Path
Drainage - Field Mapped

1 in = 125 ft
1:1,500
N W E S
0 62.5 125 250 Feet

COVE WASH MIDDLE 2 DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

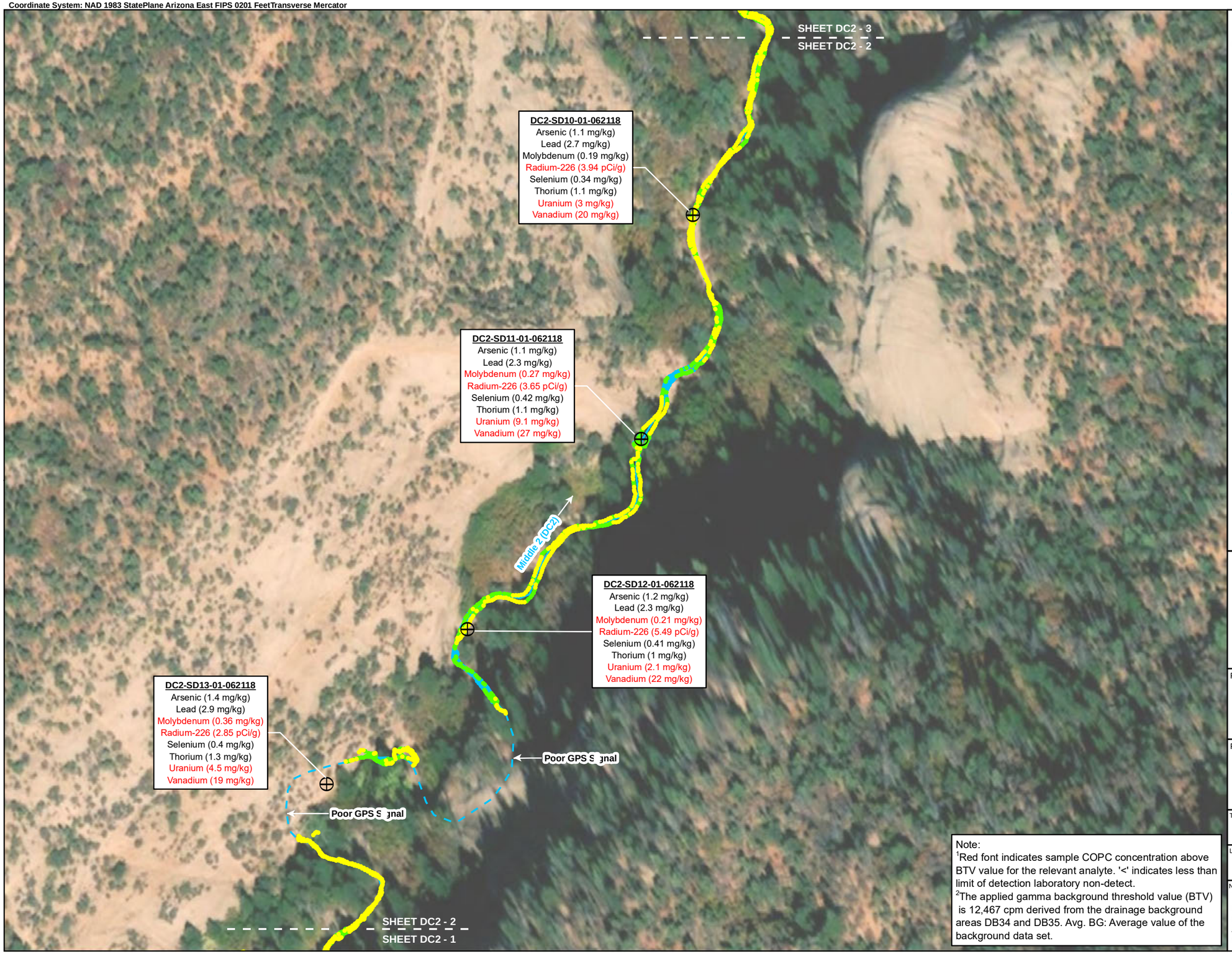
Prepared By:
TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	Date: 7/9/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DC2 - 1**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

Drainage - Estimated Path

Drainage - Field Mapped

1 in = 125 ft

1:1,500

N

W E

S

0 62.5 125 250 Feet

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte. '<' indicates less than limit of detection laboratory non-detect.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

COVE WASH MIDDLE 2 DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

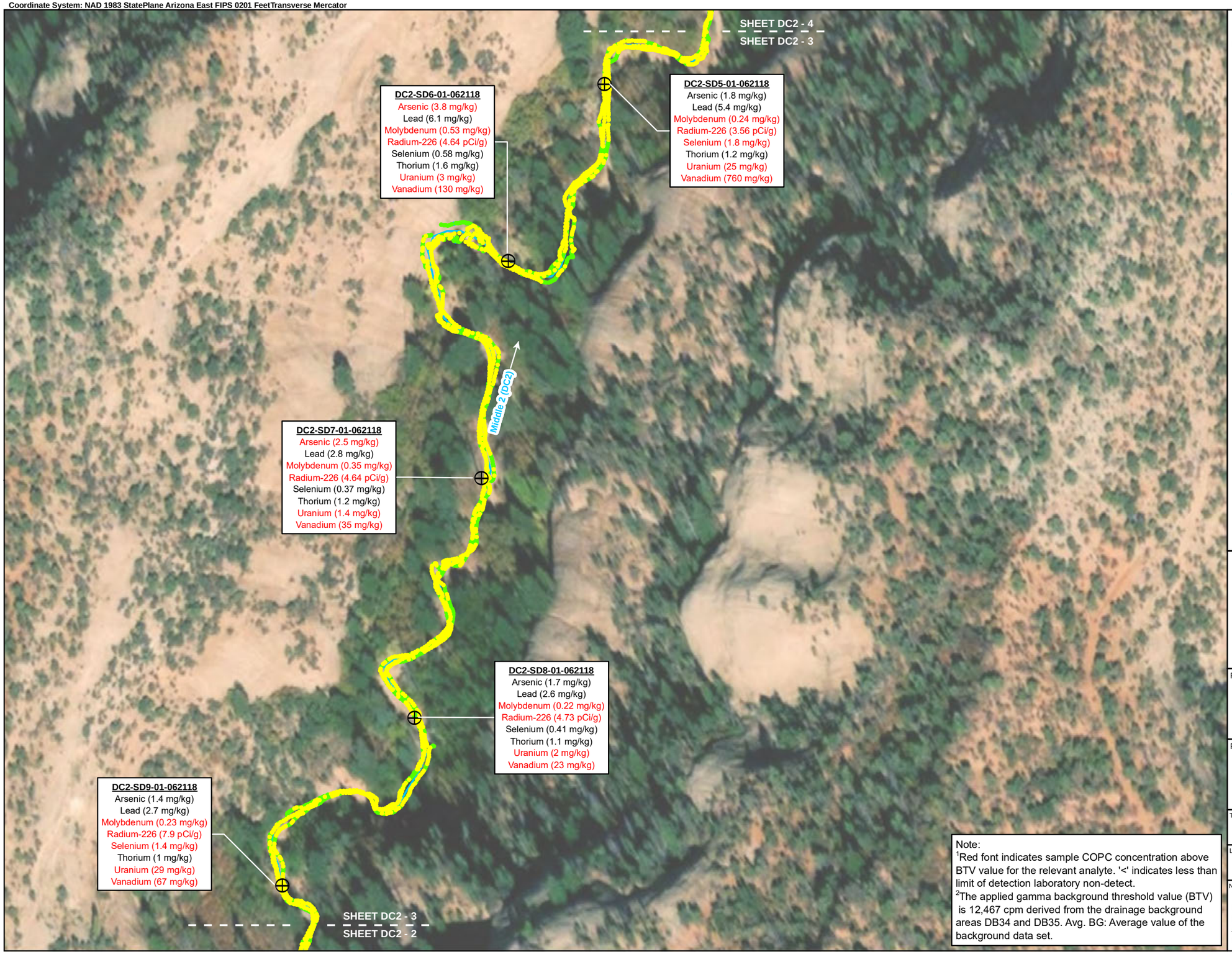
TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 7/9/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DC2 - 2**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

Drainage - Field Mapped

1 in = 125 ft

1:1,500

N W E S

0 62.5 125 250 Feet

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte. '<' indicates less than limit of detection laboratory non-detect.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

COVE WASH MIDDLE 2 DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

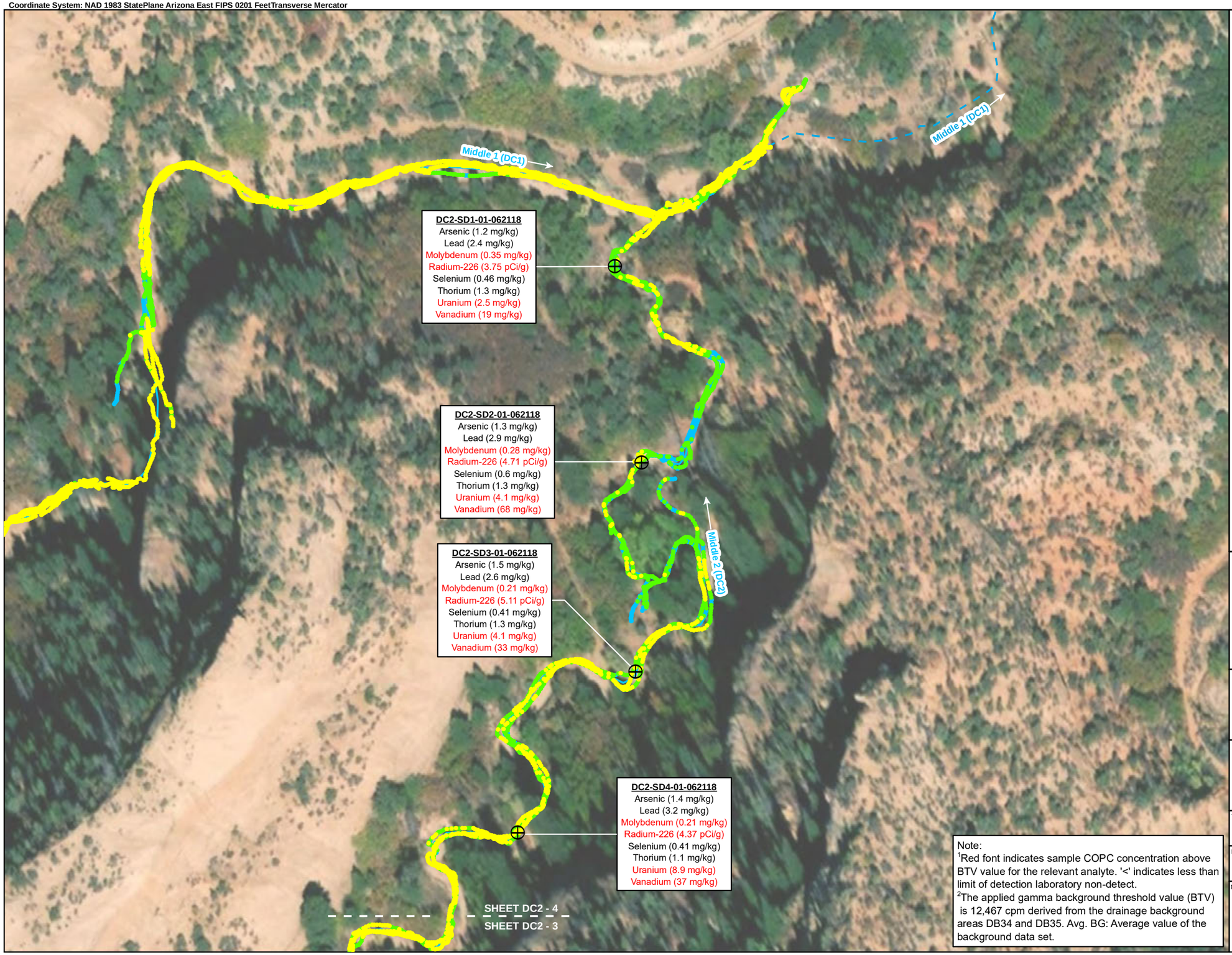
TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	Date: 7/9/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DC2 - 3**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

Drainage[3]

Drainage - Field Mapped

1 in = 125 ft

1:1,500

N W E S

0 62.5 125 250 Feet

COVE WASH MIDDLE 2 DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	Date: 7/9/2019

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte. '<' indicates less than limit of detection laboratory non-detect.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DC2 - 4**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

- Sediment Sample Locations
- AUM Site Boundary
- Non-AUM Target Site Boundary
- AUM Related Site Boundary
- Drainage Background Location
- Background Location
- Non-Tronox AUM Site
- Drainage*
- Drainage - Field Mapped

1 in = 1,000 ft

1:12,000

N W E S

0 500 1,000 2,000 Feet

COVE WASH MIDDLE 2A DRAINAGE SURVEY INDEX MAP

Prepared For:

Prepared By:

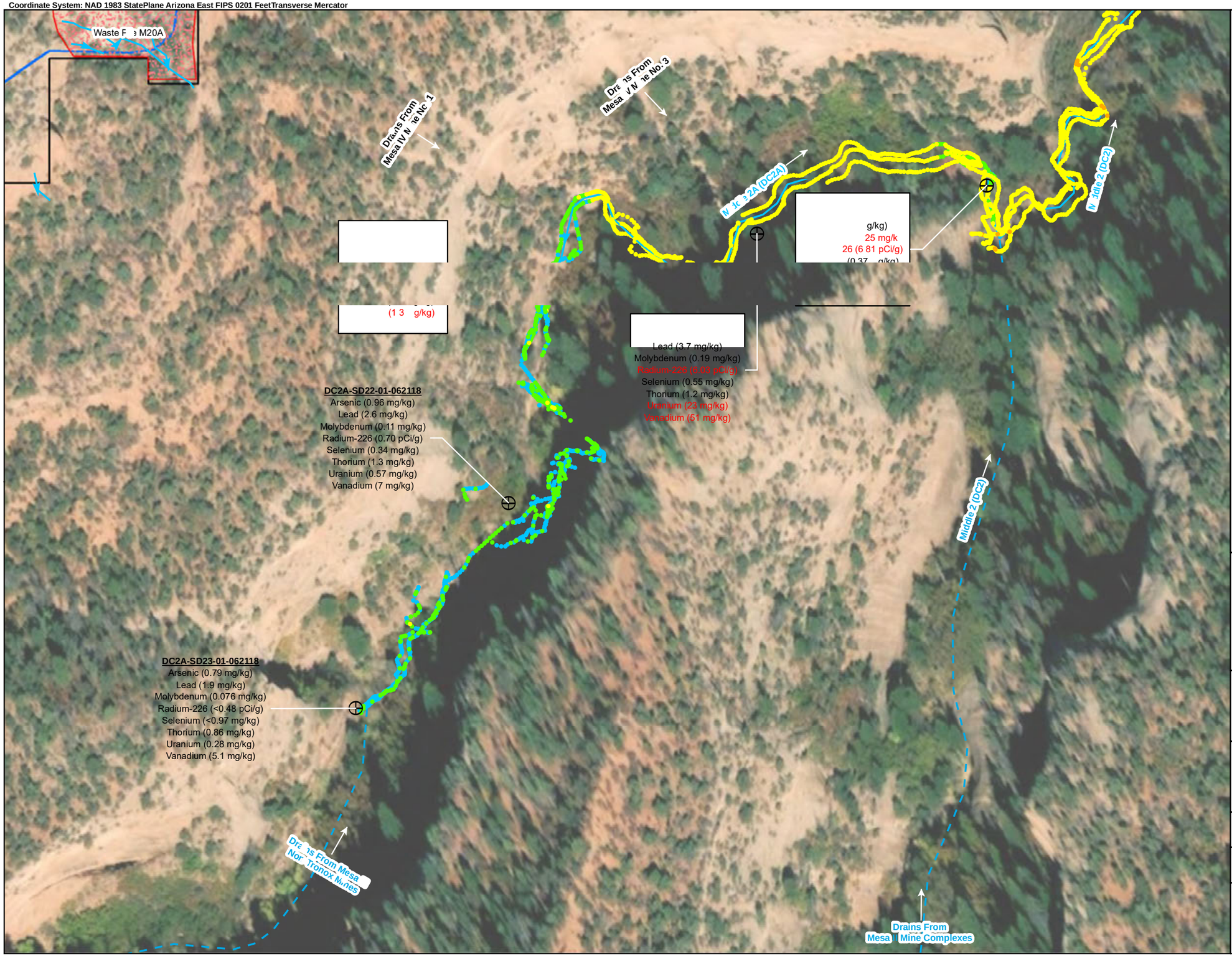
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 7/9/2019

Note:
*U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DC2A - I**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

AUM Site

AUM Survey Area

Waste Pile - Unreclaimed

Drainage[3]

Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte. '<' indicates less than limit of detection laboratory non-detect.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

1 in = 125 ft

1:1,500

N W E S

0 62.5 125 250 Feet

COVE WASH MIDDLE 2A DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 7/9/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DC2A - 1**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

East Portal, Frank No. 1 Mine
Frank No. 2
South Portal, Frank No. 1 Mine
NA-0316
BSA-26 (B26)
Mesa IV, West Mine (M23)
M4-02 (T27) Non-AUM Target
BSA-27 (B27)
Mesa III, Northwest Mine
Mesa IV, East Side
BSA-31 (B31)
Mesa III Mine (M32)
Mesa III, West Mine
Mesa II 1/2, Mine 4 (M31)
Cov068
M4-03 (T28) Non-AUM Target
M4-04 (T29) Non-AUM Target
Mesa IV, Mine No. 2 (M21)
Mesa IV, Mine No. 3 (M22)
Mesa IV, Mine No. 1 (M20)
BSA-25 (B25)
Mesa II Pit (M24)
BSA-24 (B24)
BSA-9 (B9)
Mesa I Mine 15 (M8)
Mesa I Mine 11 (M4)
BSA-10 (B10)
Mesa I Mine 10 (M3)
Mesa I Camp (T17)
Mesa I Mine 12 (M5)
Mesa I Mine 13 (M6)
BSA-35 (DB35)
M1-04 (T16) Non-AUM Target
M1-03 (T15) Non-AUM Target
Mesa II, Mine 4 (M29)
M1-05 (T35) Non-AUM Target
Mesa I Mine 14 (M7)
M1-06 (T36) Non-AUM Target
BSA-15 (B15)
Henry Phillips Mine (M11)
Mesa I 1/2 Mine (M10)
BSA-14 (B14)
Mesa I 1/2, West Mine (M12)
BSA-29 (B29)
Mesa II, Mine No. 1, P-150 (M28)
Mesa II, Mine No. 1 & 2, P-21 (M27)
Mesa I 3/4, Mine No. 2, P150 (M26)
Mesa II 1/4 Mine
Mesa II 1/2 Mine (M30)
BSA-30 (B30)
M2-01 (T32) Non-AUM Target
DC2B-SD2
DC2B-SD3
DC2B-SD4
DC2B-SD5
DC2B-SD6
DC2B-SD7
DC2B-SD8
DC2B-SD8A
DC2B-SD9
M32-SD1

Sheet DC2B - 2
Sheet DC2B - 1

Middle 1G
Middle 1C
Middle 1D
Middle 1
Middle 1E
Middle 2A
Middle 2
Middle 2B
Middle 2C
Middle 3C
Middle 3F
Middle 3
Middle 3B
Middle 3A
Middle 3D
Middle 3E

- Sediment Sample Locations
- Survey Index Sheet
- AUM Site Boundary
- Non-AUM Target Site Boundary
- AUM Related Site Boundary
- Drainage Background Location
- Background Location
- Non-Tronox AUM Site
- Drainage*
- Drainage - Field Mapped

1 in = 1,000 ft

1:12,000

N W E S

0 500 1,000 2,000 Feet

COVE WASH MIDDLE 2B DRAINAGE SURVEY INDEX MAP

Prepared For:

Prepared By:

1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 7/8/2019

Note:
*U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DC2B - I**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

SHEET DC3C - 2
SHEET DC3C - 1

DC2B-SD9-01-062218
Arsenic (1.7 mg/kg)
Lead (3 mg/kg)
Molybdenum (0.96 mg/kg)
Radium-226 (58.6 pCi/g)
Selenium (0.72 mg/kg)
Thorium (1.5 mg/kg)
Uranium (10 mg/kg)
Vanadium (53 mg/kg)

Middle 2B (DC2B)

DC2B-SD8A-01-062218
Arsenic (2.5 mg/kg)
Lead (3.5 mg/kg)
Molybdenum (1.5 mg/kg)
Radium-226 (26.4 pCi/g)
Selenium (0.78 mg/kg)
Thorium (1.6 mg/kg)
Uranium (14 mg/kg)
Vanadium (47 mg/kg)

DC2B-SD8-01-062218
Arsenic (2.5 mg/kg)
Lead (3.7 mg/kg)
Molybdenum (1.1 mg/kg)
Radium-226 (18 pCi/g)
Selenium (1.6 mg/kg)
Thorium (1.7 mg/kg)
Uranium (69 mg/kg)
Vanadium (60 mg/kg)

M32-SD1-01-092918
Arsenic (5.6 mg/kg)
Lead (5.7 mg/kg)
Molybdenum (4.2 mg/kg)
Radium-226 (84.3 pCi/g)
Selenium (2.3 mg/kg)
Thorium (2.8 mg/kg)
Uranium (100 mg/kg)
Vanadium (260 mg/kg)

Portal 46
Mesa II 1/2 Mine (M30)
Portal 47
Portal 48
Waste Pile M30
Burial Cell 48
Mesa I 1/2, Mine 4 (M31)
Waste Pile M31
Portal 49
Waste Pile M32
Prospect 50
Portal 51
Mesa III Mine (M32)

Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

AUM Site Boundary
Survey Area Boundary
Closed Portal
Closed Prospect
Burial Cell
Mining Infrastructure
Waste Pile - Unreclaimed
Drainage[3]
Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

1 in = 125 ft
1:1,500
0 62.5 125 250 Feet

N E S W

COVE WASH MIDDLE 2B DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:
TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	Date: 6/6/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DC2B - 1**

J:\PROJECTS\EPA_RAES-NAVAJO NATION_103G5440\TASK ORDERS\TO-001_NORTHERN AGENCY RSE\WORKING FILES\GIS\MXD\TO01IFINAL_REPORT\DRAINAGES\DC2B (MIDDLE 2B)\DC2B_DRAINAGE_SAMPLES.MXD 05/27/19

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

DC2B-SD3-01-062218
Arsenic (2.2 mg/kg)
Lead (3.1 mg/kg)
Molybdenum (3.1 mg/kg)
Radium-226 (4.04 pCi/g)
Selenium (0.66 mg/kg)
Thorium (1.4 mg/kg)
Uranium (5.2 mg/kg)
Vanadium (24 mg/kg)

DC2B-SD4-01-062218
Arsenic (1.5 mg/kg)
Lead (2.7 mg/kg)
Molybdenum (0.39 mg/kg)
Radium-226 (8.4 pCi/g)
Selenium (0.52 mg/kg)
Thorium (1.4 mg/kg)
Uranium (5.2 mg/kg)
Vanadium (21 mg/kg)

DC2B-SD2-01-062218
Arsenic (1.5 mg/kg)
Lead (2.8 mg/kg)
Molybdenum (0.39 mg/kg)
Radium-226 (7.74 pCi/g)
Selenium (0.55 mg/kg)
Thorium (1.4 mg/kg)
Uranium (10 mg/kg)
Vanadium (32 mg/kg)

DC2B-SD5-01-062218
Arsenic (2.4 mg/kg)
Lead (3.3 mg/kg)
Molybdenum (2.6 mg/kg)
Radium-226 (10.4 pCi/g)
Selenium (0.83 mg/kg)
Thorium (1.6 mg/kg)
Uranium (23 mg/kg)
Vanadium (56 mg/kg)

DC2B-SD7-01-062218
Arsenic (4.9 mg/kg)
Lead (5.5 mg/kg)
Molybdenum (2.8 mg/kg)
Radium-226 (47.1 pCi/g)
Selenium (2 mg/kg)
Thorium (2.3 mg/kg)
Uranium (80 mg/kg)
Vanadium (140 mg/kg)

DC2B-SD6-01-062218
Arsenic (1.8 mg/kg)
Lead (3 mg/kg)
Molybdenum (0.46 mg/kg)
Radium-226 (17.5 pCi/g)
Selenium (0.84 mg/kg)
Thorium (1.9 mg/kg)
Uranium (14 mg/kg)
Vanadium (66 mg/kg)

Middle 2B (DC2B)

M2-01 (T32)
Non-AUM Target

SHEET DC3C - 2
SHEET DC3C - 1

Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

Survey Area Boundary
Non-AUM Target Site Boundary
Closed Portal
Closed Prospect
Drainage[3]
Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

1 in = 125 ft
1:1,500

N W E S

0 62.5 125 250 Feet

COVE WASH MIDDLE 2B DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

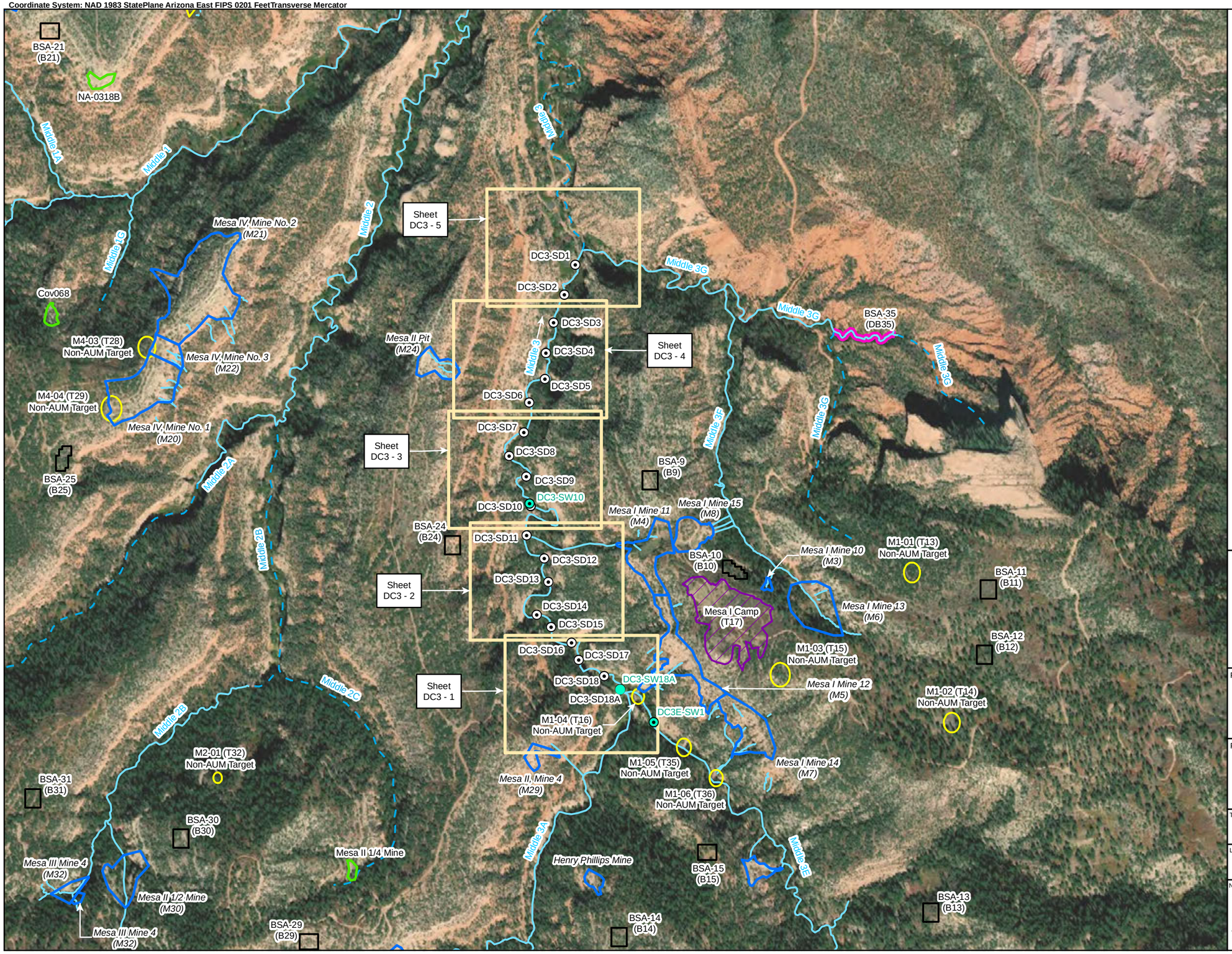
Prepared By:
TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	Date: 5/6/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DC2B - 2**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



- Sediment Sample Locations
- Surface Water Sample Locations
- Survey Index Sheet
- AUM Site Boundary
- Non-AUM Target Site Boundary
- AUM Related Site Boundary
- Drainage Background Location
- Background Location
- Non-Tronox AUM Site
- Drainage*
- Drainage - Field Mapped

1 in = 1,000 ft

1:12,000

N W E S

0 500 1,000 2,000 Feet

COVE WASH MIDDLE 3 DRAINAGE SURVEY INDEX MAP

Prepared For:

Prepared By:

1999 Harrison Street, Suite 500
Oakland, CA 94612

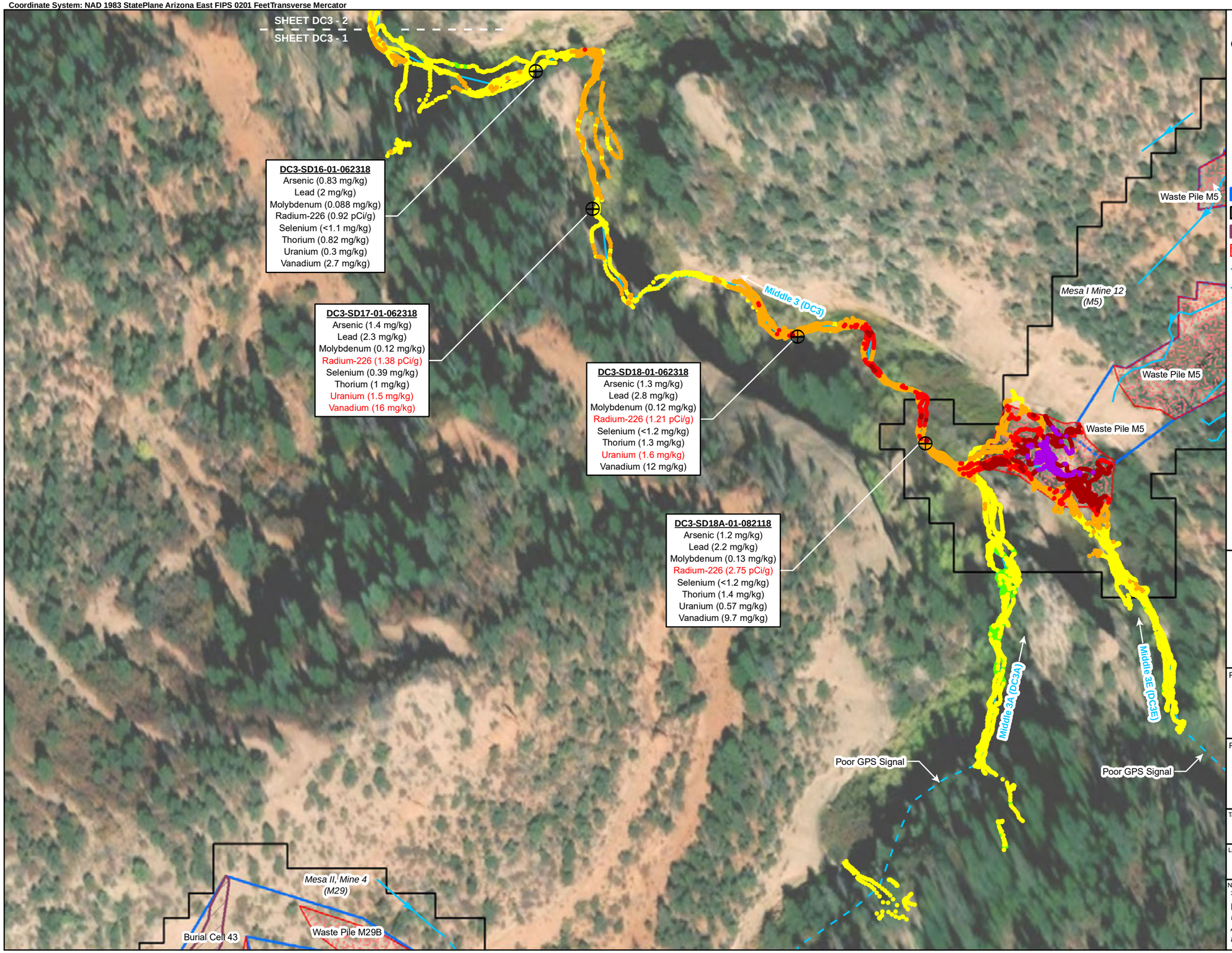
Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 7/10/2019

Note:
*U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.:

DC3 - I

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

AUM Site Boundary
Survey Area Boundary
Burial Cell
Waste Pile - Unreclaimed
Drainage - Estimated Path
Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte. '<' indicates less than limit of detection laboratory non-detect.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

1 in = 125 ft

1:1,500

N W E S

0 62.5 125 250 Feet

COVE WASH MIDDLE 3 DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

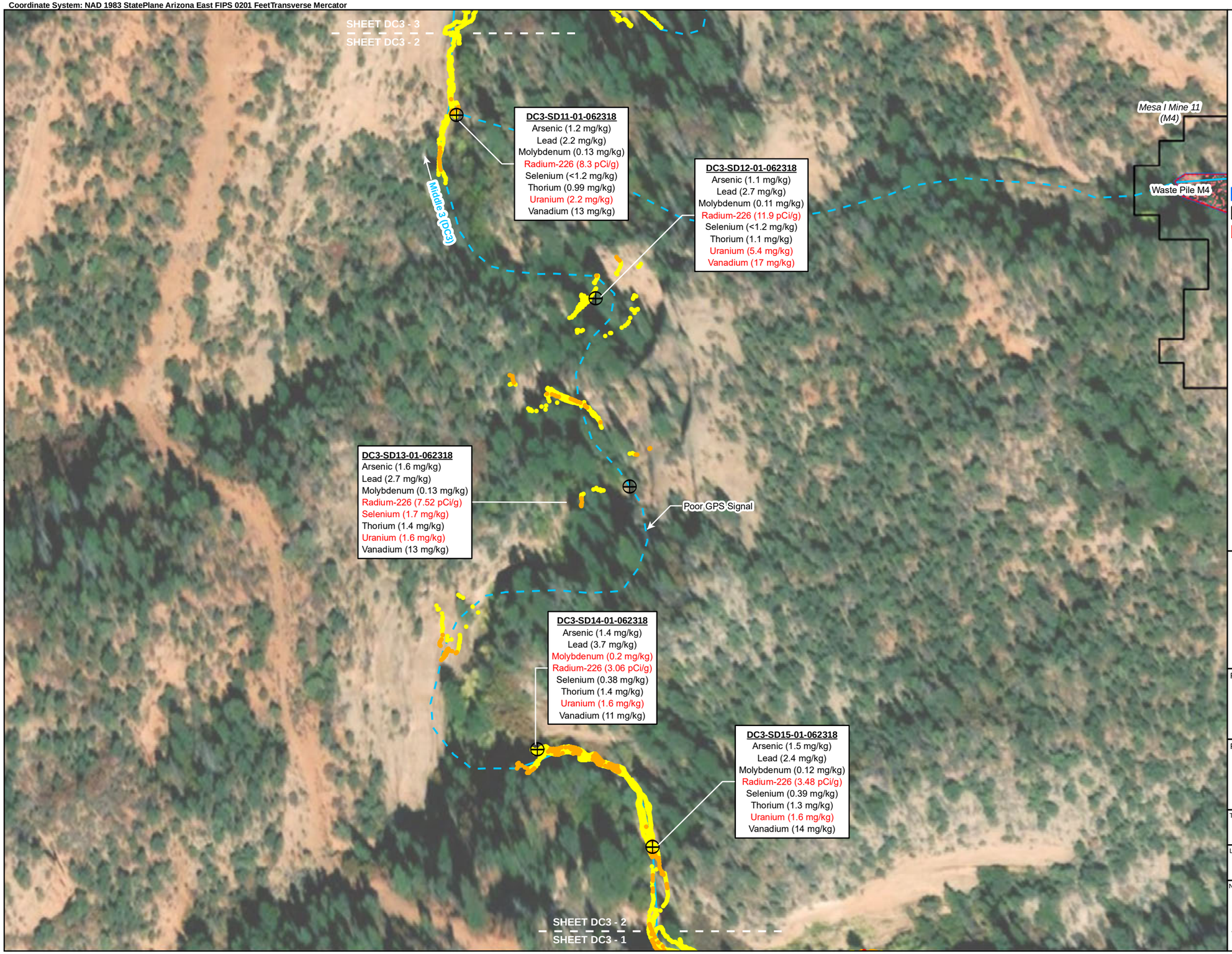
TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	Date: 7/12/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DC3 - 1**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

AUM Site Boundary

Survey Area Boundary

Waste Pile - Unreclaimed

Drainage - Estimated Path

Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte. '<' indicates less than limit of detection laboratory non-detect.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

1 in = 125 ft

1:1,500

N W E S

0 62.5 125 250 Feet

COVE WASH MIDDLE 3 DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

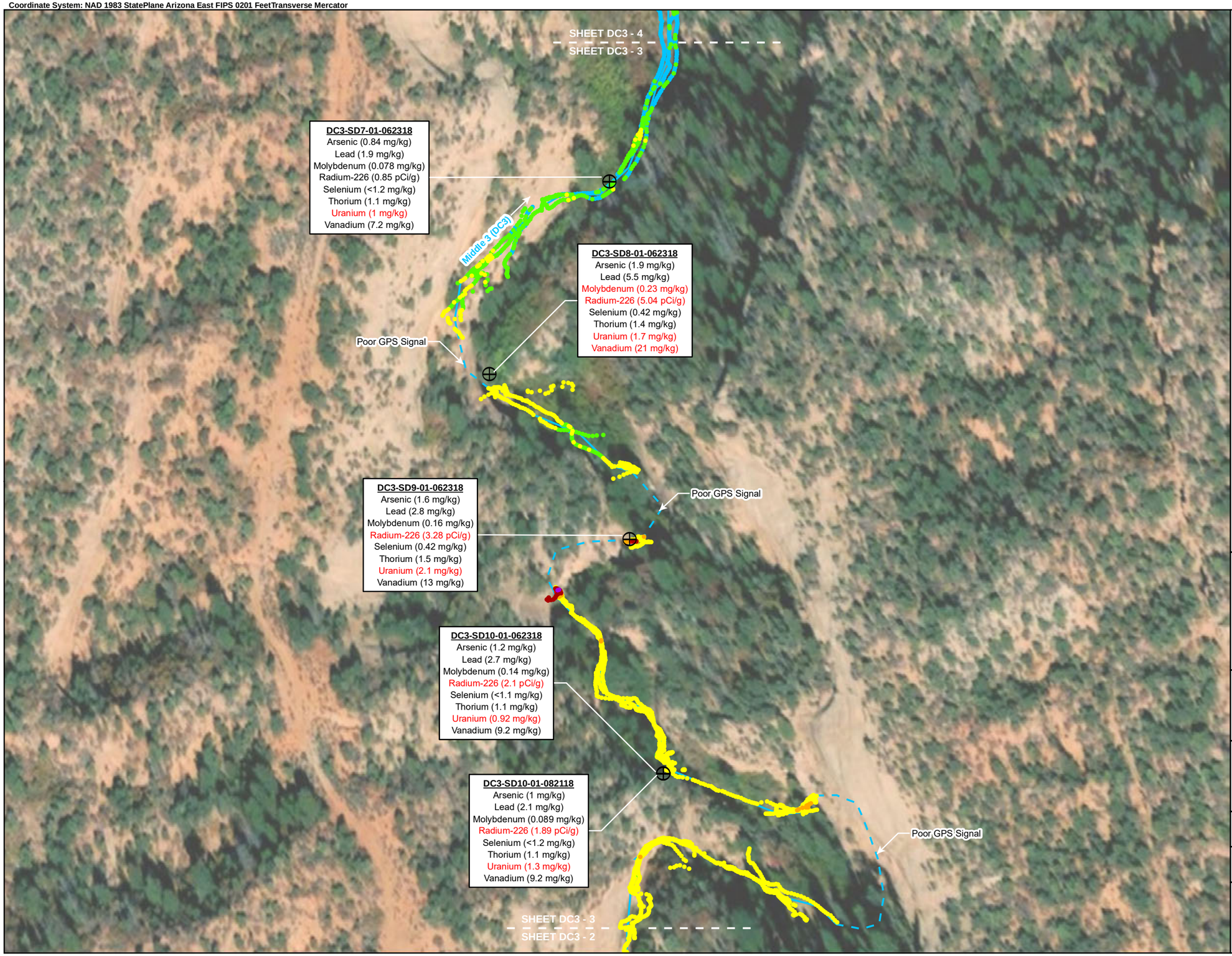
TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 7/12/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DC3 - 2**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

Drainage - Estimated Path

Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte. '<' indicates less than limit of detection laboratory non-detect.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

1 in = 125 ft

1:1,500

N W E S

0 62.5 125 250 Feet

COVE WASH MIDDLE 3 DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 7/12/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DC3 - 3**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

SHEET DC3 - 5

SHEET DC3 - 4

DC3-SD3-01-062318
Arsenic (1.8 mg/kg)
Lead (4.1 mg/kg)
Molybdenum (0.19 mg/kg)
Radium-226 (2.82 pCi/g)
Selenium (0.42 mg/kg)
Thorium (1.6 mg/kg)
Uranium (3.7 mg/kg)
Vanadium (14 mg/kg)

Middle 3 (DC3)

DC3-SD4-01-062318
Arsenic (5.9 mg/kg)
Lead (3.1 mg/kg)
Molybdenum (1.7 mg/kg)
Radium-226 (3.09 pCi/g)
Selenium (0.55 mg/kg)
Thorium (1.5 mg/kg)
Uranium (2.2 mg/kg)
Vanadium (16 mg/kg)

DC3-SD5-01-062318
Arsenic (3 mg/kg)
Lead (7 mg/kg)
Molybdenum (0.69 mg/kg)
Radium-226 (4.3 pCi/g)
Selenium (0.95 mg/kg)
Thorium (3 mg/kg)
Uranium (5.2 mg/kg)
Vanadium (22 mg/kg)

Waste Pile M24

Mesa II F
(M24)

DC3-SD6-01-062318
Arsenic (2.5 mg/kg)
Lead (5.7 mg/kg)
Molybdenum (0.79 mg/kg)
Radium-226 (3.14 pCi/g)
Selenium (1.2 mg/kg)
Thorium (2.3 mg/kg)
Uranium (9 mg/kg)
Vanadium (20 mg/kg)

SHEET DC3 - 4

SHEET DC3 - 3

⊕ Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

AUM Site Boundary

Survey Area Boundary

Waste Pile - Unreclaimed

Drainage - Estimated Path

Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte. '<' indicates less than limit of detection laboratory non-detect.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

1 in = 125 ft

1:1,500

N W E S

0 62.5 125 250 Feet

COVE WASH MIDDLE 3 DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 7/12/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DC3 - 4**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

⊕ Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

Drainage[3]

Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte. '<' indicates less than limit of detection laboratory non-detect.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

1 in = 125 ft

1:1,500

N W E S

0 62.5 125 250 Feet

COVE WASH MIDDLE 3 DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

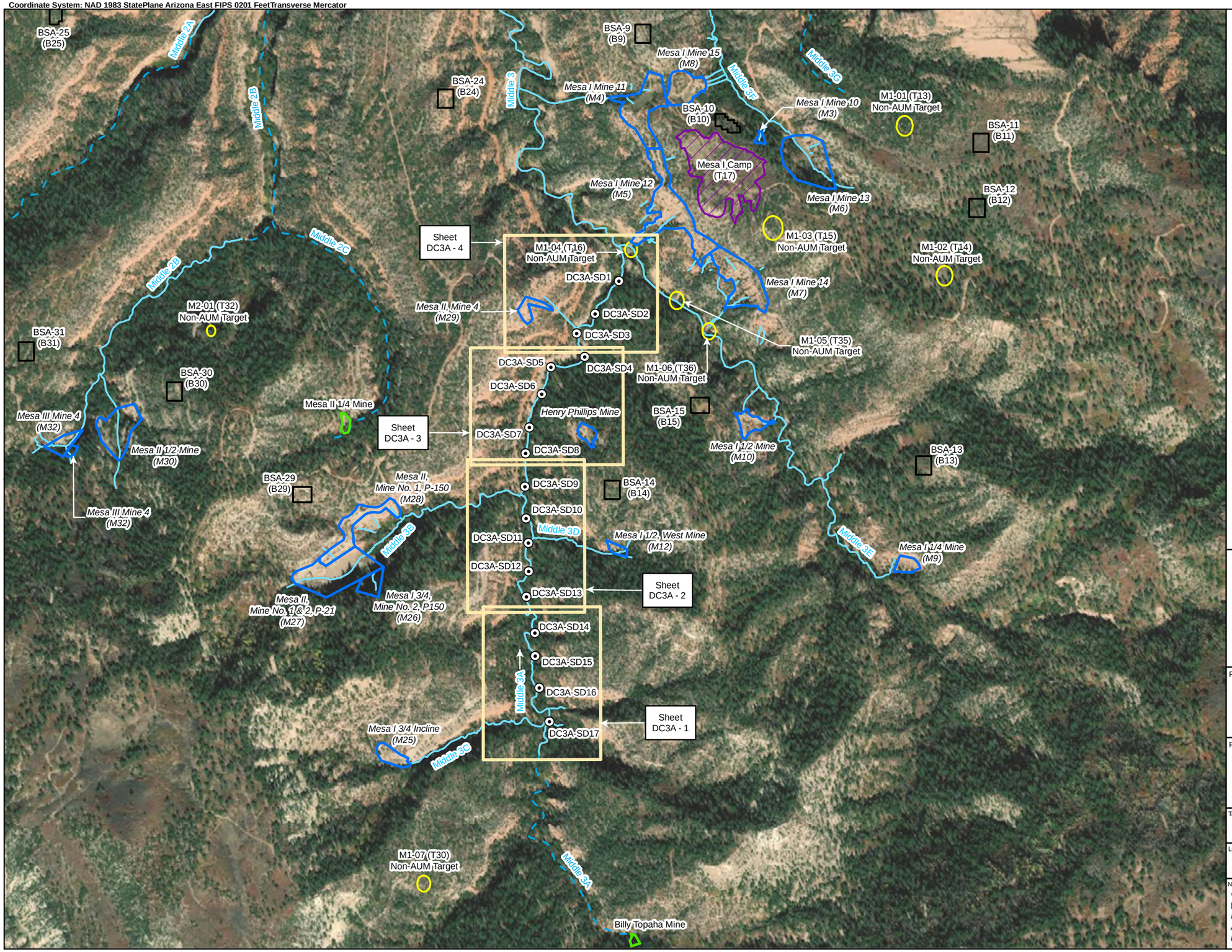
TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 7/12/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DC3 - 5**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



- Sediment Sample Locations
- Survey Index Sheet
- AUM Site Boundary
- Non-AUM Target Site Boundary
- AUM Related Site Boundary
- Background Location
- Non-Tronox AUM Site
- Drainage*
- Drainage - Field Mapped

1 in = 1,000 ft

1:12,000

N W E S

0 500 1,000 2,000 Feet

COVE WASH MIDDLE 3A DRAINAGE SURVEY INDEX MAP

Prepared For:

Prepared By:

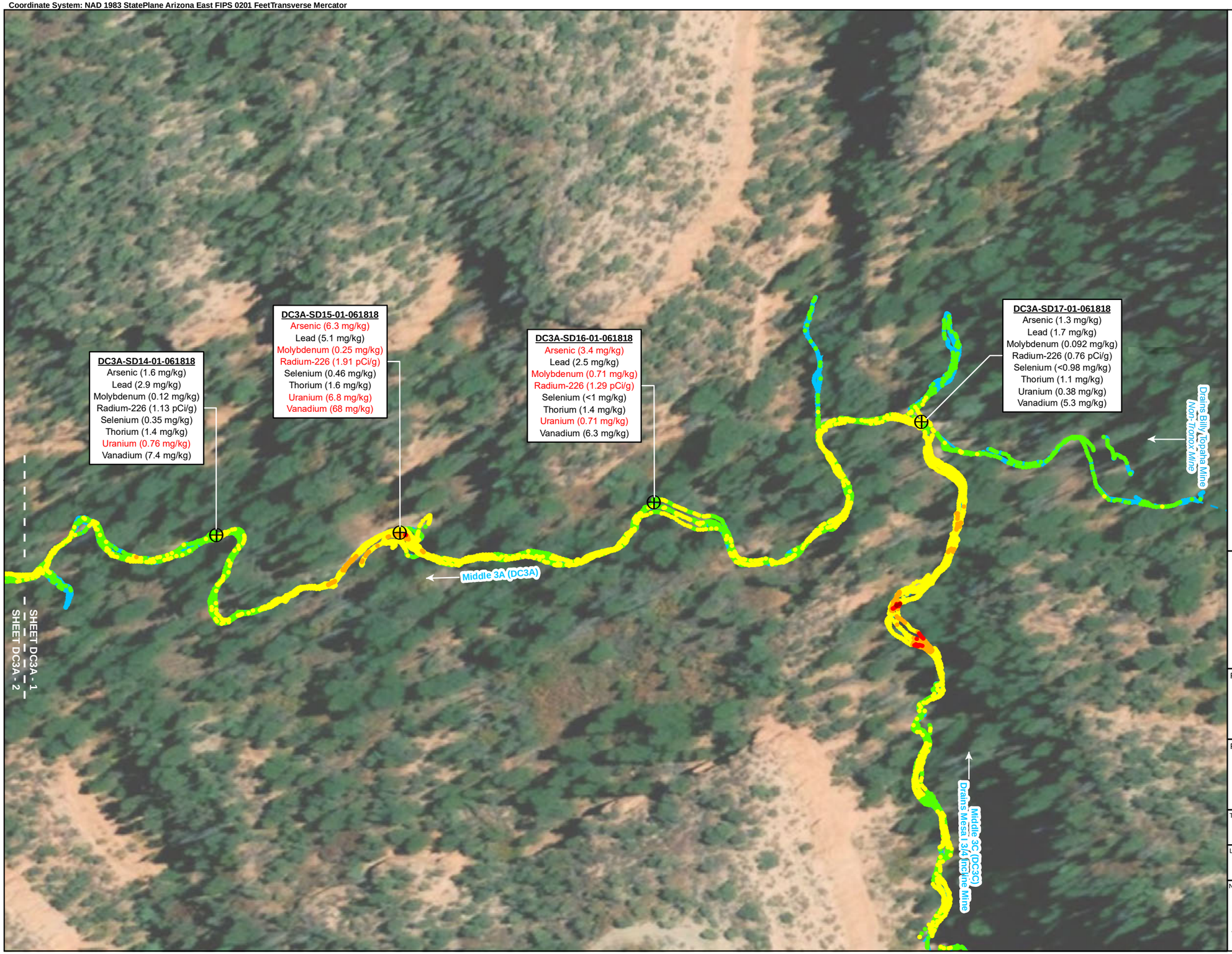
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 7/8/2019

Note:
*U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DC3A - I**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

Drainage[3]

Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte. '<' indicates less than limit of detection laboratory non-detect.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

1 in = 125 ft

1:1,500

0 62.5 125 250 Feet

N E S W

COVE WASH MIDDLE 3A DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

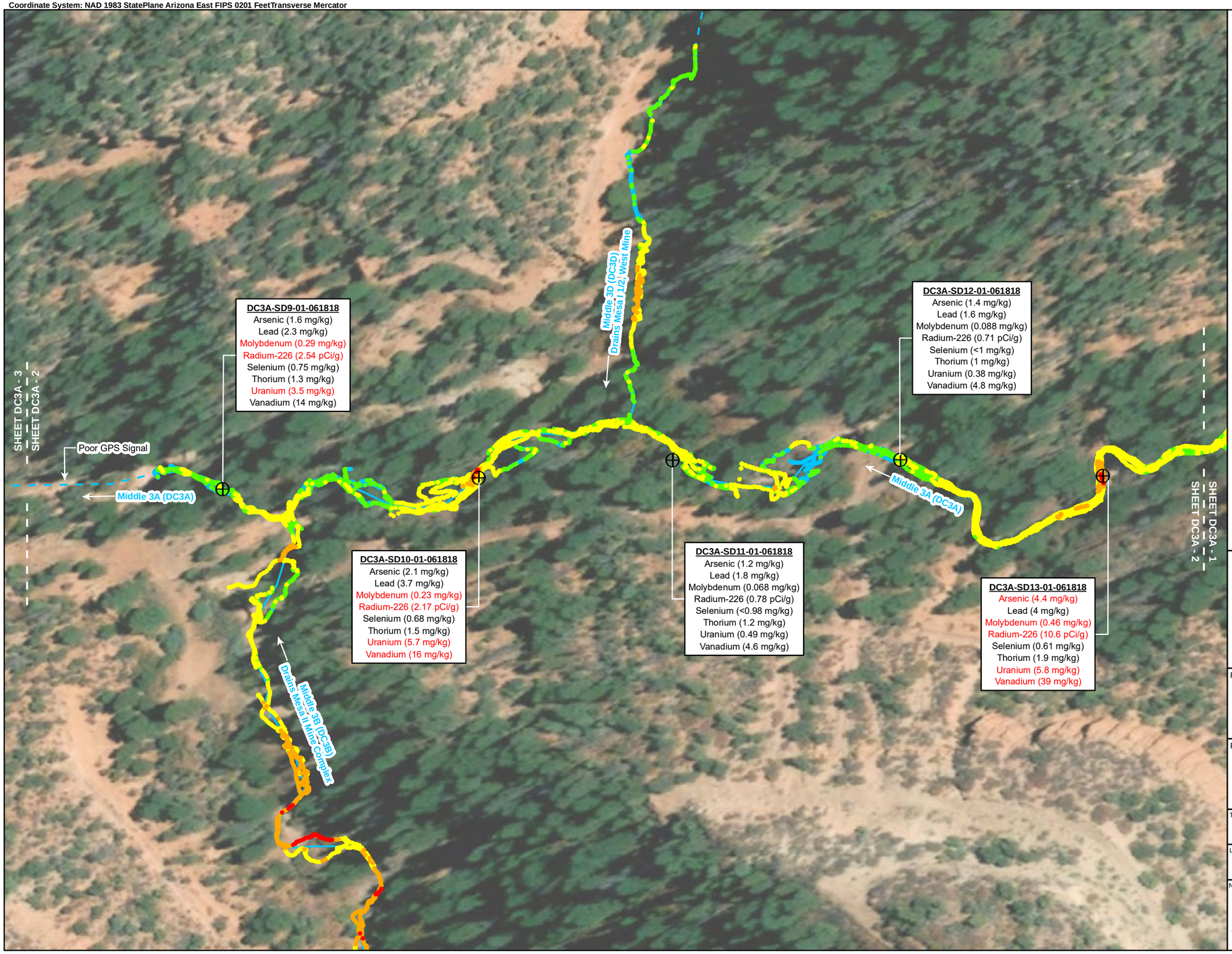
TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 5/6/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DC3A - 1**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

Drainage - Estimated Path

Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte. '<' indicates less than limit of detection laboratory non-detect.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

1 in = 125 ft

1:1,500

0 62.5 125 250 Feet

COVE WASH MIDDLE 3A DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

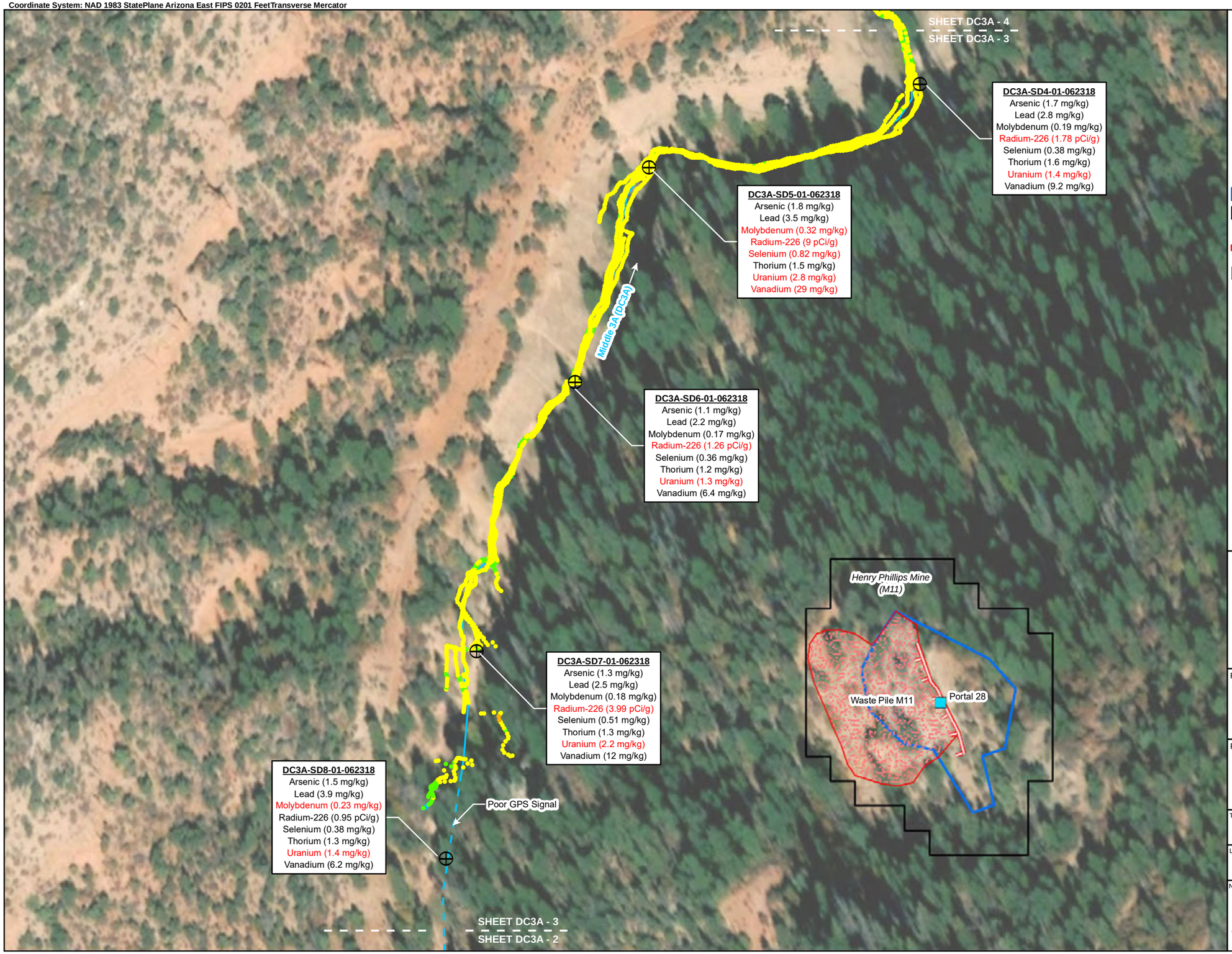
TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 5/6/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DC3A - 2**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

AUM Site Boundary
Survey Area Boundary
Closed Portal
Highwall - Unreclaimed
Waste Pile - Unreclaimed
Drainage - Estimated Path
Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte. '<' indicates less than limit of detection laboratory non-detect.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

1 in = 125 ft

1:1,500

N W E S

0 62.5 125 250 Feet

COVE WASH MIDDLE 3A DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

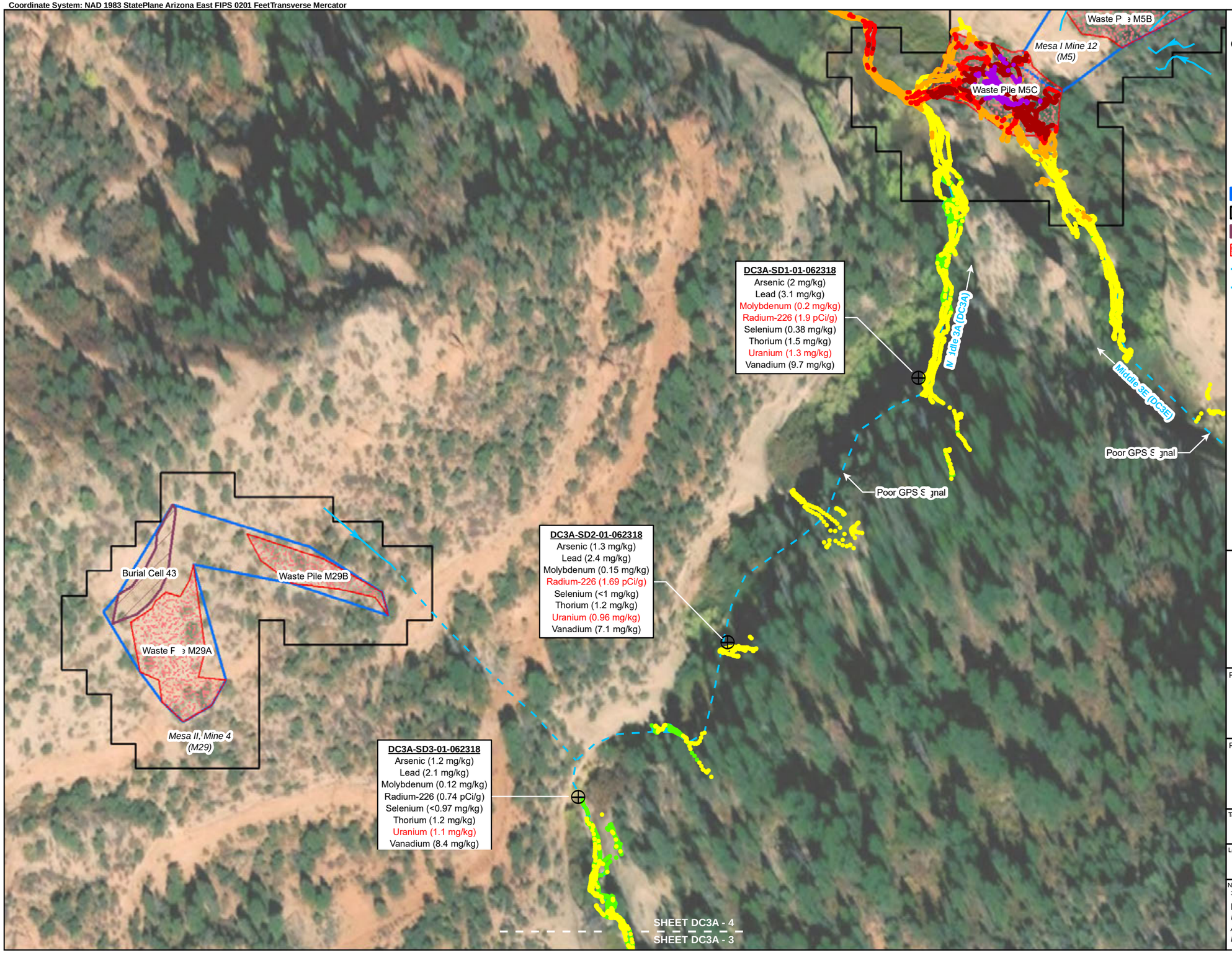
Prepared By: TETRA TECH

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	Date: 5/6/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DC3A - 3**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

- AUM Site Boundary
- Survey Area Boundary
- Burial Cell
- Waste Pile - Unreclaimed
- Drainage - Estimated Path
- Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte. '<' indicates less than limit of detection laboratory non-detect.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

1 in = 125 ft

1:1,500

N W E S

0 62.5 125 250 Feet

COVE WASH MIDDLE 3A DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

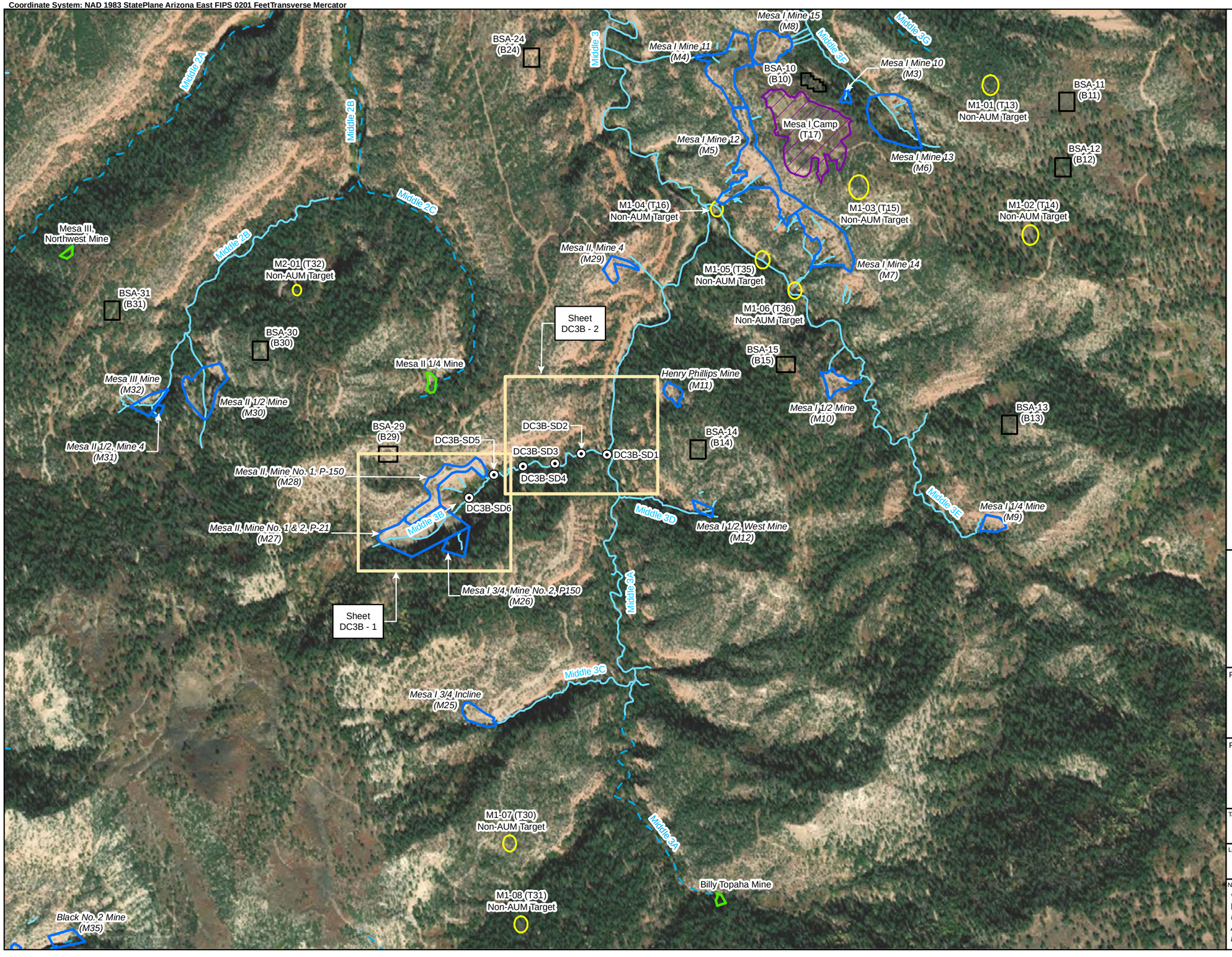
TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.: TO0001	Contract No.: EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	Date: 7/12/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DC3A - 4**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



- Sediment Sample Locations
- Survey Index Sheet
- AUM Site Boundary
- AUM Related Site Boundary
- Non-AUM Target Site Boundary
- Background Location
- Non-Tronox AUM Site
- Drainage*
- Drainage - Field Mapped

1 in = 1,000 ft

1:12,000

N W E S

0 500 1,000 2,000 Feet

COVE WASH MIDDLE 3B SURVEY INDEX MAP

Prepared For:

Prepared By:

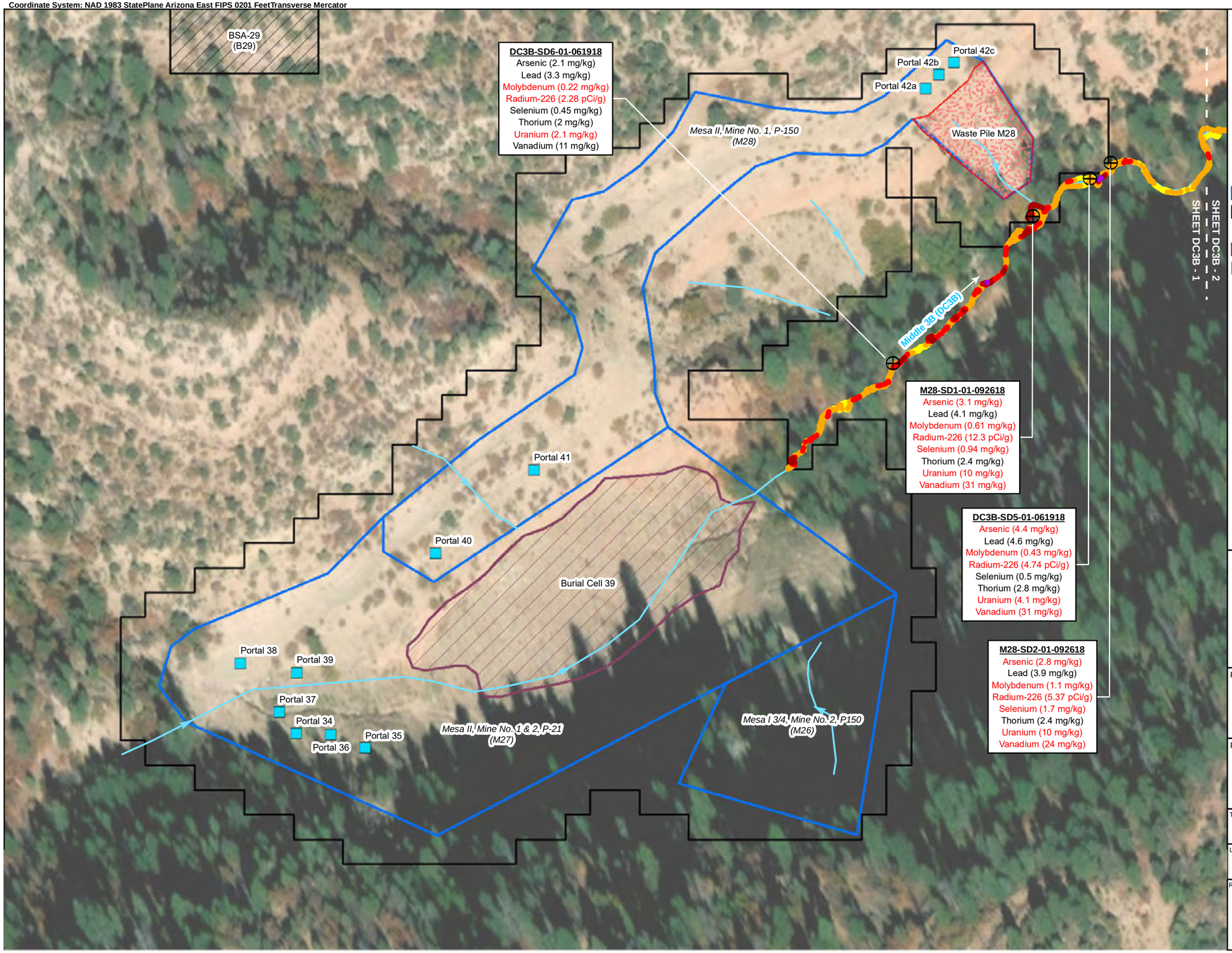
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 7/8/2019

Note:
*U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DC3B - I**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



Sediment Sample Location*

Gamma Reading (cpm)**

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

AUM Site Boundary
Survey Area Boundary
Closed Portal
Burial Cell
Waste Pile - Unreclaimed
Drainage - Field Mapped

Note:
*Red font indicates sample COPC concentration above BTV value for the relevant analyte.

1 in = 125 ft

1:1,500

N W E S

0 62.5 125 250 Feet

COVE WASH DRAINAGE MIDDLE 3B GAMMA RADIATION SURVEY MAP AND SEDIMENT SAMPLE LOCATIONS

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	Date: 5/6/2019

Reference:
*The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

Figure No.:
DC3B - 1

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

Henry Pi ...s M ...e (M11)

Waste F... M11

Middle 3A (DC3A)

Middle 3B (DC3B)

N ...dle 3A (DC3A)

DC3B-SD4-01-061918
Arsenic (3.1 mg/kg)
Lead (3.2 mg/kg)
Molybdenum (0.27 mg/kg)
Radium-226 (3.61 pCi/g)
Selenium (0.45 mg/kg)
Thorium (1.6 mg/kg)
Uranium (1 mg/kg)
Vanadium (8.9 mg/kg)

DC3B-SD3-01-061918
Arsenic (2.7 mg/kg)
Lead (3.8 mg/kg)
Molybdenum (0.18 mg/kg)
Radium-226 (3.88 pCi/g)
Selenium (0.59 mg/kg)
Thorium (2.1 mg/kg)
Uranium (1.5 mg/kg)
Vanadium (9.6 mg/kg)

DC3B-SD2-01-061918
Arsenic (2.3 mg/kg)
Lead (4.2 mg/kg)
Molybdenum (0.34 mg/kg)
Radium-226 (7.14 pCi/g)
Selenium (0.7 mg/kg)
Thorium (2.2 mg/kg)
Uranium (7.1 mg/kg)
Vanadium (26 mg/kg)

DC3B-SD1-01-061918
Arsenic (1.8 mg/kg)
Lead (3.8 mg/kg)
Molybdenum (0.53 mg/kg)
Radium-226 (2.41 pCi/g)
Selenium (0.62 mg/kg)
Thorium (1.7 mg/kg)
Uranium (5.7 mg/kg)
Vanadium (13 mg/kg)

SHEET DC3B - 2

SHEET DC3B - 1

⊕ Sediment Sample Location*

Gamma Reading (cpm)**

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

Survey Area Boundary

Waste Pile - Unreclaimed

Drainage - Field Mapped

Drainage - Estimated Path

Note:
*Red font indicates sample COPC concentration above BTV value for the relevant analyte.

1 in = 125 ft

1:1,500

N
W E
S

0 62.5 125 250 Feet

COVE WASH DRAINAGE MIDDLE 3B GAMMA RADIATION SURVEY MAP AND SEDIMENT SAMPLE LOCATIONS

Prepared For:

Prepared By:

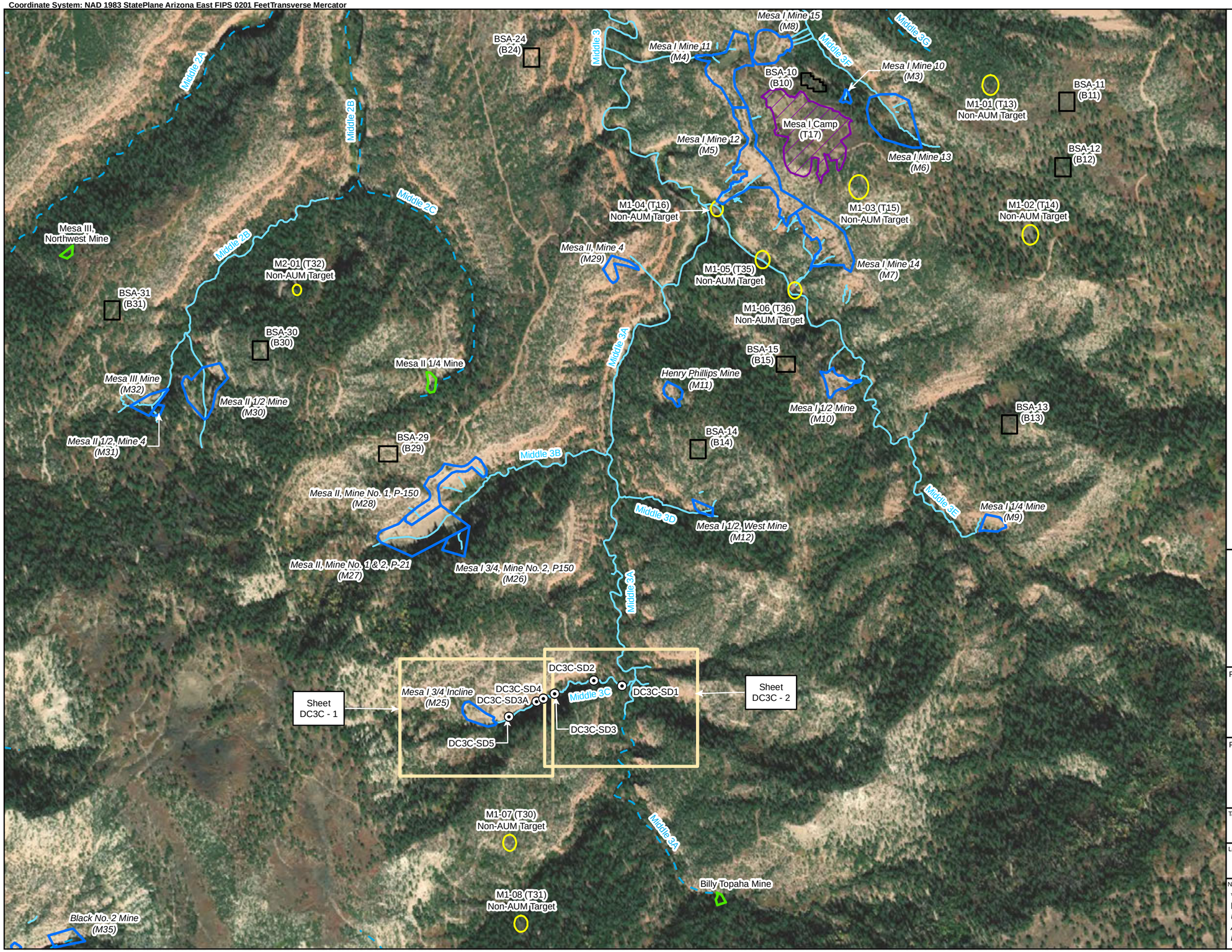
TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 5/6/2019

Reference:
*The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

Figure No.:
DC3B - 2

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



- Sediment Sample Locations
- Survey Index Sheet
- AUM Site Boundary
- AUM Related Site Boundary
- Non-AUM Target Site Boundary
- Background Location
- Non-Tronox AUM Site
- Drainage*
- Drainage - Field Mapped

1 in = 1,000 ft

1:12,000

N W E S

0 500 1,000 2,000 Feet

COVE WASH MIDDLE 3C DRAINAGE SURVEY INDEX MAP

Prepared For:

Prepared By:

1999 Harrison Street, Suite 500
Oakland, CA 94612

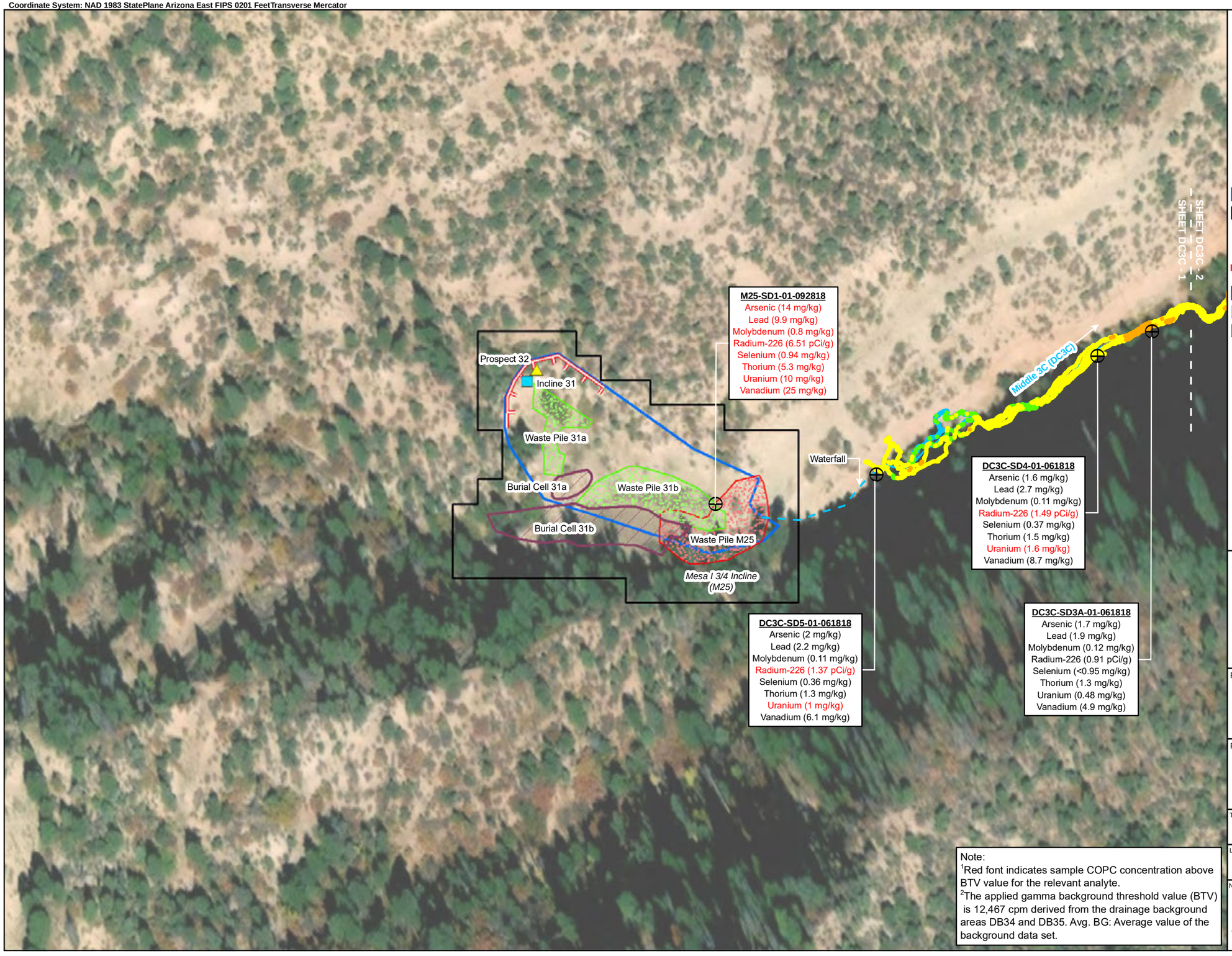
Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 7/12/2019

Note:
*U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.:

DC3C - I

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

- AUM Site Boundary
- Survey Area Boundary
- Closed Portal
- Closed Prospect
- Highwall - Unreclaimed
- Burial Cell
- Waste Pile - Reclaimed
- Waste Pile - Unreclaimed
- Drainage - Estimated Path
- Drainage - Field Mapped

1 in = 125 ft

1:1,500

N W E S

0 62.5 125 250 Feet

COVE WASH MIDDLE 3C DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

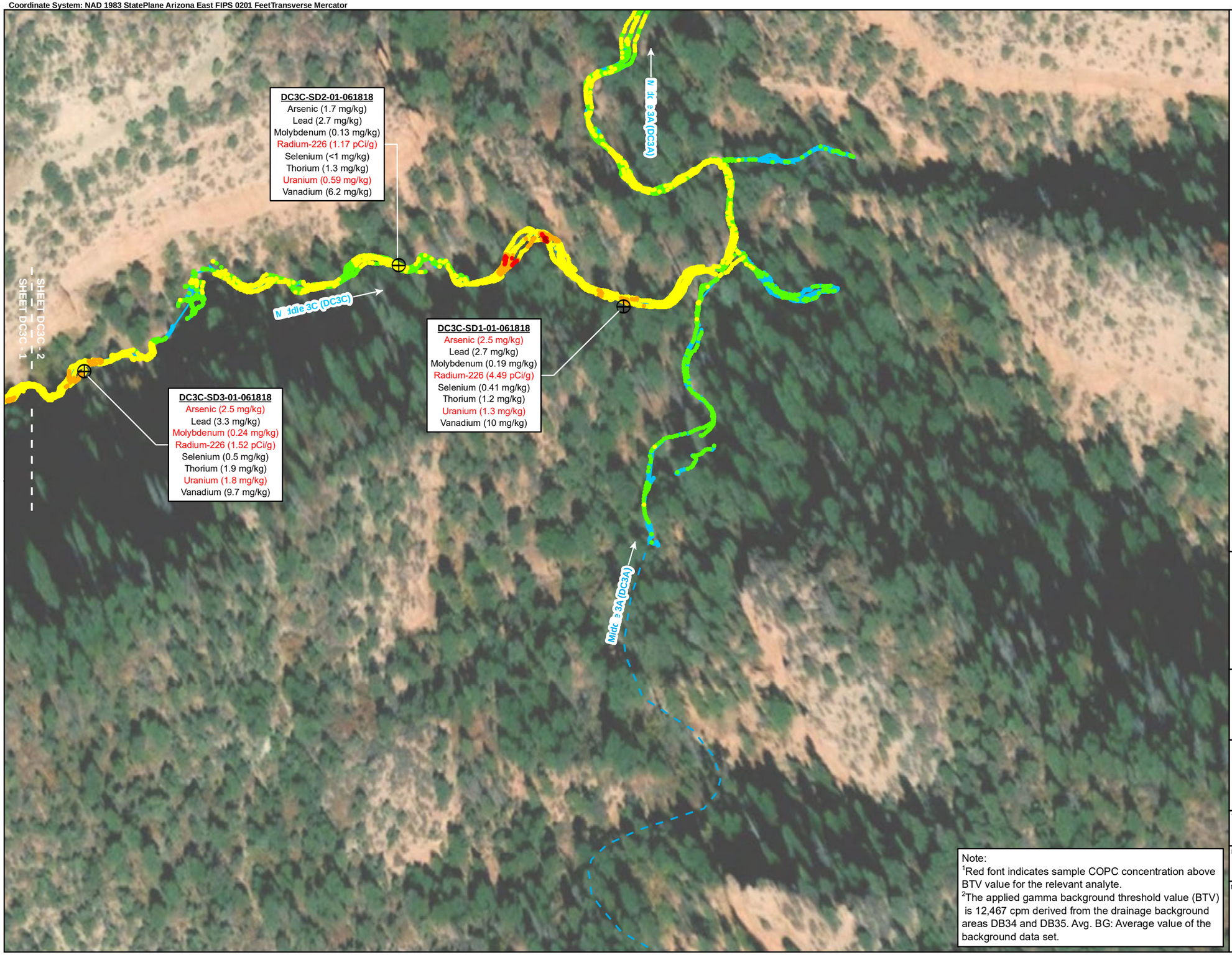
Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	Date: 7/12/2019

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DC3C - 1**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

Drainage[3]

Drainage - Field Mapped

1 in = 125 ft

1:1,500

N W E S

0 62.5 125 250 Feet

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

COVE WASH MIDDLE 3C DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

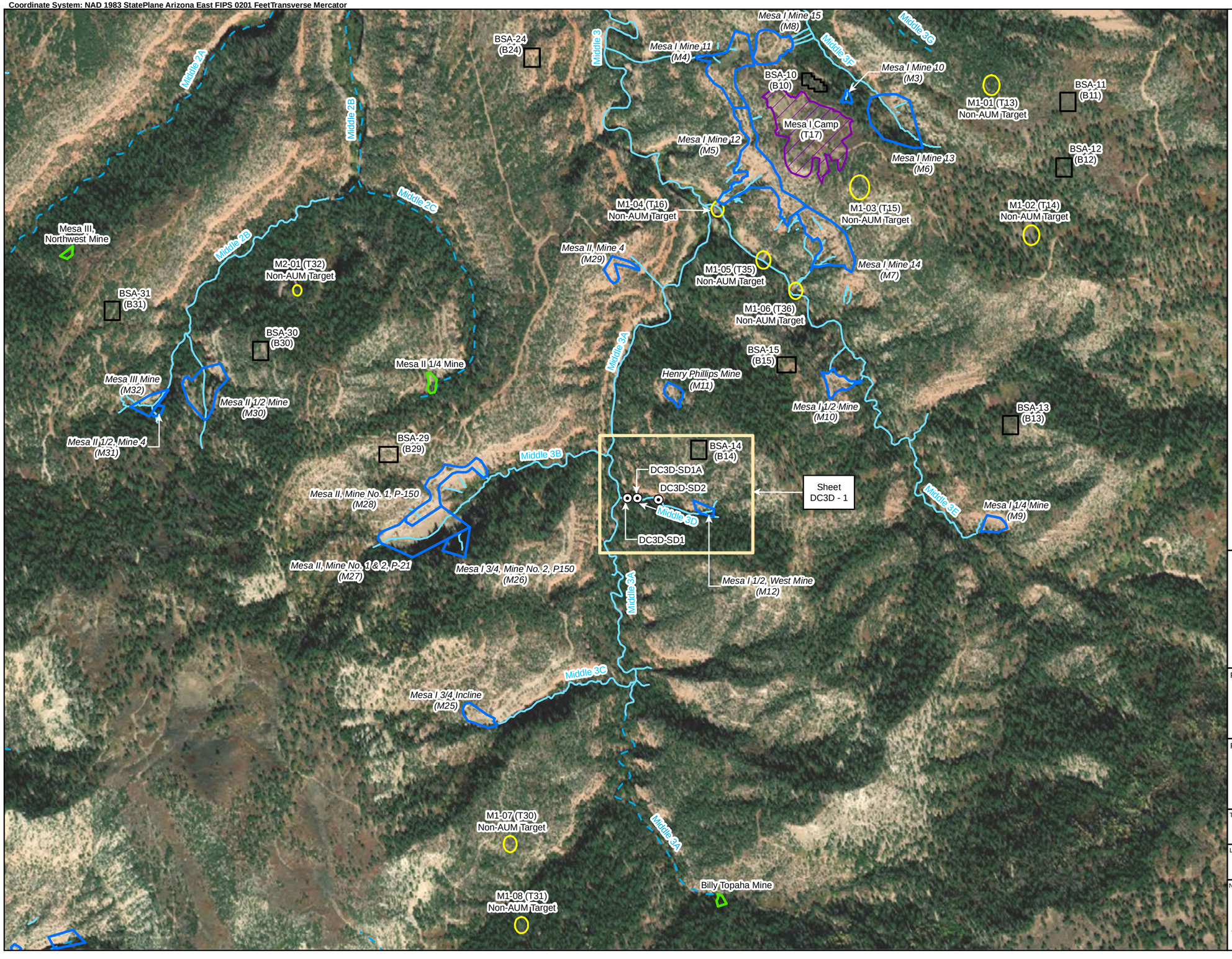
TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	Date: 7/12/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DC3C - 2**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



- Sediment Sample Locations
- Survey Index Sheet
- AUM Site Boundary
- Non-AUM Target Site Boundary
- AUM Related Site Boundary
- Background Location
- Non-Tronox AUM Site
- Drainage*
- Drainage - Field Mapped

1 in = 1,000 ft

1:12,000

N W E S

0 500 1,000 2,000 Feet

COVE WASH MIDDLE 3D DRAINAGE SURVEY INDEX MAP

Prepared For:

Prepared By:

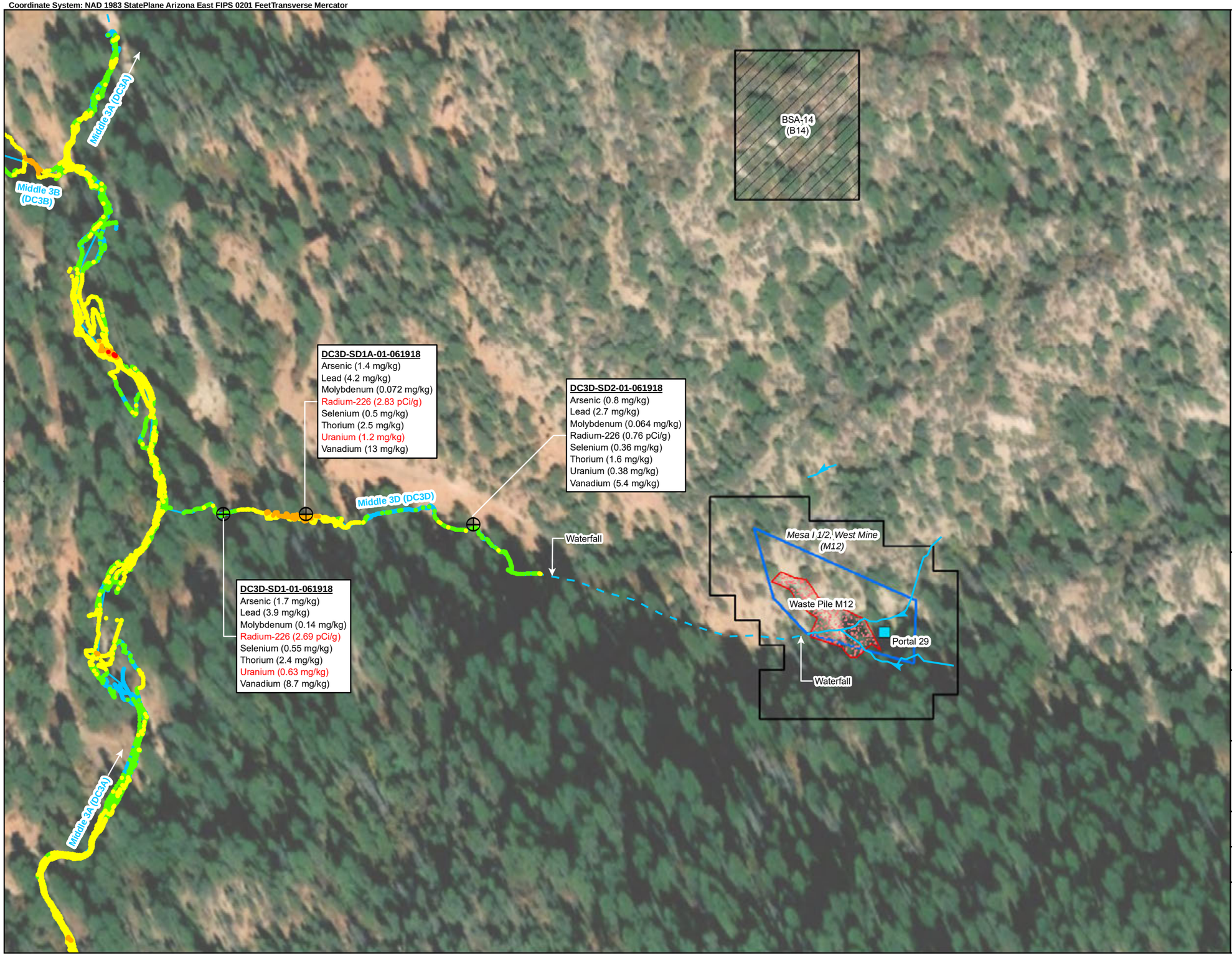
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 7/8/2019

Note:
*U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DC3D - I**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



Sediment Sample Location*

Gamma Reading (cpm)**

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

- AUM Site Boundary
- Survey Area Boundary
- Background Location
- Closed Portal
- Waste Pile - Unreclaimed
- Drainage - Field Mapped
- Drainage - Estimated Path

Note:
*Red font indicates sample COPC concentration above BTV value for the relevant analyte.

1 in = 125 ft

1:1,500

N W E S

0 62.5 125 250 Feet

COVE WASH MIDDLE 3D DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

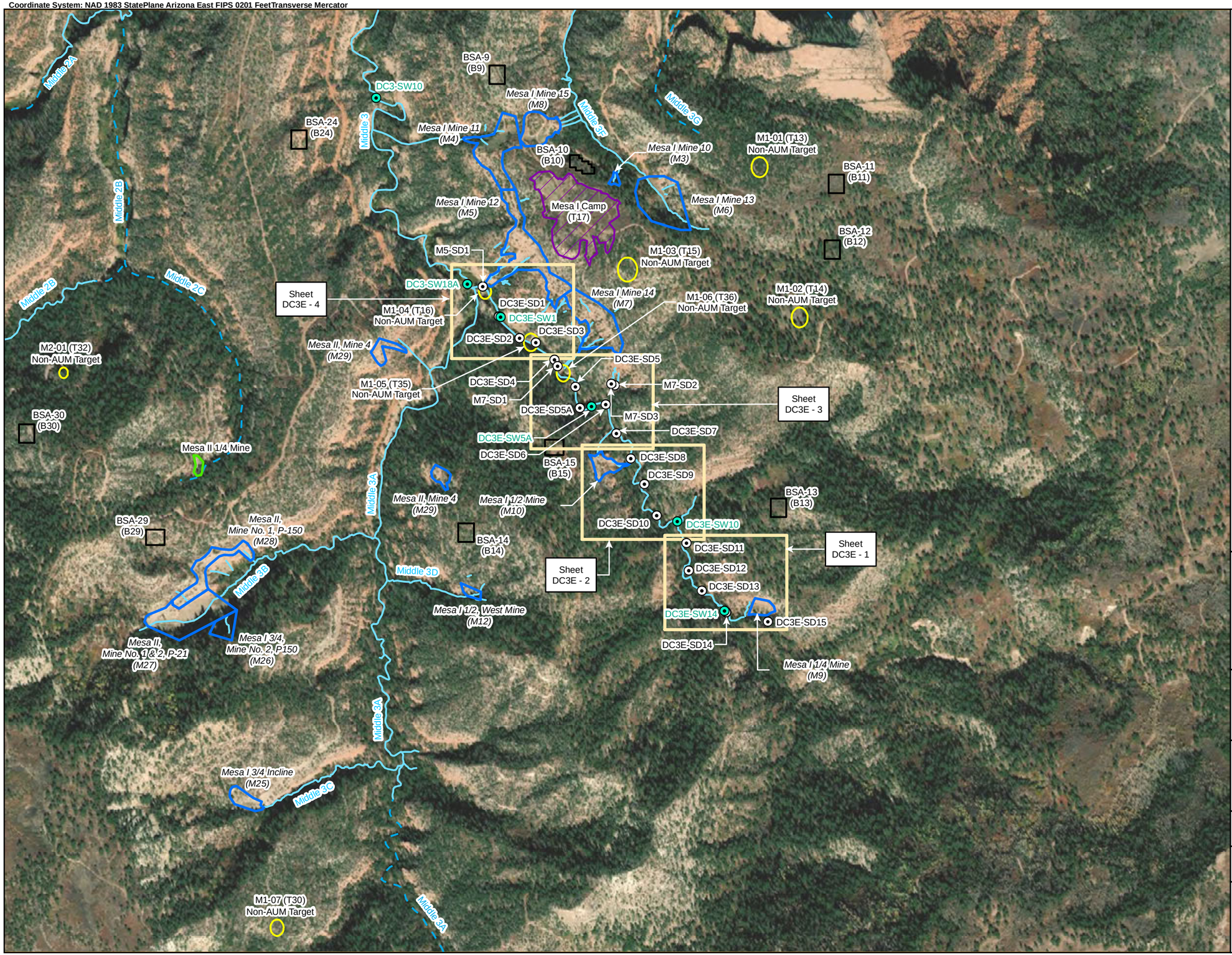
TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	Date: 5/6/2019

Note:
*The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

Figure No.: **DC3D - 1**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



- Sediment Sample Locations
- Survey Index Sheet
- AUM Site Boundary
- Non-AUM Target Site Boundary
- AUM Related Site Boundary
- Background Location
- Non-Tronox AUM Site
- Drainage*
- Drainage - Field Mapped

1 in = 1,000 ft

1:12,000

N W E S

0 500 1,000 2,000 Feet

COVE WASH MIDDLE 3E DRAINAGE SURVEY INDEX MAP

Prepared For:

Prepared By:

1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 7/8/2019

Note:
*U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DC3E - I**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

SHEET DC3E - 2

SHEET DC3E - 1

DC3E-SD11-01-081718
Arsenic (1.2 mg/kg)
Lead (3.5 mg/kg)
Molybdenum (0.074 mg/kg)
Radium-226 (0.82 pCi/g)
Selenium (0.55 mg/kg)
Thorium (1.9 mg/kg)
Uranium (0.82 mg/kg)
Vanadium (8.5 mg/kg)

Poor GPS Signal

DC3E-SD12-01-081718
Arsenic (1.2 mg/kg)
Lead (2.5 mg/kg)
Molybdenum (0.11 mg/kg)
Radium-226 (0.62 pCi/g)
Selenium (<1.1 mg/kg)
Thorium (2.1 mg/kg)
Uranium (0.3 mg/kg)
Vanadium (6.2 mg/kg)

DC3E-SD14-01-081718
Arsenic (0.64 mg/kg)
Lead (2.4 mg/kg)
Molybdenum (0.061 mg/kg)
Radium-226 (0.50 pCi/g)
Selenium (<1 mg/kg)
Thorium (1.4 mg/kg)
Uranium (0.35 mg/kg)
Vanadium (7.2 mg/kg)

DC3E-SD13-01-081718
Arsenic (0.91 mg/kg)
Lead (2.3 mg/kg)
Molybdenum (0.075 mg/kg)
Radium-226 (<0.51 pCi/g)
Selenium (<1.2 mg/kg)
Thorium (1.6 mg/kg)
Uranium (0.47 mg/kg)
Vanadium (6.6 mg/kg)

Middle 3E (DC3E)

DC3E-SD14-01-093018
Arsenic (1.1 mg/kg)
Lead (1.7 mg/kg)
Molybdenum (0.088 mg/kg)
Radium-226 (0.53 pCi/g)
Selenium (0.33 mg/kg)
Thorium (1.3 mg/kg)
Uranium (0.53 mg/kg)
Vanadium (6.6 mg/kg)

Mesa I 1/4 Mine (M9)

Portal 26

Waste Pile M9

DC3E-SD15-01-081718
Arsenic (1.6 mg/kg)
Lead (3 mg/kg)
Molybdenum (0.11 mg/kg)
Radium-226 (0.50 pCi/g)
Selenium (0.5 mg/kg)
Thorium (3.4 mg/kg)
Uranium (0.49 mg/kg)
Vanadium (11 mg/kg)

Sediment Sample Location*

Gamma Reading (cpm)**

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

AUM Site Boundary
Survey Area Boundary
Closed Portal
Closed Prospect
Open Portal
Waste Pile - Unreclaimed
Drainage - Field Mapped

Note:
*Red font indicates sample COPC concentration above BTV value for the relevant analyte. '<' indicates a less than limit of detection laboratory non-detect.

1 in = 100 ft

1:1,200

N W E S

0 50 100 200 Feet

COVE WASH MIDDLE 3E DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

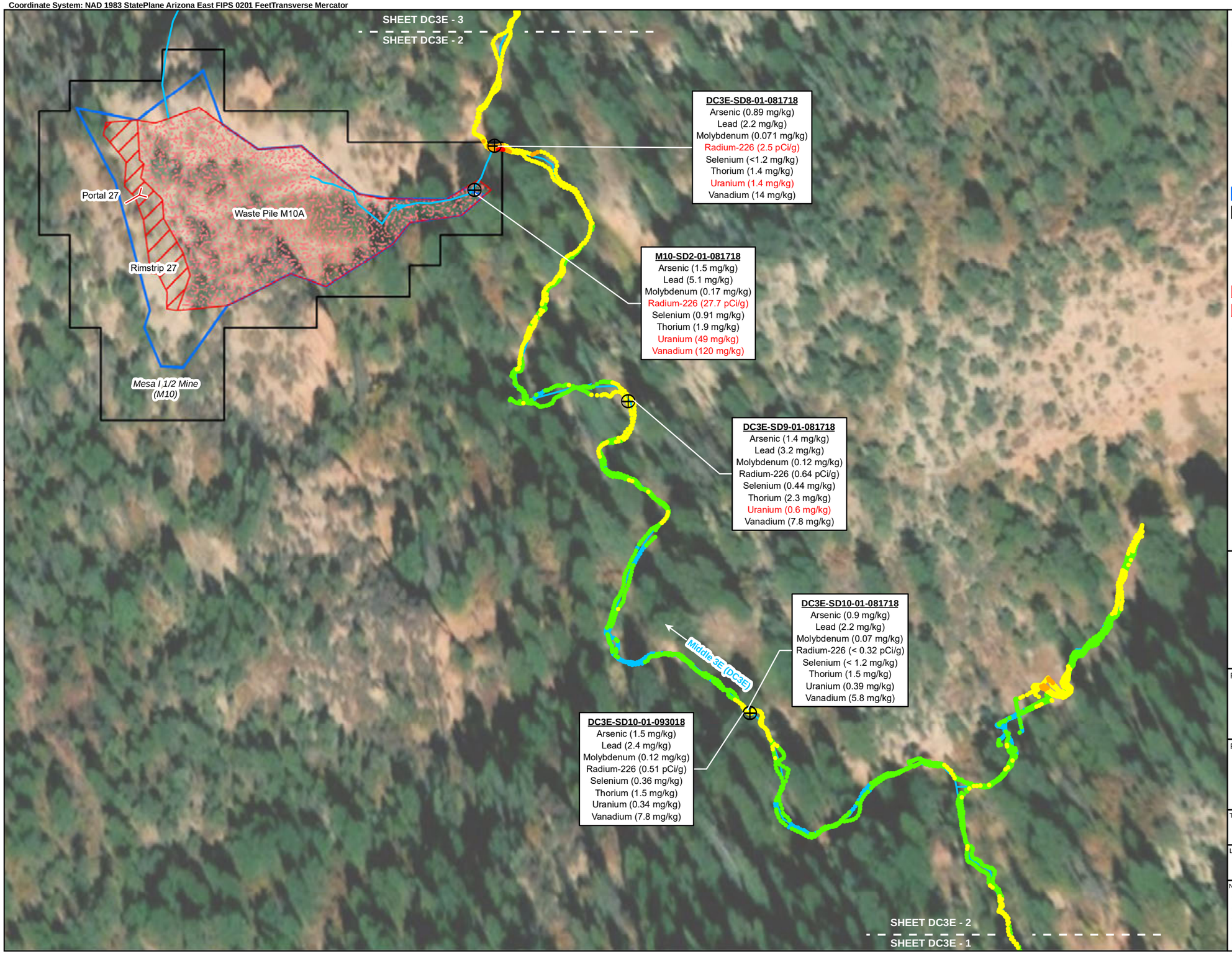
TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 5/6/2019

Note:
*The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

Figure No.:
DC3E - 1

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



⊕ Sediment Sample Location*

Gamma Reading (cpm)**

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

- AUM Site Boundary
- Survey Area Boundary
- Closed Portal
- Closed Prospect
- Open Portal
- Rimstrip - Unreclaimed
- Waste Pile - Unreclaimed
- Drainage - Field Mapped

Note:
*Red font indicates sample COPC concentration above BTV value for the relevant analyte. '<' indicates a less than limit of detection laboratory non-detect.

1 in = 100 ft

1:1,200

N W E S

0 50 100 200 Feet

COVE WASH MIDDLE 3E DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	Date: 6/6/2019

Note:
*The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

Figure No.: **DC3E - 2**

G:\PROJECTS\EPA_RAES-NAVAJO NATION_103554\01\TASK ORDERS\TO-001_NORTHERN AGENCY RSE\WORKING FILES\GIS\MXD\TO01\FINAL_REPORT\DRAINAGES\DC3E (MIDDLE 3E)\DC3E_DRAINAGE_SAMPLES.MXD 06/06/19

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

SHEET DC3E - 4

SHEET DC3E - 3

Mesa I M e 14 (M7)

Mesa I M e 14 (M7)

Lead (3.3 mg/kg)
Molybdenum (0.14 mg/kg)
Radium-226 (6.56 pCi/g)
Selenium (0.49 mg/kg)
Thor um (1.6 mg/kg)
Uranium (11 mg/kg)
Vanadium (33 mg/kg)

M1 06 (T36)
Nor AUM Target

Lead (5.2 mg/kg)
Molybdenum (0.25 mg/kg)
Radium-226 (27.4 pCi/g)
Selenium (1 mg/kg)
Thorium (2 mg/kg)
Uranium (17 mg/kg)
Vanadium (54 mg/kg)

M7-SD3-01-081418
Arsenic (1.2 mg/kg)
Lead (3.7 mg/kg)
Molybdenum (0.09 mg/kg)
Radium-226 (3.17 pCi/g)
Selenium (< 0.97 mg/kg)
Thorium (1.8 mg/kg)
Uranium (3.1 mg/kg)
Vanadium (31 mg/kg)

M7-SD2-01-081418
Arsenic (0.8 mg/kg)
Lead (1.5 mg/kg)
Molybdenum (0.06 mg/kg)
Radium-226 (< 0.36 pCi/g)
Selenium (< 0.92 mg/kg)
Thorium (1.0 mg/kg)
Uranium (0.3 mg/kg)
Vanadium (2.1 mg/kg)

DC3E-SD5-01-062318
Arsenic (0.9 mg/kg)
Lead (2.4 mg/kg)
Molybdenum (0.095 mg/kg)
Radium-226 (1.59 pCi/g)
Selenium (<1.3 mg/kg)
Thorium (1.5 mg/kg)
Uranium (2.1 mg/kg)
Vanadium (12 mg/kg)

DC3E-SD5A-01-062318
Arsenic (1.4 mg/kg)
Lead (3.8 mg/kg)
Molybdenum (0.12 mg/kg)
Radium-226 (2.94 pCi/g)
Selenium (0.56 mg/kg)
Thorium (2.1 mg/kg)
Uranium (2.9 mg/kg)
Vanadium (33 mg/kg)

DC3E-SD6-01-08171
Arsenic (1.4 mg/kg)
Lead (5.5 mg/kg)
Molybdenum (0.13 mg/kg)
Radium-226 (13.5 pCi/g)
Selenium (0.67 mg/kg)
Thorium (2.3 mg/kg)
Uranium (7.9 mg/kg)
Vanadium (32 mg/kg)

Poor GPS S gna

Molybdenum (0.057 mg/kg)
Radium-226 (0.72 pCi/g)
Selenium (<1.1 mg/kg)
Thorium (1.2 mg/kg)
Uranium (0.51 mg/kg)
Vanadium (6.6 mg/kg)

Wash 3E (DC3E)

DC3E-SD7-01-081718
Arsenic (1.3 mg/kg)
Lead (3.2 mg/kg)
Molybdenum (0.23 mg/kg)
Radium-226 (9.2 pCi/g)
Selenium (0.43 mg/kg)
Thorium (1.6 mg/kg)
Uranium (11 mg/kg)
Vanadium (29 g/kg)

M10-SD1-01-081718
Arsenic (2 mg/kg)
Lead (5.4 mg/kg)
Molybdenum (0.67 mg/kg)
Radium-226 (55.4 pCi/g)
Selenium (3.8 mg/kg)
Thorium (2.0 mg/kg)
Uranium (47 mg/kg)
Vanadium (160 mg/kg)

Waste P e M10B

Drains From Mesa 1 1/2 M e

SHEET DC3E - 3

SHEET DC3E - 2

Sediment Sample Location*

Gamma Reading (cpm)**

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

Survey Area Boundary
Non-AUM Target Site Boundary
Closed Portal
Closed Prospect
Waste Pile - Unreclaimed
Drainage - Field Mapped
Drainage - Estimated Path

Note:
*Red font indicates sample COPC concentration above BTV value for the relevant analyte. '<' indicates a less than limit of detection laboratory non-detect.

1 in = 100 ft

1:1,200

N W E S

0 50 100 200 Feet

COVE WASH MIDDLE 3E DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	Date: 6/6/2019

Note:
*The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

Figure No.: **DC3E - 3**

G:\PROJECTS\EPA_RAES-NAVAJO NATION_100G5440\TASK ORDERS\TO-001_NORTHERN AGENCY RSE\WORKING FILES\GIS\MXD\TO01\FINAL_REPORT\DRAINAGES\DC3E (MIDDLE 3E)\DC3E_DRAINAGE_SAMPLES.MXD 06/06/19

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

Waste Pile M5

Middle 3 (DC3)

Waste Pile M5

M5-SD1-01-062318
Arsenic (2.8 mg/kg)
Lead (7.7 mg/kg)
Molybdenum (0.39 mg/kg)
Radium-226 (64.4 pCi/g)
Selenium (7 mg/kg)
Thorium (1.8 mg/kg)
Uranium (100 mg/kg)
Vanadium (360 mg/kg)

M1-04 (T16)
Non-AUM Target

DC3E-SD1-01-062318
Arsenic (1.5 mg/kg)
Lead (3.3 mg/kg)
Molybdenum (0.15 mg/kg)
Radium-226 (3.11 pCi/g)
Selenium (0.41 mg/kg)
Thorium (1.7 mg/kg)
Uranium (3.2 mg/kg)
Vanadium (19 mg/kg)

DC3E-SD1-01-082118
Arsenic (2.3 mg/kg)
Lead (3.8 mg/kg)
Molybdenum (0.44 mg/kg)
Radium-226 (7.7 pCi/g)
Selenium (0.43 mg/kg)
Thorium (1.5 mg/kg)
Uranium (3.5 mg/kg)
Vanadium (40 mg/kg)

Middle 3A (DC3A)

Middle 3E (DC3E)

Poor GPS Signal

Poor GPS Signal

M1-05 (T35)
Non-AUM Target

DC3E-SD2-01-062318
Arsenic (1.7 mg/kg)
Lead (4 mg/kg)
Molybdenum (0.13 mg/kg)
Radium-226 (5.43 pCi/g)
Selenium (0.66 mg/kg)
Thorium (2.3 mg/kg)
Uranium (11 mg/kg)
Vanadium (32 mg/kg)

DC3E-SD3-01-062318
Arsenic (1.4 mg/kg)
Lead (3.6 mg/kg)
Molybdenum (0.11 mg/kg)
Radium-226 (3.54 pCi/g)
Selenium (0.75 mg/kg)
Thorium (1.9 mg/kg)
Uranium (3.2 mg/kg)
Vanadium (19 mg/kg)

Mesa I Camp (T17)

Mesa I Mine 12 (M5)

Portal 21

Portal 22

Portal 23

Waste Pile M5

Mesa I Mine 14 (M7)

SHEET DC3E - 4
SHEET DC3E - 3

⊕ Sediment Sample Location*

Gamma Reading (cpm)**

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

AUM Site Boundary
Survey Area Boundary
Non-AUM Target Site Boundary
Closed Portal
Closed Prospect
Waste Pile - Unreclaimed
Drainage - Field Mapped
Drainage - Estimated Path

Note:
*Red font indicates sample COPC concentration above BTV value for the relevant analyte. '<' indicates a less than limit of detection laboratory non-detect.

1 in = 100 ft

1:1,200

N W E S

0 50 100 200 Feet

COVE WASH MIDDLE 3E DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	Date: 6/6/2019

Note:
*The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

Figure No.: **DC3E - 4**

G:\PROJECTS\EPA_RAES-NAVAJO NATION_105G5401\TASK ORDERS\TO-001_NORTHERN AGENCY RSE\WORKING FILES\GIS\MXD\TO01\FINAL_REPORT\DRAINAGES\DC3E (MIDDLE 3E)\DC3E_DRAINAGE_SAMPLES.MXD 06/06/19

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

- Sediment Sample Locations
- Survey Index Sheet
- AUM Site Boundary
- Non-AUM Target Site Boundary
- AUM Related Site Boundary
- Background Location
- Non-Tronox AUM Site
- Drainage*
- Drainage - Field Mapped

1 in = 1,000 ft

1:12,000

N W E S

0 500 1,000 2,000 Feet

MIDDLE 3F
DRAINAGE SURVEY INDEX MAP

Prepared For:

Prepared By:

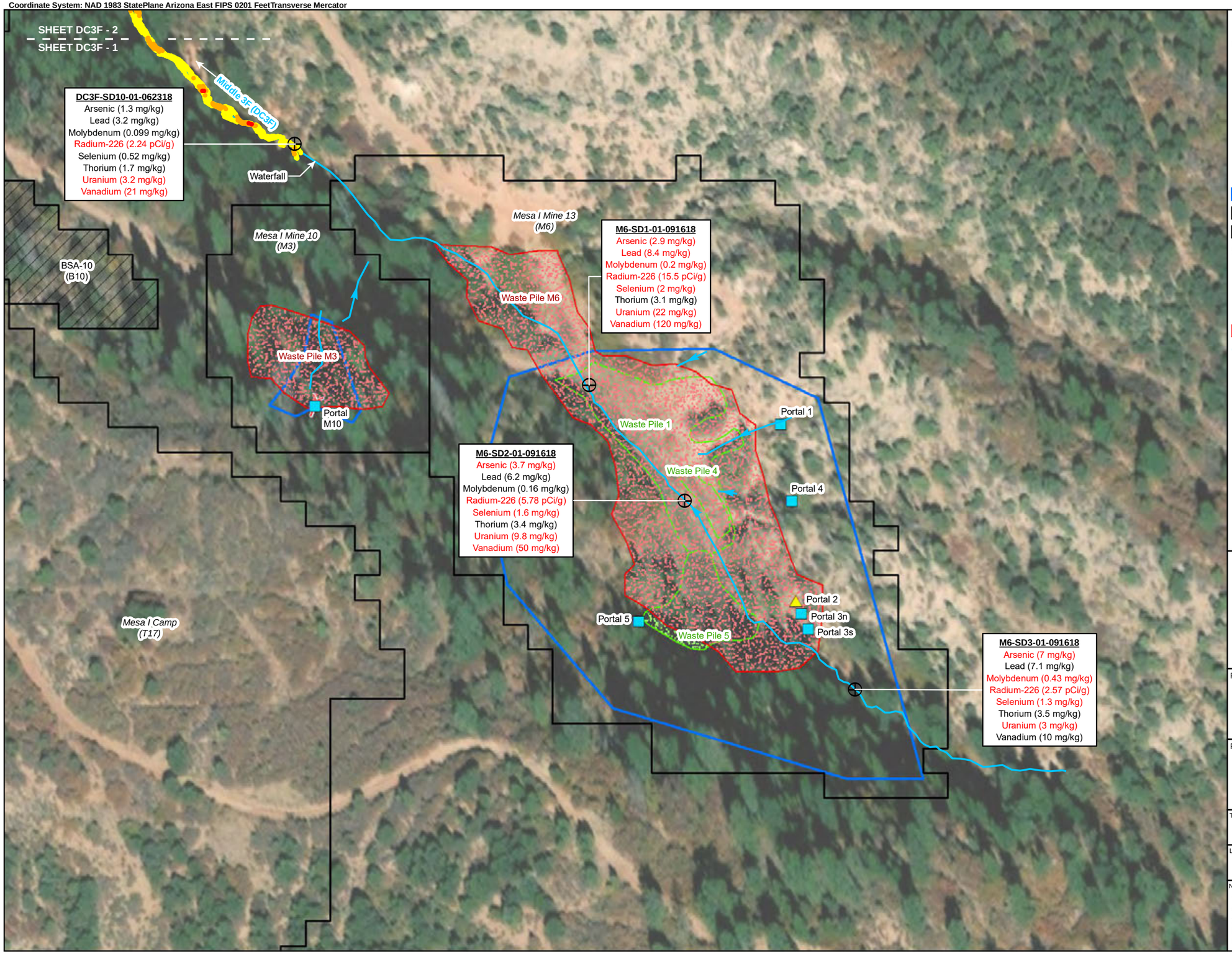
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 7/8/2019

Note:
*U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DC3F - I**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



Sediment Sample Location*

Gamma Reading (cpm)**

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

AUM Site Boundary
Survey Area Boundary
Background Location

Site Features

Closed Portal
Closed Prospect
Open Portal
Waste Pile - Unreclaimed
Drainage - Field Mapped

Note:
*Red font indicates sample COPC concentration above BTV value for the relevant analyte.

1 in = 125 ft

1:1,500

N W E S

0 62.5 125 250 Feet

COVE WASH MIDDLE 3F DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

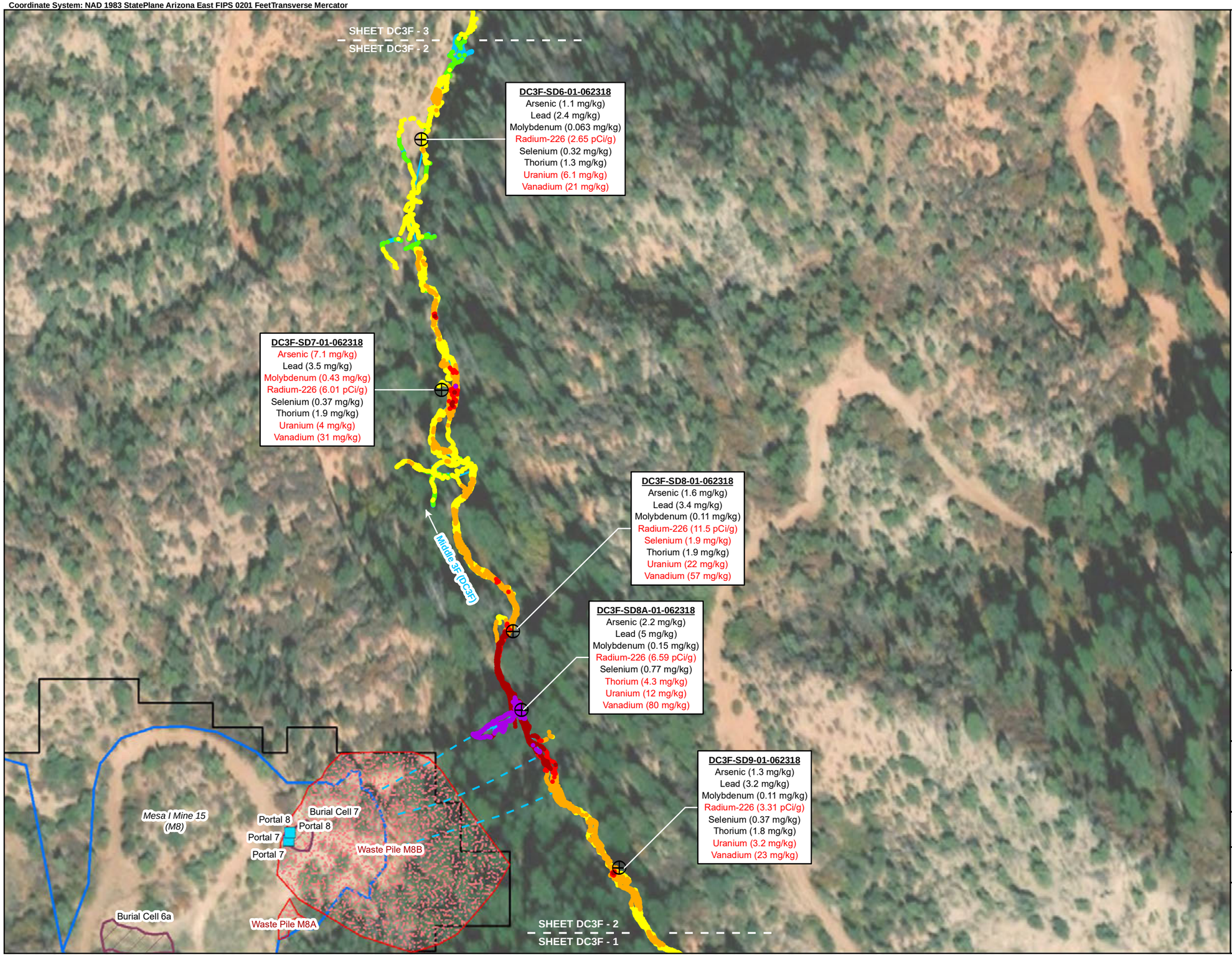
TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	Date: 7/9/2019

Note:
*The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

Figure No.:
DC3F - 1

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



Sediment Sample Location*

Gamma Reading (cpm)**

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

AUM Site Boundary

Survey Area Boundary

Site Features

Closed Portal

Burial Cell

Waste Pile - Unreclaimed

Drainage - Field Mapped

Drainage - Estimated Path

Note:
*Red font indicates sample COPC concentration above BTV value for the relevant analyte.

1 in = 125 ft

1:1,500

N W E S

0 62.5 125 250 Feet

COVE WASH MIDDLE 3F DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

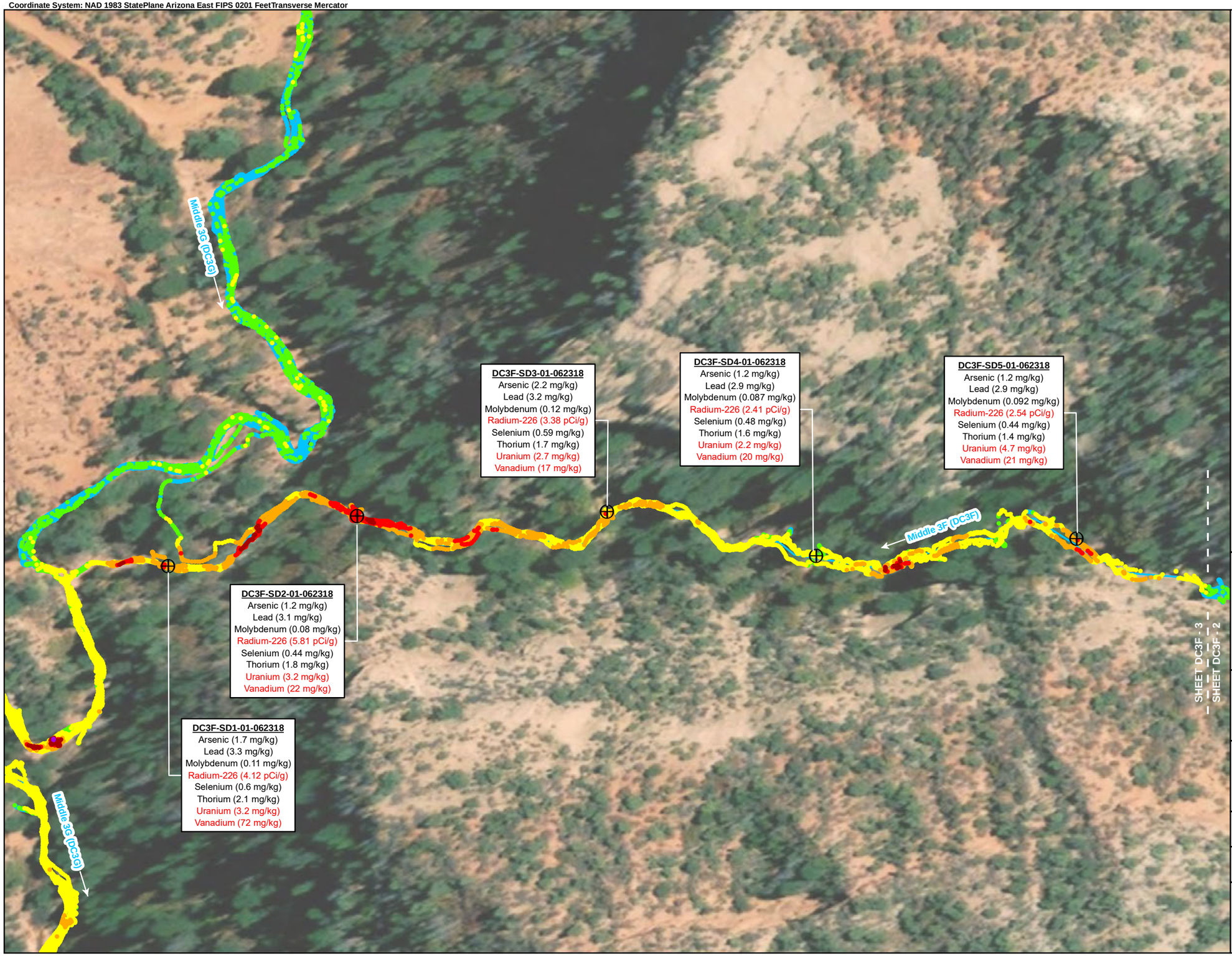
TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.: TO0001	Contract No.: EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	Date: 7/9/2019

Note:
*The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

Figure No.: **DC3F - 2**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



⊕ Sediment Sample Location*

Gamma Reading (cpm)**

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

Drainage - Field Mapped

Note:
*Red font indicates sample COPC concentration above BTV value for the relevant analyte.

1 in = 125 ft

1:1,500

0 62.5 125 250 Feet

N E S W

COVE WASH MIDDLE 3F DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

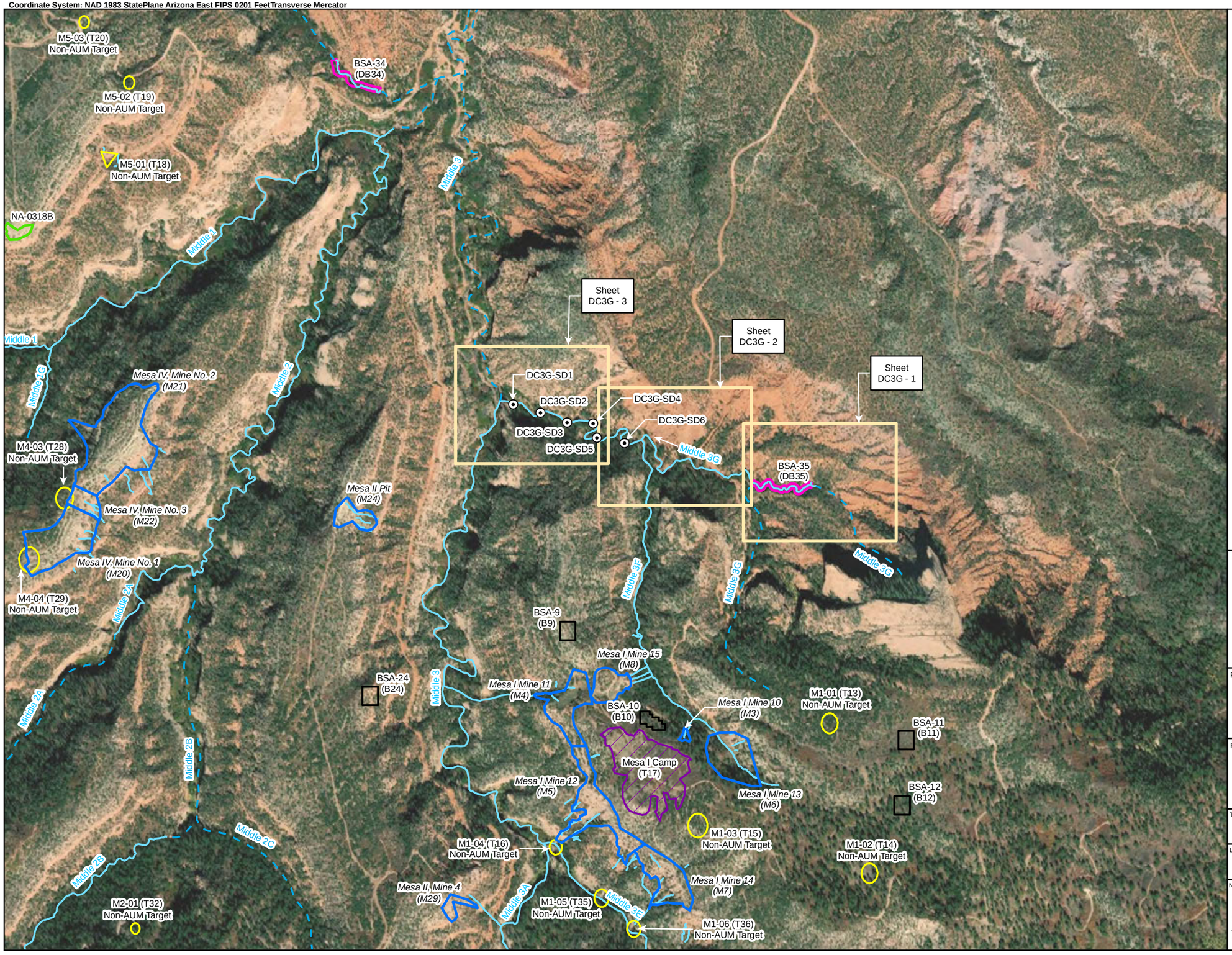
TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	Date: 7/9/2019

Note:
*The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

Figure No.: **DC3F - 3**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



- Sediment Sample Locations
- Survey Index Sheet
- AUM Site Boundary
- Non-AUM Target Site Boundary
- AUM Related Site Boundary
- Drainage Background Location
- Background Location
- Non-Tronox AUM Site
- Drainage*
- Drainage - Field Mapped

1 in = 1,000 ft

1:12,000

N W E S

0 500 1,000 2,000 Feet

COVE WASH MIDDLE 3G DRAINAGE SURVEY INDEX MAP

Prepared For:

Prepared By:

1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 7/8/2019

Note:
*U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.:

DC3G - I

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

⊕ Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

Drainage Background Location

Drainage[3]

Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

1 in = 125 ft

1:1,500

N W E S

0 62.5 125 250 Feet

COVE WASH MIDDLE 3G DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

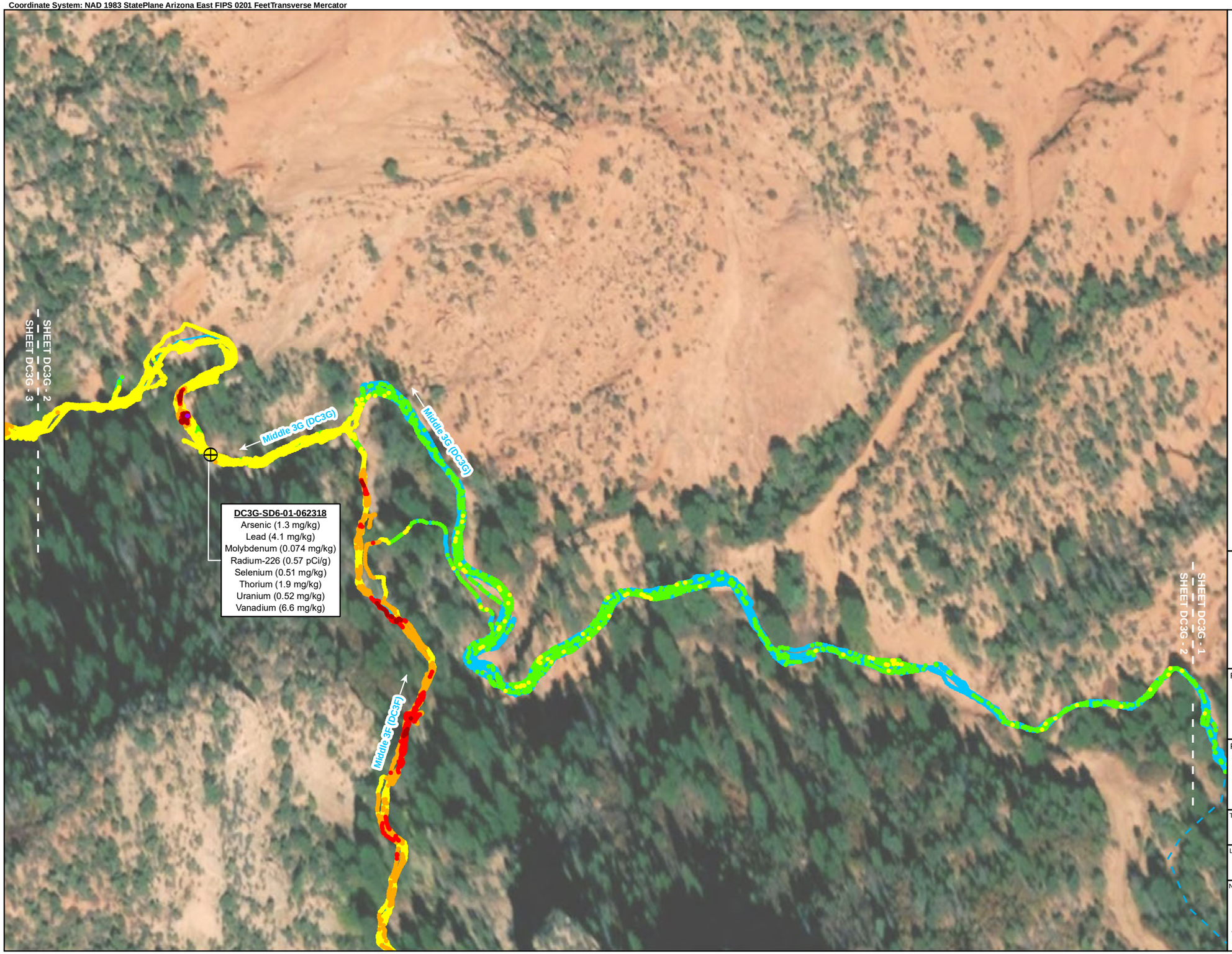
TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	Date: 5/6/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DC3G - 1**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



⊕ Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

Drainage[3]

Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

1 in = 125 ft

1:1,500

N W E S

0 62.5 125 250 Feet

COVE WASH MIDDLE 3G DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

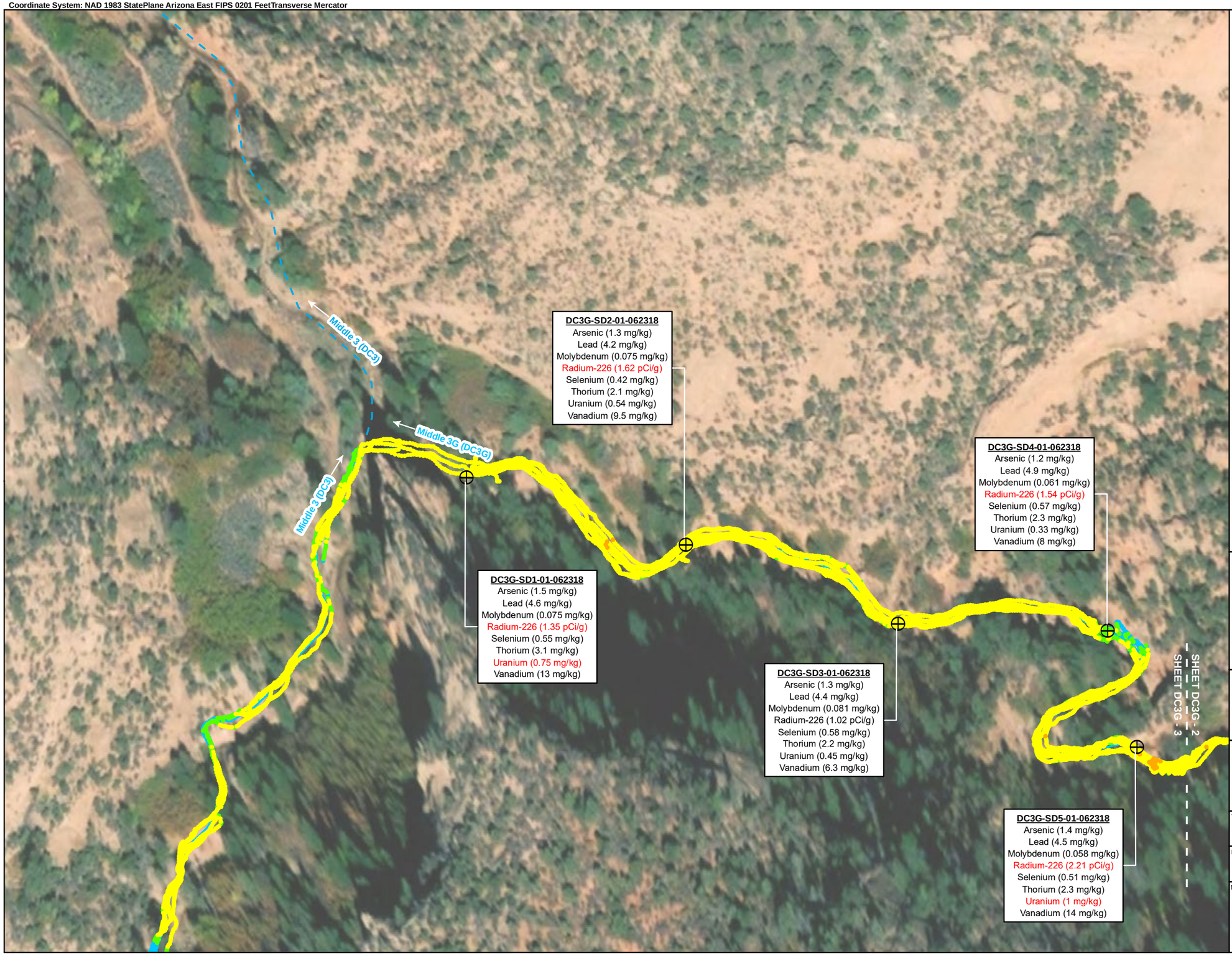
TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	**Date:** 5/6/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DC3G - 2**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



⊕ Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

Drainage[3]

Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

1 in = 125 ft

1:1,500

N W E S

0 62.5 125 250 Feet

COVE WASH MIDDLE 3G DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

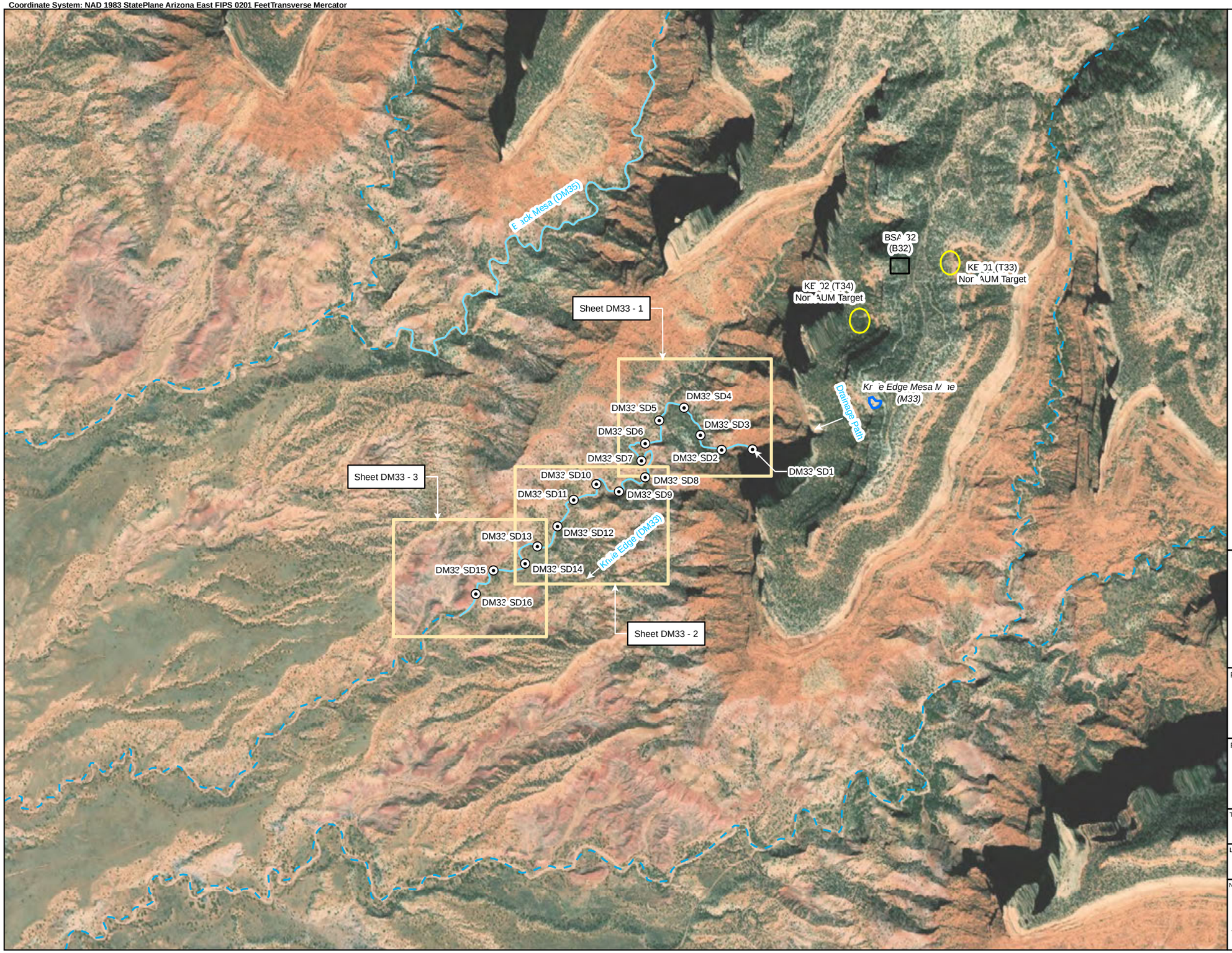
TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.: TO0001	Contract No.: EP-S9-17-03
Location: COVE CHAPTER NAVAJO NATION	Date: 5/6/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DC3G - 3**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



- Sediment Sample Locations
- Survey Index Sheet
- AUM Site Boundary
- Non-AUM Target Site Boundary
- Background Location
- Drainage*
- Drainage - Field Mapped

1 in = 1,000 ft

1:12,000

N W E S

0 500 1,000 2,000 Feet

KNIFE EDGE MESA MINE
DRAINAGE SURVEY INDEX MAP

Prepared For:

Prepared By:

1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: LUKACHUKAI CHAPTER NAVAJO NATION	Date: 7/8/2019

Note:
*U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DM33 - I**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

DM33-SD4-01-081818
Arsenic (1.9 mg/kg)
Lead (6.2 mg/kg)
Molybdenum (0.073 mg/kg)
Radium-226 (1.23 pCi/g)
Selenium (0.62 mg/kg)
Thorium (3.4 mg/kg)
Uranium (0.61 mg/kg)
Vanadium (8.4 mg/kg)

DM33-SD5-01-081818
Arsenic (2.9 mg/kg)
Lead (5.5 mg/kg)
Molybdenum (0.13 mg/kg)
Radium-226 (0.58 pCi/g)
Selenium (0.57 mg/kg)
Thorium (3 mg/kg)
Uranium (0.73 mg/kg)
Vanadium (10 mg/kg)

DM33-SD7-01-081818
Arsenic (3.4 mg/kg)
Lead (7 mg/kg)
Molybdenum (0.081 mg/kg)
Radium-226 (0.84 pCi/g)
Selenium (0.76 mg/kg)
Thorium (3.4 mg/kg)
Uranium (0.42 mg/kg)
Vanadium (13 mg/kg)

DM33-SD3-01-081818
Arsenic (1.9 mg/kg)
Lead (6.6 mg/kg)
Molybdenum (0.092 mg/kg)
Radium-226 (0.86 pCi/g)
Selenium (0.64 mg/kg)
Thorium (3.4 mg/kg)
Uranium (0.43 mg/kg)
Vanadium (8.5 mg/kg)

DM33-SD2-01-081818
Arsenic (1.5 mg/kg)
Lead (5.1 mg/kg)
Molybdenum (0.085 mg/kg)
Radium-226 (0.94 pCi/g)
Selenium (0.49 mg/kg)
Thorium (2.3 mg/kg)
Uranium (0.4 mg/kg)
Vanadium (7 mg/kg)

DM33-SD1-01-081818
Arsenic (1.5 mg/kg)
Lead (5.3 mg/kg)
Molybdenum (0.093 mg/kg)
Radium-226 (0.84 pCi/g)
Selenium (0.54 mg/kg)
Thorium (2.6 mg/kg)
Uranium (0.49 mg/kg)
Vanadium (8.6 mg/kg)

DM33-SD6-01-081818
Arsenic (2.6 mg/kg)
Lead (5.5 mg/kg)
Molybdenum (0.12 mg/kg)
Radium-226 (0.62 pCi/g)
Selenium (0.59 mg/kg)
Thorium (2.7 mg/kg)
Uranium (0.46 mg/kg)
Vanadium (9.8 mg/kg)

Knife Edge (DM33)

Drains From Knife Edge Mesa Mine

SHEET DM33 - 1
SHEET DM33 - 2

⊕ Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

1 in = 125 ft

1:1,500

N W E S

0 62.5 125 250 Feet

KNIFE EDGE MESA MINE DRAINAGE GAMMA RADIATION SURVEY MAP AND SEDIMENT SAMPLE LOCATIONS

Prepared For:

Prepared By:

TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.: TO0001	Contract No.: EP-S9-17-03
Location: LUKACHUKAI CHAPTER NAVAJO NATION	Date: 5/6/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DM33 - 1**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

DM33-SD10-01-081818
Arsenic (3 mg/kg)
Lead (6.1 mg/kg)
Molybdenum (0.056 mg/kg)
Radium-226 (0.68 pCi/g)
Selenium (0.66 mg/kg)
Thorium (3.7 mg/kg)
Uranium (0.41 mg/kg)
Vanadium (13 mg/kg)

DM33-SD11-01-081818
Arsenic (3.3 mg/kg)
Lead (7.1 mg/kg)
Molybdenum (0.078 mg/kg)
Radium-226 (0.63 pCi/g)
Selenium (0.65 mg/kg)
Thorium (3.4 mg/kg)
Uranium (0.44 mg/kg)
Vanadium (15 mg/kg)

DM33-SD12-01-081818
Arsenic (3.5 mg/kg)
Lead (7.4 mg/kg)
Molybdenum (0.1 mg/kg)
Radium-226 (0.69 pCi/g)
Selenium (0.73 mg/kg)
Thorium (3.9 mg/kg)
Uranium (0.37 mg/kg)
Vanadium (14 mg/kg)

DM33-SD13-01-081818
Arsenic (2.9 mg/kg)
Lead (6.2 mg/kg)
Molybdenum (0.081 mg/kg)
Radium-226 (0.49 pCi/g)
Selenium (0.66 mg/kg)
Thorium (3.3 mg/kg)
Uranium (0.4 mg/kg)
Vanadium (13 mg/kg)

DM33-SD14-01-081818
Arsenic (4.1 mg/kg)
Lead (6.9 mg/kg)
Molybdenum (0.086 mg/kg)
Radium-226 (0.65 pCi/g)
Selenium (0.79 mg/kg)
Thorium (3.9 mg/kg)
Uranium (0.41 mg/kg)
Vanadium (16 mg/kg)

DM33-SD9-01-081818
Arsenic (3.4 mg/kg)
Lead (7.8 mg/kg)
Molybdenum (0.087 mg/kg)
Radium-226 (0.99 pCi/g)
Selenium (0.72 mg/kg)
Thorium (4.1 mg/kg)
Uranium (0.51 mg/kg)
Vanadium (14 mg/kg)

DM33-SD8-01-081818
Arsenic (3.9 mg/kg)
Lead (6.4 mg/kg)
Molybdenum (0.087 mg/kg)
Radium-226 (0.59 pCi/g)
Selenium (0.68 mg/kg)
Thorium (3.9 mg/kg)
Uranium (0.46 mg/kg)
Vanadium (15 mg/kg)

Knife Edge (DM33)

SHEET DM33 - 1
SHEET DM33 - 2
SHEET DM33 - 3

Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

1 in = 125 ft

1:1,500

N W E S

0 62.5 125 250 Feet

KNIFE EDGE MESA MINE DRAINAGE GAMMA RADIATION SURVEY MAP AND SEDIMENT SAMPLE LOCATIONS

Prepared For:

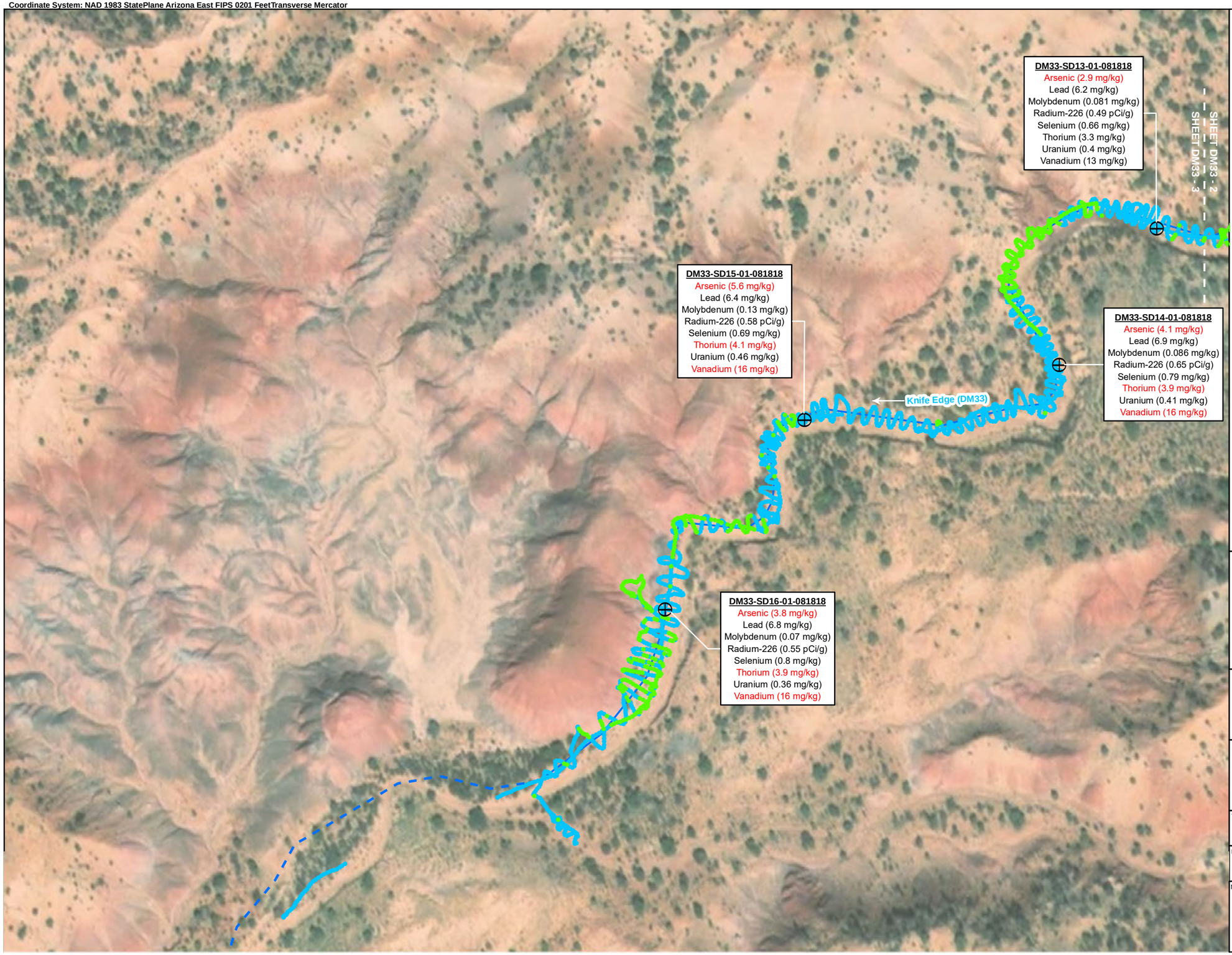
Prepared By:
TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: LUKACHUKAI CHAPTER NAVAJO NATION	Date: 5/6/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DM33 - 2**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



⊕ Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

Drainage[3]

Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

1 in = 125 ft

1:1,500

N W E S

0 62.5 125 250 Feet

KNIFE EDGE MESA MINE DRAINAGE GAMMA RADIATION SURVEY MAP AND SEDIMENT SAMPLE LOCATIONS

Prepared For:

Prepared By:

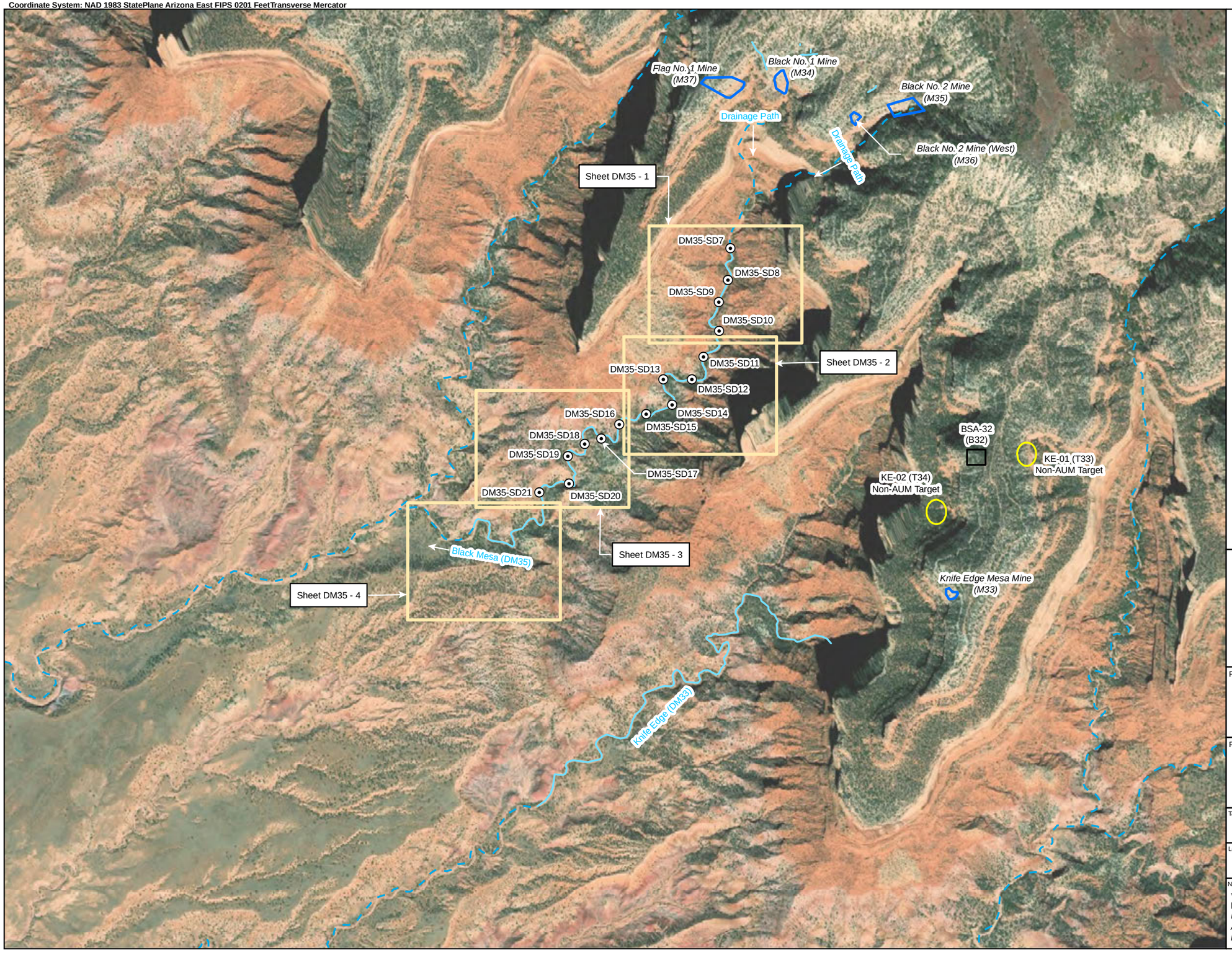
TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: LUKACHUKAI CHAPTER NAVAJO NATION	Date: 5/6/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DM33 - 3**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



- Sediment Sample Locations
- Survey Index Sheet
- AUM Site Boundary
- Non-AUM Target Site Boundary
- Background Location
- Drainage*
- Drainage - Field Mapped

1 in = 1,000 ft

1:12,000

N W E S

0 500 1,000 2,000 Feet

BLACK AND FLAG MESA MINE COMPLEXES DRAINAGE SURVEY INDEX MAP

Prepared For:

Prepared By:

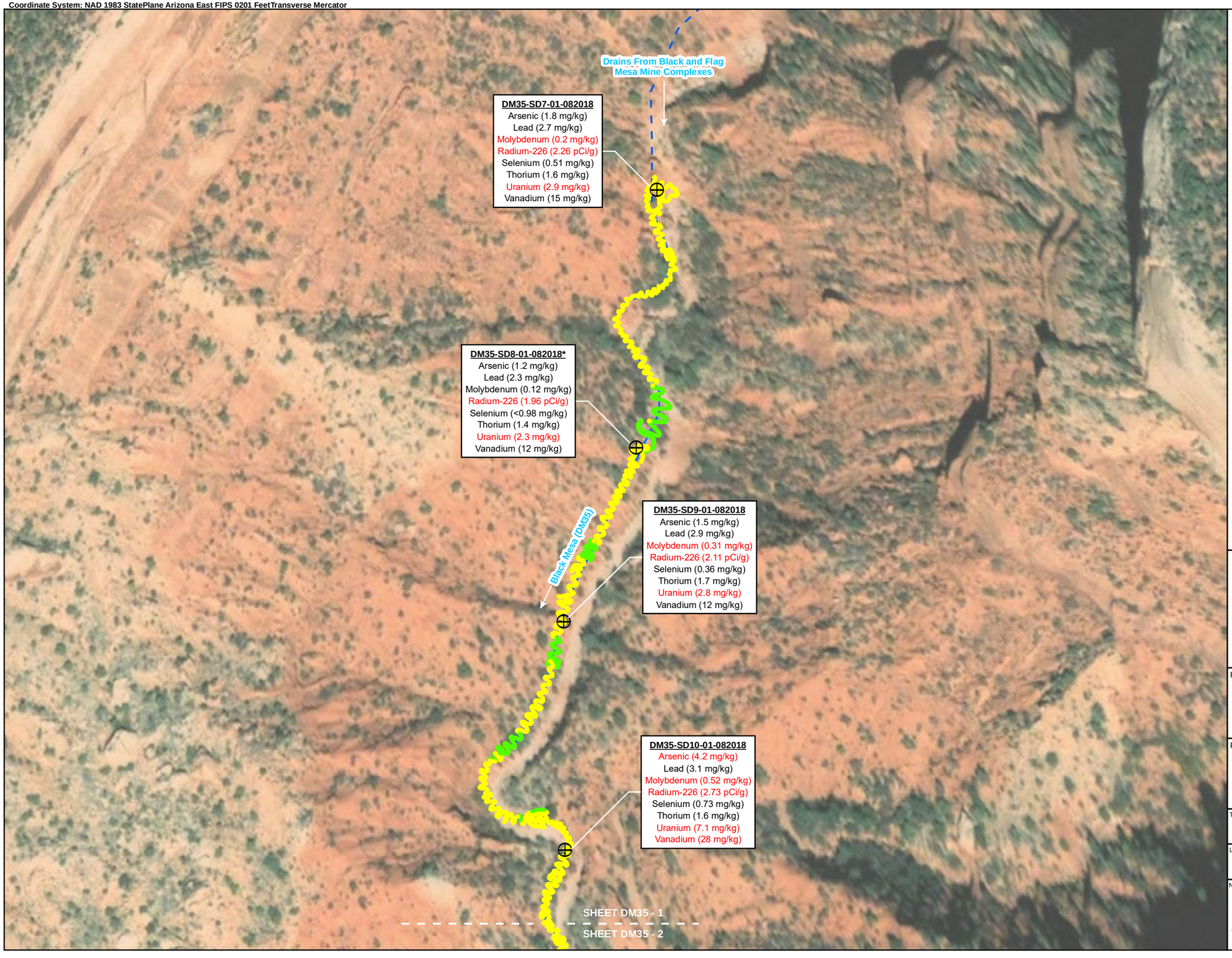
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: LUKACHUKAI CHAPTER NAVAJO NATION	**Date:** 7/8/2019

Note:
*U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DM35-I**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

Drainage[3]

Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte. '<' indicates less than limit of detection laboratory non-detect.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

1 in = 125 ft

1:1,500

N W E S

0 62.5 125 250 Feet

BLACK AND FLAG MESA DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

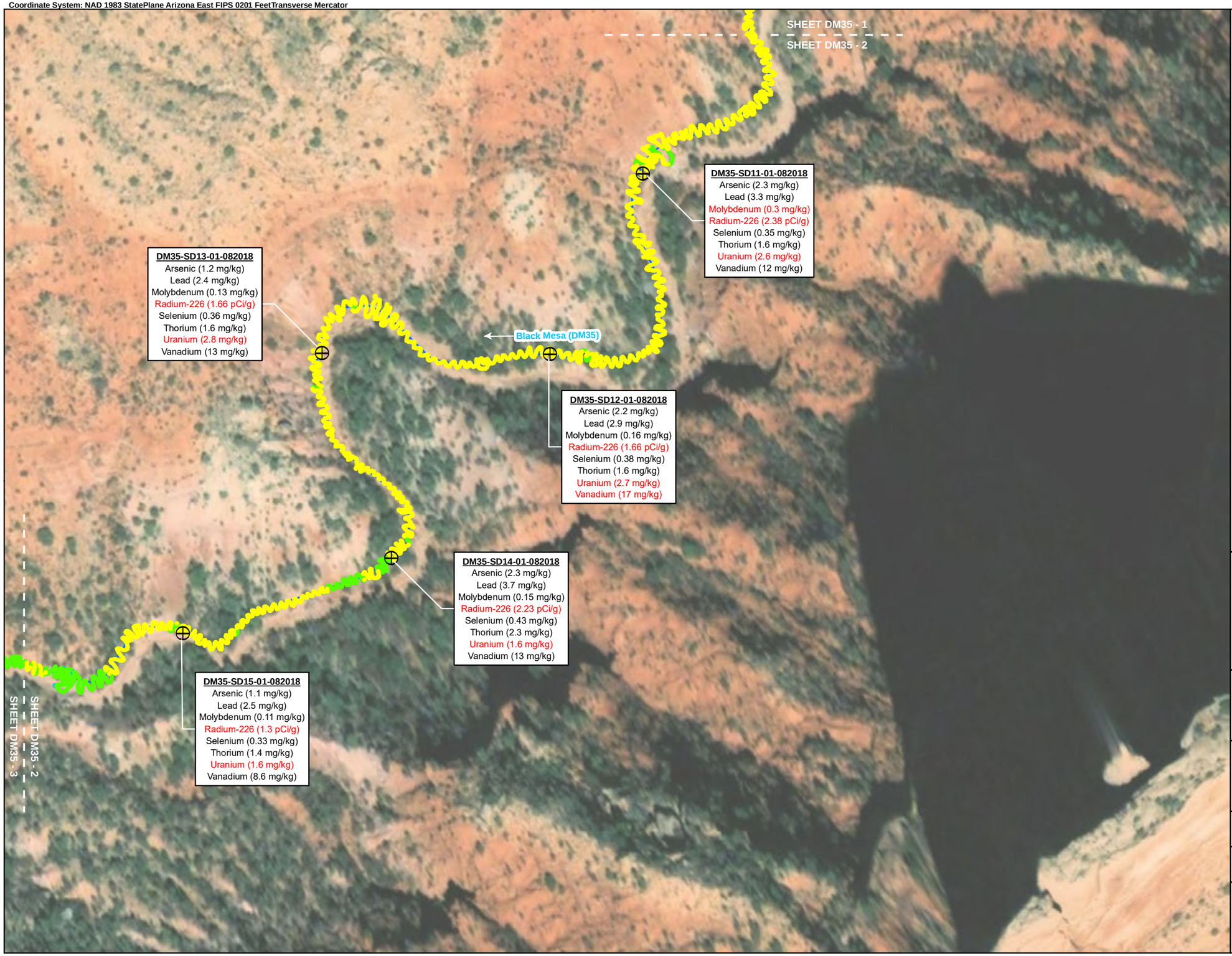
TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: LUKACHUKAI CHAPTER NAVAJO NATION	Date: 5/6/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DM35 - 1**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



⊕ Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte. '<' indicates less than limit of detection laboratory non-detect.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

1 in = 125 ft

1:1,500

N W E S

0 62.5 125 250 Feet

BLACK AND FLAG MESA DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

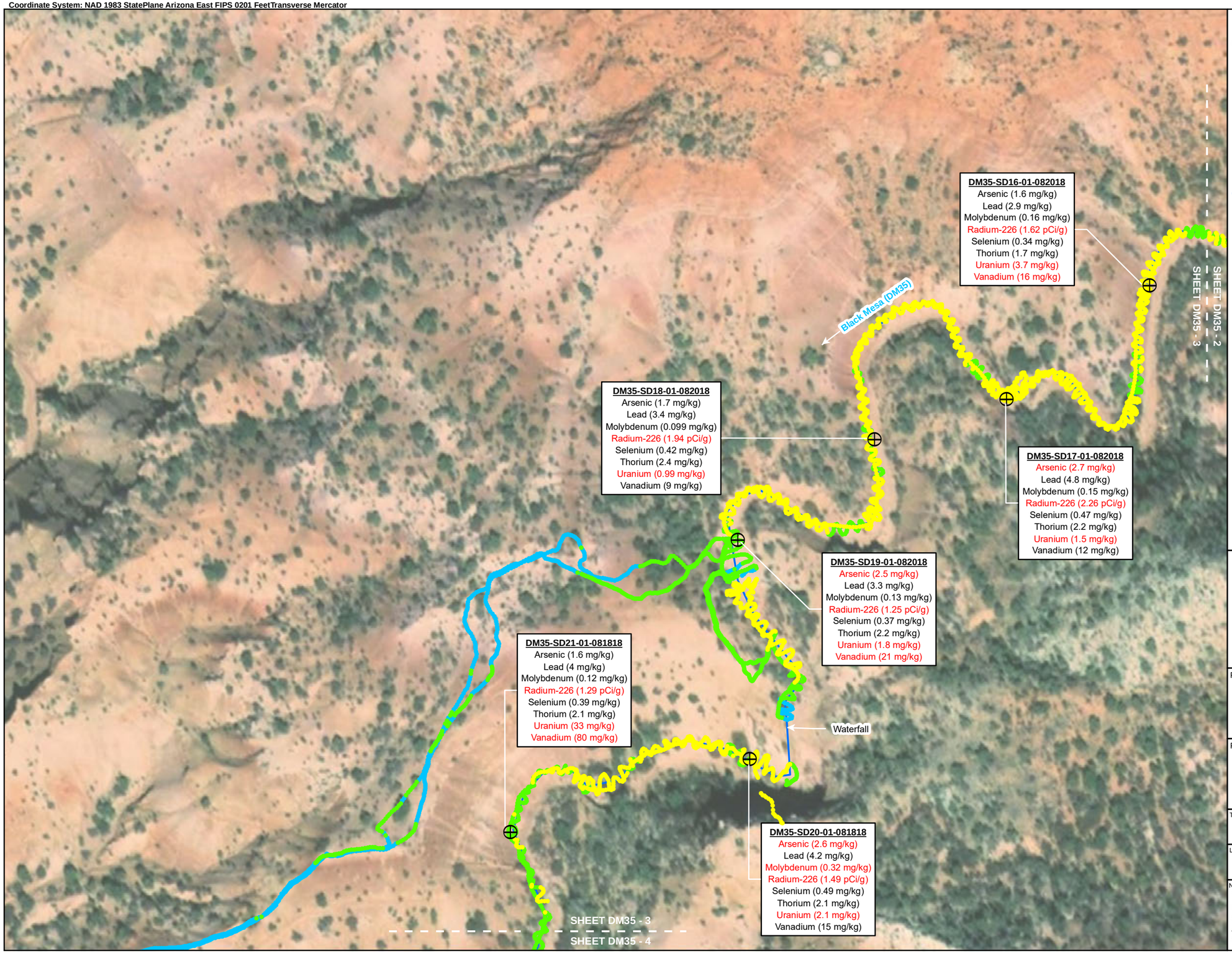
TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: LUKACHUKAI CHAPTER NAVAJO NATION	**Date:** 5/6/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navajo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DM35 - 2**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



⊕ Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte. '<' indicates less than limit of detection laboratory non-detect.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

1 in = 125 ft

1:1,500

N W E S

0 62.5 125 250 Feet

BLACK AND FLAG MESA DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

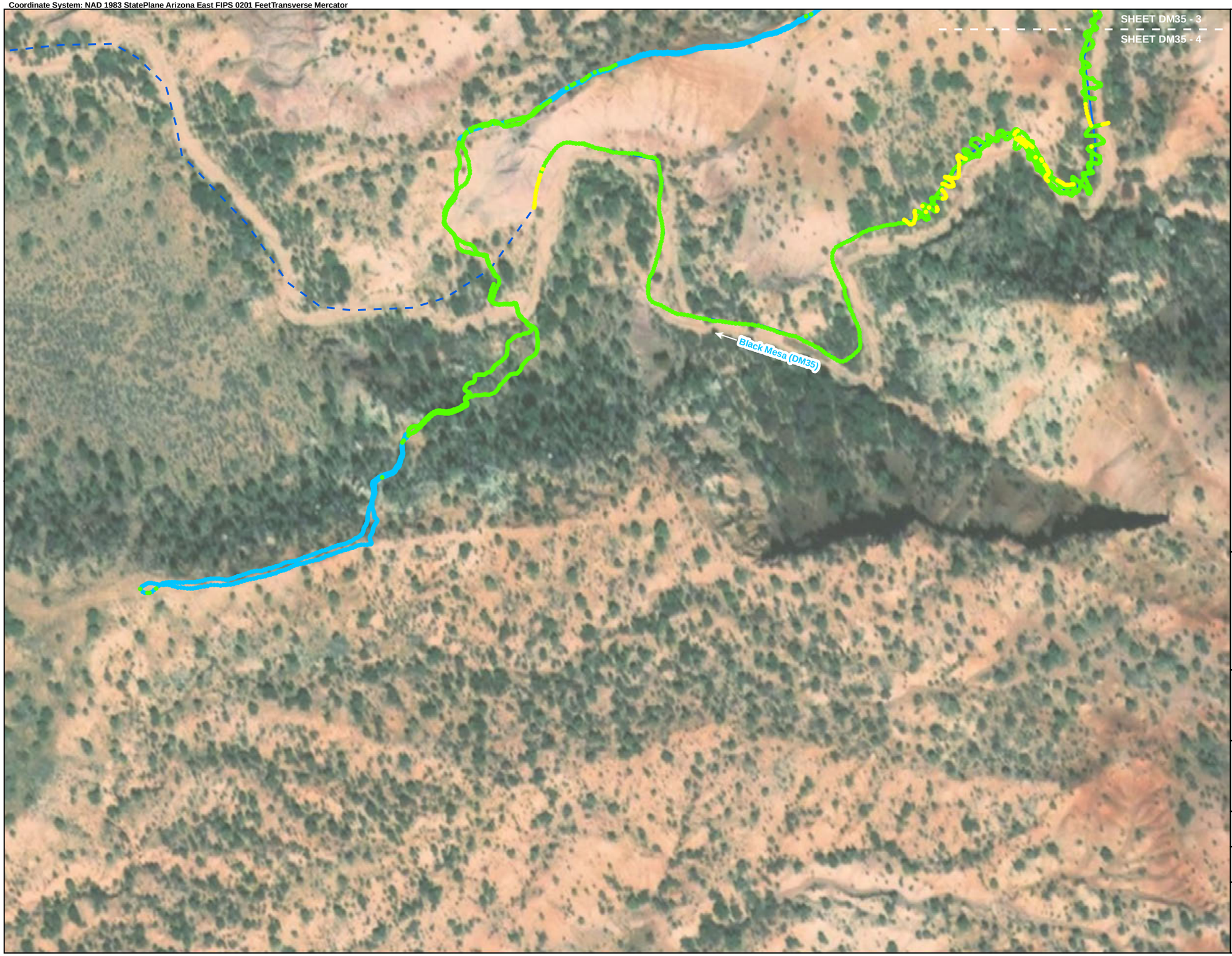
TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.: TO0001	Contract No.: EP-S9-17-03
Location: LUKACHUKAI CHAPTER NAVAJO NATION	Date: 5/6/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DM35 - 3**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

Drainage[3]

Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte. '<' indicates less than limit of detection laboratory non-detect.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

1 in = 125 ft

1:1,500

N W E S

0 62.5 125 250 Feet

BLACK AND FLAG MESA DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

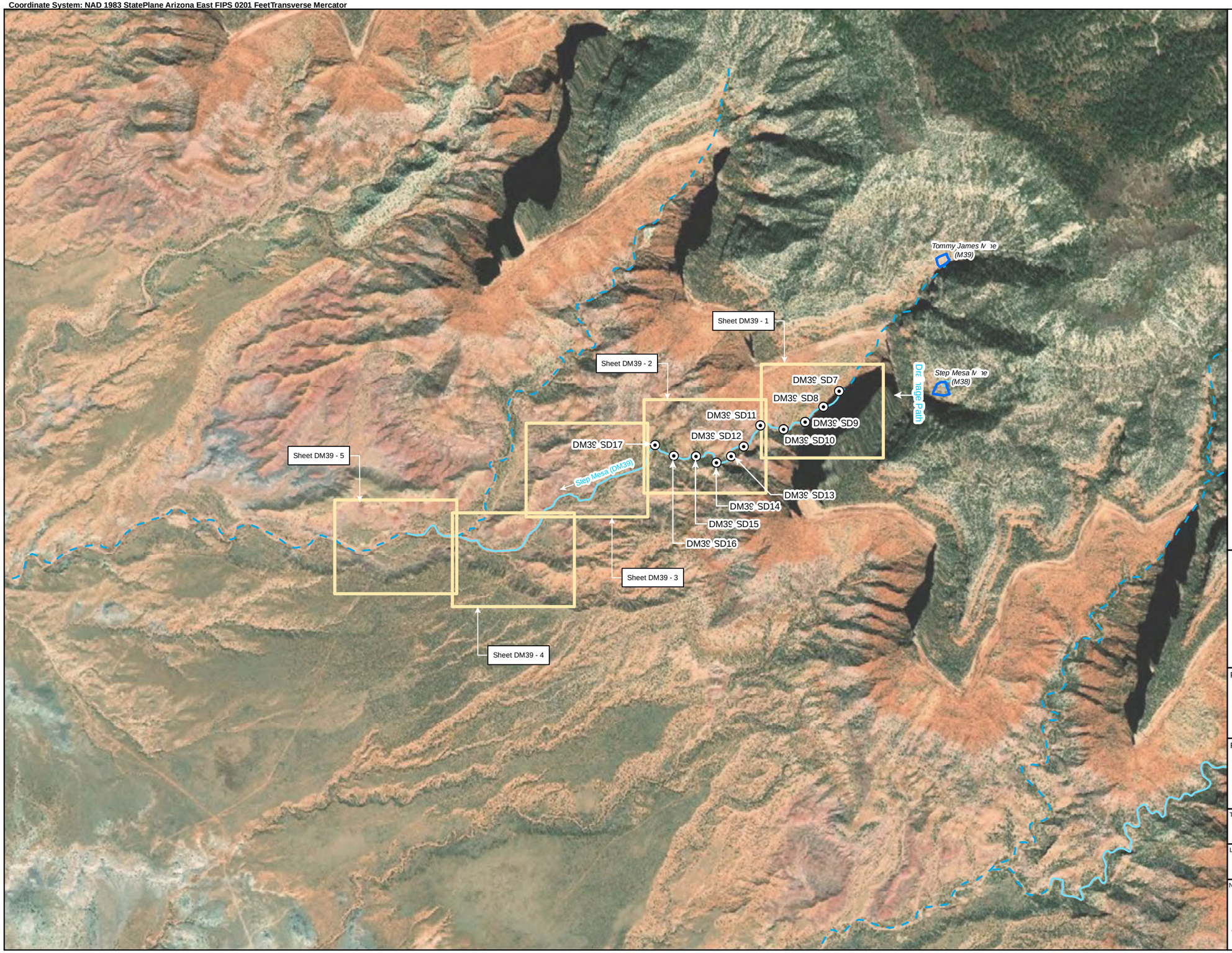
TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: LUKACHUKAI CHAPTER NAVAJO NATION	Date: 5/6/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DM35 - 4**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



1 in = 1,253 ft

1:15,040

N
W E
S

0 500 1,000 2,000 Feet

STEP MESA AND TOMMY JAMES MINE COMPLEXES DRAINAGE SURVEY INDEX MAP

Prepared For:

Prepared By:

1999 Harrison Street, Suite 500
Oakland, CA 94612

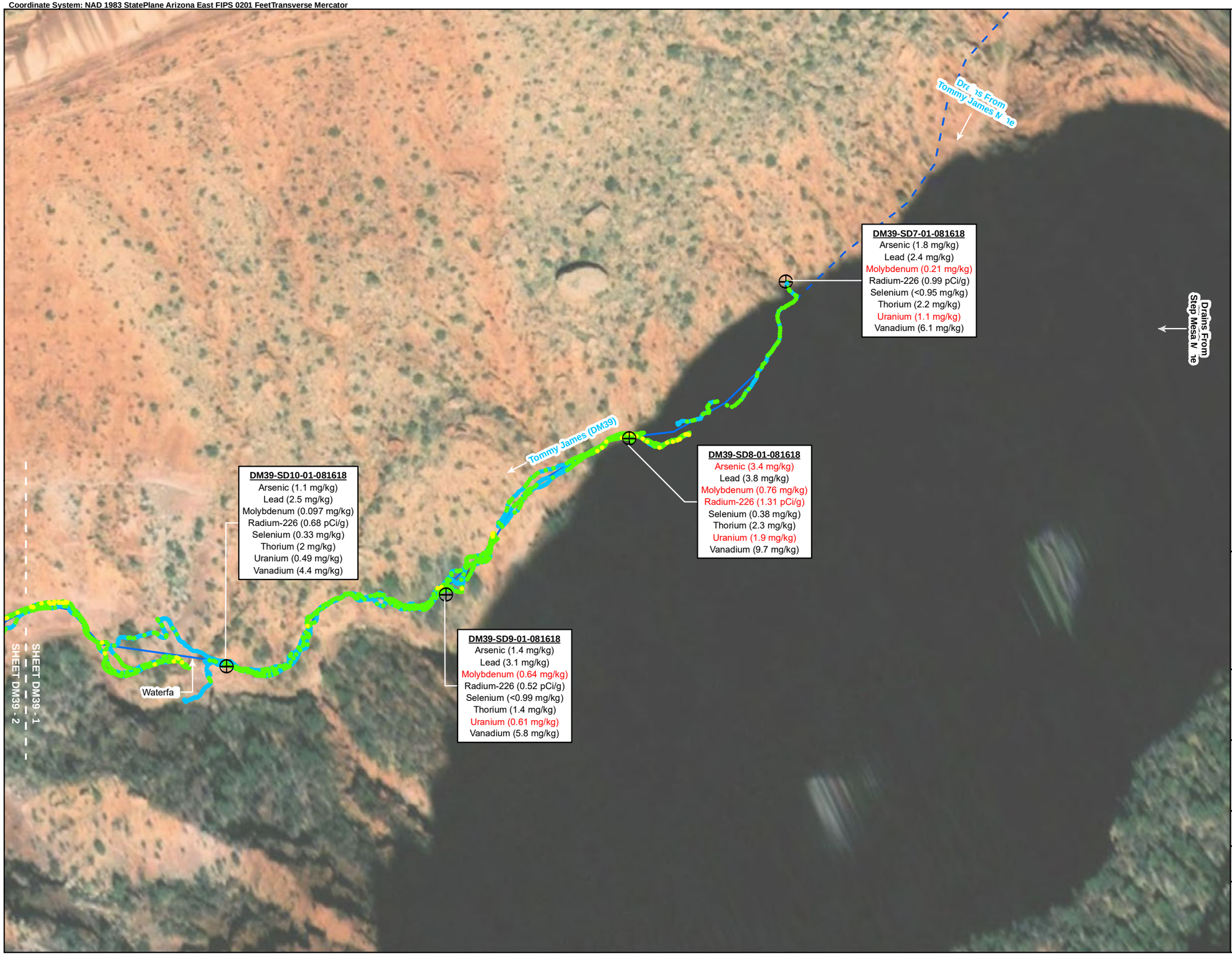
Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: LUKACHUKAI CHAPTER NAVAJO NATION	Date: 7/8/2019

Note:
*U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.:

DM39 - I

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

Drainage[3]

Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte. '<' indicates less than limit of detection laboratory non-detect.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

1 in = 125 ft

1:1,500

N W E S

0 62.5 125 250 Feet

STEP MESA DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By: TETRA TECH

Task Order No.: TO0001	Contract No.: EP-S9-17-03
Location: LUKACHUKAI CHAPTER NAVAJO NATION	Date: 5/6/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DM39 - 1**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator

DM39-SD11-01-081618
Arsenic (1.2 mg/kg)
Lead (2.3 mg/kg)
Molybdenum (0.12 mg/kg)
Radium-226 (0.45 pCi/g)
Selenium (0.37 mg/kg)
Thorium (1.9 mg/kg)
Uranium (0.49 mg/kg)
Vanadium (5.1 mg/kg)

DM39-SD17-01-081618
Arsenic (2.3 mg/kg)
Lead (3.9 mg/kg)
Molybdenum (0.13 mg/kg)
Radium-226 (0.76 pCi/g)
Selenium (0.36 mg/kg)
Thorium (2.6 mg/kg)
Uranium (0.38 mg/kg)
Vanadium (8.7 mg/kg)

DM39-SD14-01-081618
Arsenic (1.8 mg/kg)
Lead (3.5 mg/kg)
Molybdenum (0.12 mg/kg)
Radium-226 (0.75 pCi/g)
Selenium (0.5 mg/kg)
Thorium (2.6 mg/kg)
Uranium (0.59 mg/kg)
Vanadium (7.9 mg/kg)

DM39-SD12-01-081618
Arsenic (1.4 mg/kg)
Lead (2.3 mg/kg)
Molybdenum (0.12 mg/kg)
Radium-226 (0.67 pCi/g)
Selenium (0.32 mg/kg)
Thorium (1.8 mg/kg)
Uranium (0.89 mg/kg)
Vanadium (6.5 mg/kg)

DM39-SD16-01-081618
Arsenic (1.7 mg/kg)
Lead (4.9 mg/kg)
Molybdenum (0.39 mg/kg)
Radium-226 (0.81 pCi/g)
Selenium (0.56 mg/kg)
Thorium (2.9 mg/kg)
Uranium (0.43 mg/kg)
Vanadium (8 mg/kg)

DM39-SD15-01-081618
Arsenic (1.8 mg/kg)
Lead (3.3 mg/kg)
Molybdenum (0.12 mg/kg)
Radium-226 (0.81 pCi/g)
Selenium (0.43 mg/kg)
Thorium (2.4 mg/kg)
Uranium (1.3 mg/kg)
Vanadium (9 mg/kg)

DM39-SD13-01-081618
Arsenic (2.4 mg/kg)
Lead (4.9 mg/kg)
Molybdenum (0.091 mg/kg)
Radium-226 (0.90 pCi/g)
Selenium (0.56 mg/kg)
Thorium (3.2 mg/kg)
Uranium (0.45 mg/kg)
Vanadium (10 mg/kg)

Waterfall

Tommy James (DM39)

SHEET DM39 - 1

SHEET DM39 - 2

SHEET DM39 - 2

SHEET DM39 - 3

Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte. '<' indicates less than limit of detection laboratory non-detect.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

1 in = 125 ft

1:1,500

N W E S

0 62.5 125 250 Feet

STEP MESA DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

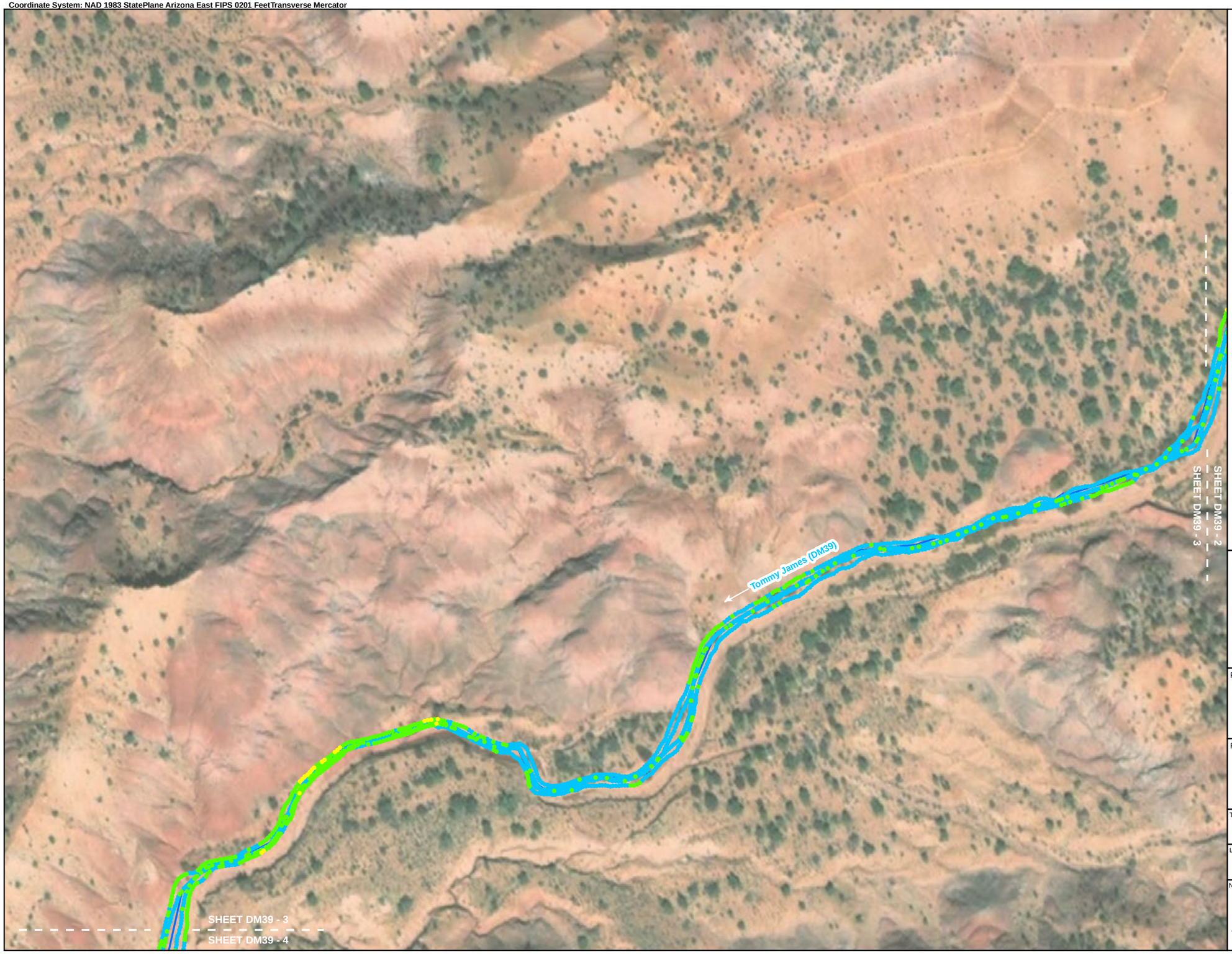
TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: LUKACHUKAI CHAPTER NAVAJO NATION	**Date:** 5/6/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DM39 - 2**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



⊕ Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte. '<' indicates less than limit of detection laboratory non-detect.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

1 in = 125 ft

1:1,500

N W E S

0 62.5 125 250 Feet

STEP MESA DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

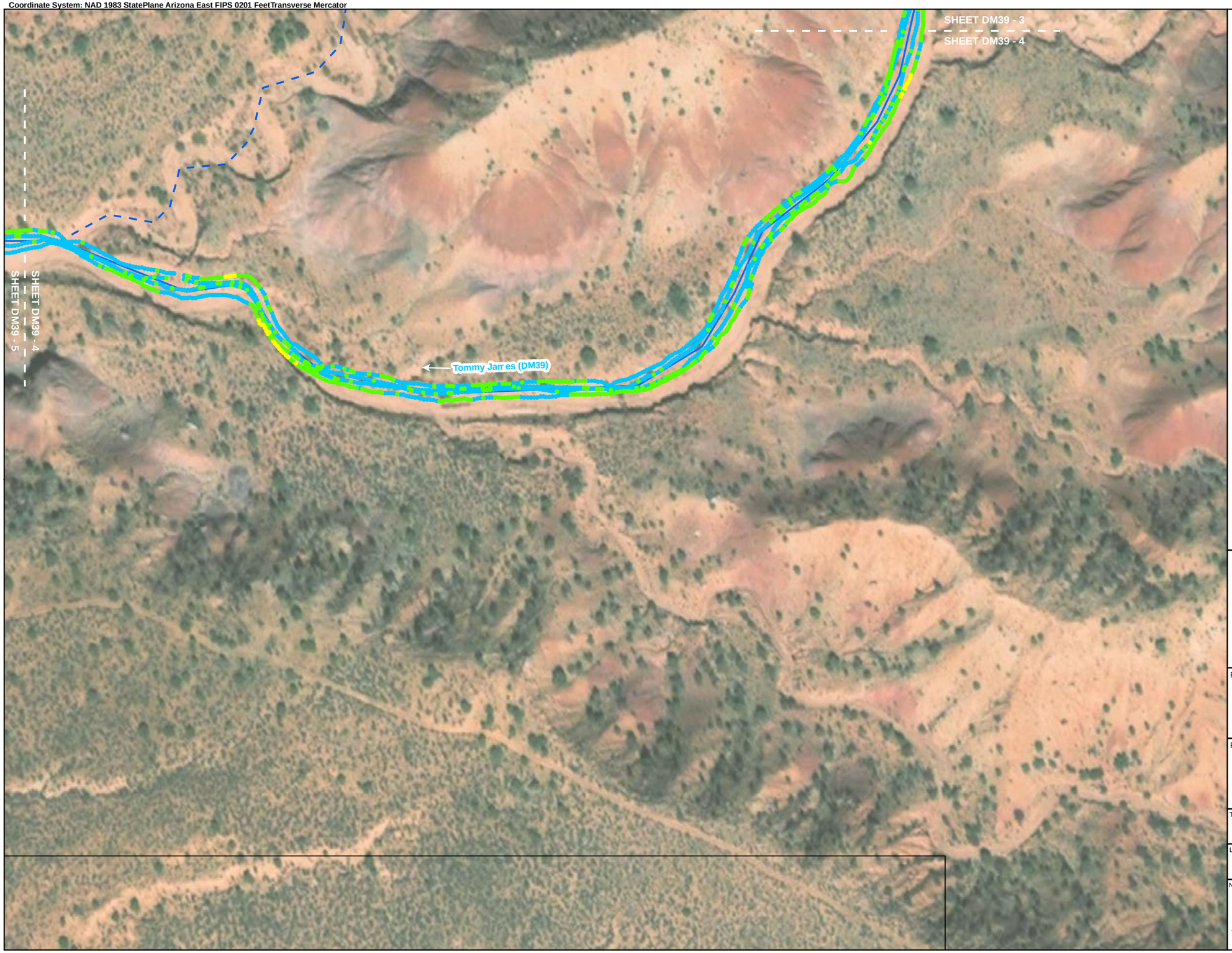
TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.: TO0001	Contract No.: EP-S9-17-03
Location: LUKACHUKAI CHAPTER NAVAJO NATION	Date: 5/6/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DM39 - 3**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



⊕ Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

Drainage[3]

Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte. '<' indicates less than limit of detection laboratory non-detect.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

1 in = 125 ft

1:1,500

N W E S

0 62.5 125 250 Feet

STEP MESA DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By:

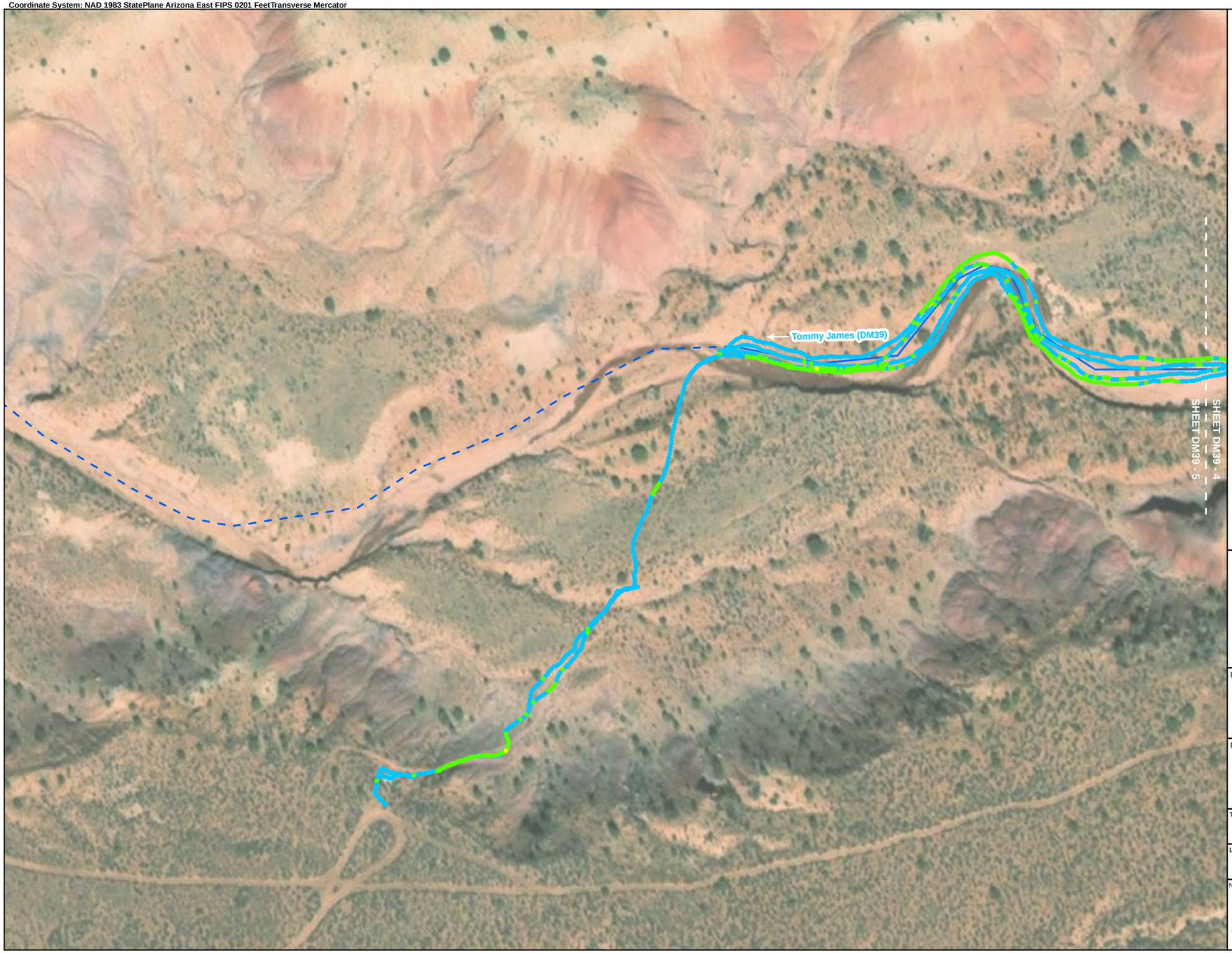
TETRA TECH
1999 Harrison Street, Suite 500
Oakland, CA 94612

Task Order No.:	Contract No.:
TO0001	EP-S9-17-03
Location: LUKACHUKAI CHAPTER NAVAJO NATION	**Date:** 5/6/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DM39 - 4**

Coordinate System: NAD 1983 StatePlane Arizona East FIPS 0201 FeetTransverse Mercator



⊕ Sediment Sample Location[1]

Gamma Reading (cpm)[2]

≤ 10,288	≤ Avg. BG
10,288 - 12,467	Avg. BG - 1 x BTV
12,467 - 24,934	1 x BTV - 2 x BTV
24,934 - 37,401	2 x BTV - 3 x BTV
37,401 - 49,868	3 x BTV - 4 x BTV
49,868 - 124,670	4 x BTV - 10 x BTV
≥ 124,670	≥ 10 x BTV

Drainage[3]

Drainage - Field Mapped

Note:
[1]Red font indicates sample COPC concentration above BTV value for the relevant analyte. '<' indicates less than limit of detection laboratory non-detect.
[2]The applied gamma background threshold value (BTV) is 12,467 cpm derived from the drainage background areas DB34 and DB35. Avg. BG: Average value of the background data set.

1 in = 125 ft

1:1,500

N W E S

0 62.5 125 250 Feet

STEP MESA DRAINAGE GAMMA RADIATION SURVEY AND SEDIMENT SAMPLE LOCATIONS MAP

Prepared For:

Prepared By: TETRA TECH

Task Order No.: TO0001	Contract No.: EP-S9-17-03
Location: LUKACHUKAI CHAPTER NAVAJO NATION	Date: 5/6/2019

Note:
[3]U.S Environmental Protection Agency, Region 9, Superfund Program, *Abandoned Uranium Mines and the Navjo Nation Part II Atlas With Geospatial Data. NN_Drainage_HR_AUM.shp.* July, 2007.

Figure No.: **DM39 - 5**

ATTACHMENT J4

SEDIMENT SAMPLING FIELD FORMS

Sediment Sampling Field Form

Drainage Name: TSE TAH
Drainage ID: DM1
Sampling Team: LEM, BRYAN, PATRICK, MITCH
Date: 8/19/18 75° SLIGHT BREEZE
Weather: SUNNY CLEAR AM
GPS Color: ORANGE
Example Sample -042218
Example Duplicate -042218

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
SD DM 17 ✓	8/19/18	11:52	DM1-SD17-01-081918	N	8.5 KCPM * DM 17 IS IN DRA	SANDY FINE TO MED WITH COBBLES (BW 6m WIDE)
SD DM 16 ✓	8/19/18	11:58	DM1-SD16-01-081918	N	GPS POLYLINES SI BE OFF DRAINA	MED SAND m WIDE) 9KCPM
SD DM 15 ✓	8/19/18	1207	DM1-SD15-01-081918	N	6 KCPM	FINE SAND m WIDE)
SD DM 14 ✓	8/19/18	1213	DM1-SD14-01-081918	N	8.2 KCPM	MED SAND 5m WIDE)
SD DM 13 ✓	8/19/18	1221	DM1-SD13-01-081918	N	7.8 KCPM	m WIDE)
SD DM 12 ✓	8/19/18	1226	DM1-SD12-01-081918	N	8 KCPM	7m WIDE)
SD DM 11 ✓	8/19/18	1234	DM1-SD11-01-081918	N	7.4 KCPM	MED SAND (6 m WIDE)
DM SD10 ✓	8/19/18	1239	DM1-SD10-01-081918	N	7 KCPM	MED 12m)
SD 9 ✓	8/19/18	1245	DM1-SD9-01-081918	N	7.6 KCPM	15m W)
SD 8 ✓	8/19/18	1251	DM1-SD8-01-081918	N	7.8 KCPM	m W)

Notes to field team:
Samples will be taken at approximate 100 m transects

(1)

TSETAH

Sediment Sampling
Field Form

Drainage Name: DM1
Drainage ID:
Sampling Team: LEM, BRYAN, PATRICK, MICH
Date: 8/19/18
Weather: SEPT. 1
GPS Color: ORANGE

Example Sample ID: DT9-SD1-01-042218
Example Duplicate ID: DT9-SD1-02-042218

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
* LEM	TOOK 1	GPS SHOT (SAND "PRONE PICTURE") AT HEADCUT	WHERE FLAT WIDE (U/S) CHANNEL IS SID (D/S) AGAIN			CHANNEL BECOMES *
SD 7 ✓	8/19/18	12:59	DM1-SD7-01-081918	N	8 KCPM	FINE SAND (BW IS 6m WIDE)
SD 6 ✓	8/19/18	13:10	DM1-SD6-01-081918	N	8 KCPM	FINE-MED SAND (BW IS 7m WIDE)
SD 5 ✓	8/19/18	13:17	DM1-SD5-01-081918	N	8.6 KCPM	FINE SAND (BW IS 2.5m WIDE)
SD 4 ✓	8/19/18	13:22	DM1-SD4-01-081918	N	8.5 KCPM	FINE SAND (BW IS 6 m WIDE)
SD 3 ✓	8/19/18	13:27	DM1-SD3-01-081918	N	8 KCPM	FINE SAND (BW IS 5 m WIDE)
SD 2 ✓	8/19/18	13:34	DM1-SD2-01-081918	N	8.4 KCPM	FINE SAND (BW IS 6m WIDE)
SD 1 ✓	8/19/18	13:44	DM1-SD1-01-081918	Y	DM1-SD1-02-081918 8.5 KCPM	FINE-MED SAND & SMALL PEBBLES (BW IS 9m WIDE)

Notes to field team:
Samples will be taken at approximate 100 m transects

(2)

Sediment Sampling Field Form

Drainage Name: Cove Wash North
Drainage ID: DCWN
Sampling Team: MS, SB, MH, AO, JB

Date: 06/24/18
Weather: 90°F, clear
GPS Color: Green

Example Sample ID: DT9-SD1-01-042218
Example Duplicate ID: DT9-SD1-02-042218

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
~~SD20~~	06/24/18	1330	DCWN-SD20-01-062418	N	—	dry sand w/silt & gravel reddish brown, pale yellow 9,000 cpm minor veg/trees 8 ft wide slot canyon silty ~~sand, reddish brown~~ MS
SD21	06/24/18	1335	DCWN-SD21-01-062418	Y	DCWN-SD21-02-062418	8500 cpm sandy silt ~~light brown~~ MS w/gravel light brown, dry
SD22	06/24/18	1340	DCWN-SD22-01-062418	N	—	11,000 cpm sandy silt w/gravel ~~w/gravel~~ MS 15 ft width light brown, dry
SD23	06/24/18	1345	DCWN-SD23-01-062418	N	—	10,500 cpm light brown, dry 6 ft width sandy silt w/gravel
SD24	06/24/18	1350	DCWN-SD24-01-062418	N	—	11,000 cpm 20 ft width Lt brown, dry, sandy silt w/gravel
SD25	06/24/18	1355	DCWN-SD25-01-062418	N	—	10,000 cpm * 15 ft width Lt brown, dry, sandy silt w/gravel
SD26	06/24/18	1400	DCWN-SD26-01-062418	N	—	10,000 cpm Fallen trees 15 ft width Lt brown, dry, sandy silt ~~w/gravel~~ MS
SD27	06/24/18	1405	DCWN-SD27-01-062418	N	—	13,000 cpm 12 ft width Lt brown, dry, sand w/silt
SD28	06/24/18	1410	DCWN-SD28-01-062418	N	—	13,000 cpm ** 5 ft width Lt brown, dry, sand w/silt
SD29	06/24/18	1415	DCWN-SD29-01-062418	N	—	14,000 cpm 10 ft width Lt brown, dry, sand w/silt

Notes to field team:
Samples will be taken at approximate 100 m transects

~~SD30~~ MS ~~1420~~ MS

* SD25 downstream from a side drainage

** First sample near survey boundary of a mine (Mesa VI)

Sediment Sampling Field Form

Drainage Name: Cove Wash North
Drainage ID: DCWN
Sampling Team: MS, AO, MH, SB, JB

Date: 06/24/18
Weather: 90°F, clear
GPS Color: Green

Example Sample ID: DT9-SD1-01-042218
Example Duplicate ID: DT9-SD1-02-042218

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
SD30	06/24/18	1420	DCWN-SD30-01-062418	N	—	13,000 cpm 20ft width lt brown, dry, sand w/silt + gravel
SD28A	06/24/18	1412	DCWN-SD28A-01-062418	N	—	30,000 cpm *** 15ft width yellowish-brown fine to med grained sand, dry
SD28B	06/24/18	1435	DCWN-SD28B-01-062418	N	—	38,000 cpm removed organic surface 8ft width tan moist, sand w/silt MS
—						
—						

Notes to field team:
Samples will be taken at approximate 100 m transects

*** possible waste pile above drainage

Sediment Sampling Field Form

DCWN-SD#-01-062418

Drainage Name: Cove Wash North
Drainage ID: DCWN
Sampling Team: KR KS CA LS NW

Date: 6/24/18
Weather: Sunny 90's
GPS Color: Pink

Example Sample ID: DT9-SD1-01-042218
Example Duplicate ID: DT9-SD1-02-042218

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
✓ SD1	6/24/18	1000	DCWN-~~SD1-01-062418~~ SD1-01-062418 KR	No		• 10 K cpm • dry, gravelly sand, reddish-brown • flat wide area
						• channel width = 25 ft
✓ SD2	6/24/18	1005	DCWN-SD2-01-062418	No		• 9K cpm • gravelly sand • refusal at 3 in
						• width ~ 40 ft • large trees
✓ SD3	6/24/18	1010	DCWN-SD3-01-062418	No		• 9500 cpm • 45 ft wide
✓ SD4	6/24/18	1015	DCWN-SD4-01-062418	No		• 10K cpm • slightly damp at 3 in • Sand, dry, reddish-brown
✓ SD5	6/24/18	1020	DCWN-SD5-01-062418	No		• 10K cpm • pebbly, gravelly sand, dry, reddish-brown • 35 width
✓ SD6	6/24/18	1025	DCWN-SD6-01-062418	No		• 10K cpm • 35ft wide • reddish-brown, dry, gravelly sand
~~SD~~ KR						• dense vegetation either side
✓ SD7	6/24/18	1030	DCWN-SD7-01-062418 ~~DCWN-01-SD7-01-062418~~ Rdk			• 10K cpm • dry, reddish brown, sandy gravel • 35 ft wide - 40ft wide

Notes to field team:
Samples will be taken at approximate 100 m transects

Sediment Sampling Field Form

Drainage Name: Cove Wash North
Drainage ID: DCWN
Sampling Team: KS, KR, CA, LS, NW

Date: 6/24/18
Weather: Sunny 90's
GPS Color: Pink

Example Sample ID: DT9-SD1-01-042218
Example Duplicate ID: DT9-SD1-02-042218

	Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
✓	SD8	6/24/18	1035	DCWN-KR-SD8-01-062418	N		• 11K cpm • sample directly above pink sandstone • reddish-brown, dry sand • 20ft wide
✓	SD9	6/24/18	1040	DCWN-SD9-01-062418	N		• 10K cpm • refusal at 3 in • Dry reddish brown gravelly sand • channel width ~15-20ft • pine trees on banks
✓	SD10	6/24/18	1050	DCWN-SD10-01-062418	N		• 9K cpm • refusal at 1 in • stream channel on outcrop of pink sandstone • dry reddish sand -20ft wide
✓	SD11	6/24/18	1055	DCWN-SD11-01-062418	✓ Yes	DCWN-SD11-02-062418	• 10K cpm • Damp, reddish-brown sand - width ~30ft
✓	SD12	6/24/18	1105	DCWN-SD12-01-062418	N		• 9500 cpm • adjacent to pink sandstone outcrop - dry reddish brown sandstone • 4ft wide
✓	SD13	6/24/18	1110	DCWN-SD13-01-062418			• 12K cpm • wet sand, reddish brown • 15 ft wide

Notes to field team:
Samples will be taken at approximate 100 m transects

Sediment Sampling Field Form

Drainage Name: Cove Wash North
Drainage ID: DCWN
Sampling Team: KS, KR, CA, NW, LS

Date: 6/24/18
Weather: Sunny 90s
GPS Color: Pink

Example Sample ID: DT9-SD1-01-042218
Example Duplicate ID: DT9-SD1-02-042218

	Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
✓	SD14	6/24/18	1115	DCWN-SD14-01-062418	N		• 1,500 cpm • slightly moist at 3 in • sand, reddish-brown
							• channel width ~ 15 ft
✓	SD15	6/24/18	1120	DCWN-SD15-01-062418	N		• 9K cpm • moist at 3 in • light brown sand
							• channel width ~15 ft
✓	SD16	6/24/18	1125	DCWN-SD16-01-062418	N		• moist • more organic matter in soil at 4 in • reddish-brown sand
							• 11K cpm • channel width 8-10 ft
✓	SD17	6/24/18	1130	DCWN-SD17-01-062418	N		• 20 ft wide • 13 k cpm • light-brown-reddish sand, dry
✓	SD18	6/24/18	1140	DCWN-SD18-01-062418			• Drainage becomes 2 slot canyon surrounded by sandstone • 10K cpm
							• Dry reddish-light brown sand • 30-40 ft wide

Notes to field team:
Samples will be taken at approximate 100 m transects

Sediment Sampling Field Form

Drainage Name: Cove Wash North
Drainage ID: DCWN
Sampling Team: KS, KR, CA, NW, LS

Date: 6/24/18
Weather: Sunny 90s
GPS Color: Pink

Example Sample ID: DT9-SD1-01-042218
Example Duplicate ID: DT9-SD1-02-042218

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
✓ SD19	6/24/18	1150	DCWN-SD19-01-062418	No	—	• standing water below sample • GPS ~~too~~ low accuracy due to canyon walls
						• 10k cpm • no satellites • slot canyon above point

Notes to field team:
Samples will be taken at approximate 100 m transects

Sediment Sampling Field Form

Page ~~1/3~~ KR 1/4

Drainage Name: Middle
Drainage ID: ~~DC2~~ DC1
Sampling Team: KS, AO, KR, NW

Date: 6/21/18
Weather: Sunny 60s
GPS Color: Pink

Example Sample ID: DT9-SD1-01-042218 DC1-SD~~1~~-01-062118
Example Duplicate ID: DT9-SD1-02-042218

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	cpm, width, time, refusal Notes
~~DC1~~ KR SD1	06-21-18	10:08	DC1-SD1-01-062118			~15000 CPM Dry light brown, poorly graded gravelly sand, 4 inch refusal
	~~06-21-18~~					cow manure adjacent to sample.
SD2	06-21-18	10:15	DC1-SD2-01-062118			Channel width ~9 ft Dry, same soil type adjacent to Summerville outcrop
	~~06-21-18~~					3 inches of refusal 15K CPM
SD3	06-21-18	10:20	DC1-SD3-01-062118			Downstream of large Summerville outcrop. Thalweg of main channel is 13 ft wide. Dead cow skull & remnants
SD4	06.21.18	10:30	DC1-SD4-01-062118			~~Located prior to~~ Located upstream of canyon, RHS. Channel width is 5 ft soil slightly moist, silty sand, 14K cpm, less gravel
SD5		10:35	DC1-SD5-01-062118			10K CPM, leaf cover, soil more chalky, fewer loose cobbles, downstream of cliff facing canyon, silty sand
						Left outcrop of massive Pink Sandstone. Refusal at 2 in, 15 ft wide thin soil layer topping bedrock
~~SD6~~ KR SD6	6/21/18	~~10:40~~ 10:45	DC1-SD6-01-062118			located before dropoff of small waterfall 15K CPM, No refusal, Very Moist soil, sandy, no gravel 15 ft wide

Notes to field team:
Samples will be taken at approximate 100 m transects

Sediment Sampling Field Form

Drainage Name: Middle 1
Drainage ID: ~~DC2~~ DC1
Sampling Team: AO, NW, KS, KR

Date: 6/21/18
Weather: Sunny 80s
GPS Color: Pink

Example Sample ID: DT9-SD1-01-042218
Example Duplicate ID: DT9-SD1-02-042218

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
✓ SD7	6/21/18	10:50	DC1-SD7-01-062118 SL			18K CPM 35 ft wide large boulders present moist sandy soil, some cobbles
✓ SD8	6/21/18	1100	DC1-SD8-01-062118			17K CPM Adjusted due to boulders collected adjacent to massive sandstone boulder, Downstream of standing water 45 ft wide
✓ SD8a	6/21/18	1105	DC1-SD8a-01-062118			21K avg 17Ft wide collected on side of R#S channel deposit judgmental sample due to increase in activity, located above an obstruction, gravelly sand
✓ SD9	6/21/18	1110	DC1-SD9-01-062118			Dry silty sand ~30ft wide, 18K Sample located ~~downstream of~~ upstream of obstruction & deposit
✓ SD10	6/21/18	1120	DC1-SD10-01-062418			19K CPM, ~75ft wide upstream of floodplain, riparian habitat, willow,
✓ SD11	6/21/18	1130	DC1-SD11-01-062118			21K CPM Riparian floodplain (Dry) ~100ft wide Sandy silt
✓ SD12	6/21/18	1135	DC1-SD12-01-062118			23K Dry reddish-brown sand small channel width within main channel ~6ft wide

Notes to field team:
Samples will be taken at approximate 100 m transects

KR
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Sediment Sampling Field Form

Drainage Name: Middle ~~2~~ 1 KR
Drainage ID: ~~DC2~~ DC1 KR
Sampling Team: KS, AO, KR, NW

Date: 6/21/18
Weather: Sunny, high 80s
GPS Color: Pink

Example Sample ID: DT9-SD1-01-042218
Example Duplicate ID: DT9-SD1-02-042218

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
✓ SD 13	6/21/18	11:40	DC1-SD13-01-062118			23k cpm Dry gravelly sand
✓ SD 14	6/21/18	~~11:45~~ KR ~~11:50~~	DC1-SD14-01-062118			upstream of flood plain 26-28k 6ft wide ~~moderate~~ slope of stream bed Dark brown, silty sand, damp
✓ SD 15	" "	11:55	DC1-SD15-01-062118			21k wet, ~~root~~ stagnant water Brown-red sandy
✓ SD 16	" "	1325 ~~12~~	DC1-SD16-01-062118			standing water upstream & downstream 22k Channel width 15ft wide
—						moist silty sand collected adjacent to standing water High organic content
✓ SD 17	" "	1330	DC1-SD17-01-062118	Yes ✓	DC1-SD17-02-062118	18k CPM 25ft wide Dry pale yellow-pink sand
✓ SD 18	" "	1340	DC1-SD18-01-062118			~15ft wide, 20k adjacent to standing water & massive sandstone cliff
						reddish brown silty sand Standing water upstream
✓ SD 19	" "	1345	DC1-SD19-01-062118			~~23~~ 22k cpm, offset due to lost signal Pale yellow, slightly moist
✓ SD20	" "	1355	DC1-SD20-01-062118			25k Taken directly below confluence of Middle 1 & ~~Middle 3~~ Middle 1 Moist sample Animal droppings upstream of canyon Moist reddish brown silty sand

Notes to field team:
Samples will be taken at approximate 100 m transects

~~Che - grandpa~~
~~Njon eh - beautiful~~ KR
~~Yeh- atteh ob.neh - good morning~~

Page 4/4

Sediment Sampling
Field Form

Drainage Name: Middle 1
Drainage ID: DC1
Sampling Team: KR, KS, AO, NW

Date: 6/21/18
Weather: Sunny 80s
GPS Color: Pink

Example Sample ID: DT9-SD1-01-042218
Example Duplicate ID: DT9-SD1-02-042218

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
✓ SD21	6/21/18	1355	DC1-SD21-062118			22K, 15 ft Damp reddish brown
✓ SD22	6/21/18	1405	DC1-SD21-062118			Dry light brown, medium sand Possible drainage from East Frank No. 1 mine
						upstream inaccessible due to slot canyon and no alternative route

Notes to field team:
Samples will be taken at approximate 100 m transects

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Sediment Sampling Field Form

Page 1/13 KS

Drainage Name: Middle 1
Drainage ID: DC1
Sampling Team: KS, CA, KR, BE, NW

Date: 6/23/18
Weather: High 80s, sunny
GPS Color: Orange

Example Sample ID: DT9-SD1-01-042218
Example Duplicate ID: DT9-SD1-02-042218

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
✓ SD23	6/23/18	1125	DC1-SD23-01-062318	N	—	Collected above pinch point / waterfall. Dry reddish brown sand
						gamma = 25,000 cpm
						channel width = 5 feet
✓ SD24	6/23/18	1140	DC1-SD24-01-062318	N	—	gamma = 26,000 cpm
						channel width ≈ 25 feet
						dry reddish brown sand
✓ SD25	6/23/18	1150	DC1 KS ~~DC2~~-SD25-01-062318	N	—	gamma = 37,000 cpm
						channel width ≈ 20 feet
					KS	Dry reddish brown ~~gravelly~~ sand
✓ SD26	6/23/18	1155	DC1-SD26-01-062318	N	-	Dry reddish brown sand
						gamma = 20,000 cpm
						channel width = 20-25 ft
✓ SD27	6/23/18	1205	DC1-SD27-01-062318	N	—	gamma = 50,000 cpm
						channel width ≈ 5 ft
						Dry reddish brown gravelly sand. Sample collected from main channel. Trimble shows the sample is ~~west~~ east of the drainage. KS

Notes to field team:
Samples will be taken at approximate 100 m transects

Sediment Sampling Field Form

Drainage Name: ~~DC1~~ MS Middle 1
Drainage ID: DC1
Sampling Team: KS, KR, CA, NW, BE

Date: 6/23/18
Weather: High 80s, Sunny
GPS Color: orange

Example Sample ID: DT9-SD1-01-042218
Example Duplicate ID: DT9-SD1-02-042218

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
✓ SD28	6/23/18	1220	DC1-SD28-01-062318	N	—	gamma = 11,000 cpm Dry tan to brown sand
						Sample collected in main drainage channel. Trimble location is ~~west~~ east of drainage on vegetated slope.
✓ SD29	6/23/18	1240	DC1-SD29-01-062318	N	—	gamma ≈ 12,000 cpm channel width ≈ 8 ft
						Dry reddish brown sand Trimble location is east of main drainage.
✓ SD30	6/23/18	1250	DC1-SD30-01-062318	N	—	gamma = 10,000 cpm trimble location is east
						of main drainage channel width ≈ 15 feet Dry reddish brown sand.
✓ SD31	6/23/18	1255	DC1-SD31-01-062318	N	—	gamma = 12,000 cpm Dry reddish brown sand
						channel width ≈ 12,000 cpm

Notes to field team:
Samples will be taken at approximate 100 m transects

Sediment Sampling Field Form

Drainage Name: Middle 1
Drainage ID: DC1
Sampling Team: KS, CA, KR, NW, BE

Date: 6/23/18
Weather: High 80s, sunny
GPS Color: orange

Example Sample ID: DT9-SD1-01-042218
Example Duplicate ID: DT9-SD1-02-042218

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
✓ SD32	6/23/18	1310	DC1-SD32-01-06238	N	—	opportunistic sample Gamma = 9800 cpm
						Dry reddish brown sand. Location isolated
						topographically from waste rock pile.

Notes to field team:
Samples will be taken at approximate 100 m transects

Sediment Sampling Field Form Page 1/13 KS

Drainage Name: Middle 1
Drainage ID: DC1
Sampling Team: KS, CA, KR, BE, NW

Date: 6/23/18
Weather: High 80s, sunny
GPS Color: Orange

Example Sample ID: DT9-SD1-01-042218
Example Duplicate ID: DT9-SD1-02-042218

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
SD23	6/23/18	1125	DC1-SD23-01-062318	N	—	Collected above pinch point / waterfall, dry reddish brown sand
						gamma = 25,000 cpm channel width = 5 feet
SD24	6/23/18	1140	DC1-SD24-01-062318	N	—	gamma = 26,000 cpm channel width ≈ 25 feet
						dry reddish brown sand
SD25	6/23/18	1150	~~DC2~~ DC1 KS -SD25-01-062318	N	—	gamma = 37,000 cpm channel width ≈ 20 feet
					ES	Dry reddish brown ~~gravelly~~ sand
SD26	6/23/18	1155	DC1-SD26-01-062318	N	—	Dry reddish brown sand gamma = 20,000 cpm
						channel width = 20-25 ft
SD27	6/23/18	1205	DC1-SD27-01-062318	N	—	gamma = 50,000 cpm channel width ≈ 50 ft
						Dry reddish brown gravelly sand. Sample collected from main channel. Trimble shows the sample is ~~west~~ east of the drainage. ES

Notes to field team:
Samples will be taken at approximate 100 m transects

Sediment Sampling Field Form

Drainage Name: ~~DC1~~ MS Middle 1
Drainage ID: DC1
Sampling Team: KS, KR, CA, NW, BE

Date: 6/23/18
Weather: High 80s, Sunny
GPS Color: orange

Example Sample ID: DT9-SD1-01-042218
Example Duplicate ID: DT9-SD1-02-042218

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
SD28	6/23/18	1220	DC1-SD28-01-062318	N	—	gamma = 11,000 cpm Dry tan to brown sand
						Sample collected in main drainage, trimble location is ~~west~~ east of drainage on vegetated slope.
SD29	6/23/18	1240	DC1-SD29-01-062318	N	—	gamma ≈ 12,000 cpm channel width ≈ 8ft
						Dry reddish brown sand Trimble location is east of main drainage.
SD30	6/23/18	1250	DC1-SD30-01-062318	N	—	gamma = 10,000 cpm trimble location is east
						of main drainage channel width ≈ 15 feet Dry reddish brown sand.
SD31	6/23/18	1255	DC1-SD31-01-062318	N	—	gamma = 12,000 cpm Dry reddish brown sand
						channel width ≈ 12,000 cpm

Notes to field team:
Samples will be taken at approximate 100 m transects

Sediment Sampling Field Form

Drainage Name: Middle 1
Drainage ID: DC1
Sampling Team: KS, CA, KR, NW, BE

Date: 6/23/18
Weather: ~~High 80s~~, sunny
GPS Color: orange

Example Sample ID: DT9-SD1-01-042218
Example Duplicate ID: DT9-SD1-02-042218

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
SD32	6/23/18	1310	DC1-SD32-01-062318	N	—	opportunistic sample Gamma = 9800 cpm
						Dry redolish brown sand. Location isolated
						topographically from waste rock pile.

Notes to field team:
Samples will be taken at approximate 100 m transects

Sediment Sampling
Field Form

Drainage Name:
Drainage ID: DC1A
Sampling Team: MS, DW, MH, SB

Date: 6/20/18
Weather: Sunny, 85°F
GPS Color: Pink

Example Sample ID: DT9-SD1-01-042218
Example Duplicate ID: DT9-SD1-02-042218

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
DC1A	6/20/18	1330	DC1A-SD1-01-062018	No	—	ST @ 1330
DC1A	6/20/18	1335	DC1A-SD2-01-062018	Y	DC1A-SD2-02-062018	ST @ 1335
DC1A	6/20/18	1345	DC1A-SD3-01-062018	N	—	ST @ 1345
DC1A	6/20/18	1352	DC1A-SD4-01-062018	N	—	ST @ 1352
DC1A	6/20/18	1405	DC1A-SD5-01-062018	N	—	ST @ 1405
DC1A	6/20/18	1410	DC1A-SD6-01-062018	N	—	ST @ 1410
DC1A	6/20/18	1425	DC1A-SD7-01-062018	N	—	ST @ 1425
DC1A	6/20/18	1450	DC1A-SD7A-01-062018	N	—	ST @ 1450
DC1A	6/20/18	1455	DC1A-SD7A-0612-01-062018	N	—	ST @ 1455 **

Notes to field team:
Samples will be taken at approximate 100 m transects

** Native soil at approx 8 in.

-0612-

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Sediment Sampling Field Form

Drainage Name: Middle 1B
Drainage ID: DC 1B
Sampling Team: AO KS KR NW

Date: 6/21/18
Weather: Sunny 80s
GPS Color: Pink

Example Sample ID: DT9-SD1-01-042218
Example Duplicate ID: DT9-SD1-02-042218

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
✓ KR DC SD1	6/21/18	1415	DC1B-SD1-01-062118			24K gamma counts Beige dry sand
✓ SD2	6/21/18	1425	DC1B-SD2-01-062118			18K gamma counts Narrow channel ~ 12 ft Dry sand
✓ SD3	6/21/18	1430	DC1B-SD3-01-062118			Narrow channel ~6ft Dry, light brown ~~sand~~ sand

Notes to field team:
Samples will be taken at approximate 100 m transects

Sediment Sampling
Field Form

Drainage Name: Middle 1
Drainage ID: 1B DC1B
Sampling Team: KTD, MH, JB, MS,

Date: 6/22/18
Weather: Clear & Sunny
GPS Color: Pink

Example Sample ID: DT9-SD1-01-042218
Example Duplicate ID: DT9-SD1-02-042218

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
SD9	6/22/18	0952	1B-SD9-01-062218	N		14,000CPM. Dry to slightly moist. Fine ~~to med~~ sand. Channel width ≈15 ft.
SD8A	6/22/18	1005	1B-SD8A-01-062218	N		140,000CPM. Dry. Fine to coarse sand. Channel width ~6ft. Loose rock above site.
SD8	6/22/18	1020	1B-SD8-01-062218	N		26,000 CPM. Lt. Brown. fine sand w/silt. Dry to slight moist. Channel width ~20ft
SD7A	6/22/18	1030	1B-SD7A-01-062218	N		52,000CPM. Lt. braun to tan. Find sand ~~to~~ w/silt. Channel width ~25ft Dry.
SD7	6/22/18	1035	1B-SD7-01-062218	N		50,000 CPM. Lt. brown to tan Fine sand w/silt w/gravel. Dry. Channel width ~10ft.
SD6	6/22/18	1045	1B-SD6-01-062218	N		26,000 CPM. Lt. Brown to ~~tan~~ reddish brown Fine ~~sand~~ to coarse sand. Dry. Channel width ~16ft.
SD5A	6/22/18	1055	1B-SD5A-01-062218	N		54,000 CPM. Lt. brown to reddish brown Fine to coarse sand. Dry. Channel width ~3ft.
SD5	6/22/18	1100	1B-SD5-01-062218	N		26,000 CPM. Moist. Well sorted sand w/gravel. Channel width ~6ft.
SD4	6/22/18	1110	1B-SD4-01-062218	~~N~~ Y	1B-SD4-02-062218	18,000 CPM. Lt. brown to reddish brown. Dry. Fine sand w/silt. Channel width ~15ft

Notes to field team:
Samples will be taken at approximate 100 m transects

All sample prefixes should be DC1B NOT 1B

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Sediment Sampling Field Form

Drainage Name: Middle 1G
Drainage ID: DC1G
Sampling Team: KR KS AO NW

Date: 6/21/18
Weather: Sunny, 80s
GPS Color: Pink

Example Sample ID: DT9-SD1-01-042218 (DC1G)
Example Duplicate ID: DT9-SD1-02-042218

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
✓ SD1	6/21/18	12:05	DC1G-SD1-01-~~062118~~ 062118			10K CPM Reddish Brown, dry gravelly sand 4 ft wide
✓ SD2	6/21/18	12:15	DC1G-~~SD1~~ SD2-01-062118			12K CPM Dry, reddish-brown, poorly sorted sand
✓ SD3	6/21/18	12:25	DC1G-SD3-01-062118			Dry reddish-brown gravelly-sand 11K CPM ~ 7ft wide Convergence point of drainage channel

Notes to field team:
Samples will be taken at approximate 100 m transects

Sediment Sampling Field Form

Drainage Name: Cove wash middle
Drainage ID: DT9
Sampling Team: JB, JM, KD, AB

Date: 06/24/18
Weather: Sunny 85°
GPS Color: Blue

Example Sample ID: DT9-SD1-01-042218
Example Duplicate ID: DT9-SD1-02-042218

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
SD1	06/24/18	10:00	DT9-SD1-01-062418 JB	Yes	DT9-SD1-02-062418	Silt 12,000 cpm 20 ft width
SD2	06/24/18	10:08	DT9-SD2-01-062418	No	—	12,500 cpm Silt Red Brown 15ft width Coarse
SD3	06/24/18	10:12	DT9-SD3-01-062418	No	—	12,000 cpm Coarse - pebble poorly sorted 16 ft width
SD4	06/24/18	10:15	DT9-SD4-01-062418	No	—	13,000-14,000 cpm Fine 20ft width
SD5	06/24/18	10:18	DT9-SD5-01-062418	No	—	13,000 cpm Medium sand 25 ft width Red-Brown
SD6	06/24/18	10:25	DT9-SD6-01-062418	No	—	13,000 cpm Coarse - Pebble Poorly sorted 14 ft width Red-Brown
SD7	06/24/18	10:30	DT9-SD7-01-062418	No	—	13000 cpm Medium - Pebble Poorly sorted 16 ft width Red-Brown
SD8	06/24/18	10:37	DT9-SD8-01-062418	No	—	13,000 cpm Coarse 9 ft width red-Brown
SD9	06/24/18	10:41	DT9-SD9 JB-01-062418	No	—	13,000 cpm Red-Brown 22 ft width Medium-Coarse
SD10	06/24/18	10:47	DT9-SD10-01-062418	No	—	13,000 cpm Red-Brown 22 ft width silt - Medium

Notes to field team:
Samples will be taken at approximate 100 m transects

Sediment Sampling Field Form

Drainage Name: Low Wash Middle
Drainage ID: PT9
Sampling Team: JB, JM, KD, AB

Date: 06/24/18
Weather: Sunny 85°
GPS Color: Blue

Example Sample ID: DT9-SD1-01-042218
Example Duplicate ID: DT9-SD1-02-042218

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
SD11	06/24/18	10:56	DT9-SD11-01-062418	Yes	DT9-SD11-02-062418	12,000cpm Muddy Red-Brown 4ft channel
SD12	06/24/18	11:04	DT9-SD12-01-062418	No	—	14,000 cpm Muddy Brown-Red 7ft channel Pebble-Cobble
SD13	06/24/18	11:10	DT9-SD13-01-062418	No	—	13,000 CPM Pebble-Coarse 9ft channel
SD14	06/24/18	11:16	DT9-SD14-01-062418	No	—	14,000 cpm Medium 9ft channel
SD15	06/24/18	11:21	DT9-SD15-01-062418	No	—	13,000cpm Fine 13ft channel
SD16	06/24/18	11:27	DT9-SD16-01-062418	No	—	15,000 Clay-silt 15ft channel
SD17	06/24/18	11:35	DT9-SD17-01-062418	No	—	12,000 cpm Coarse-Pebbles 20ft channel
SD18	06/24/18	11:41	DT9-SD18-01-062418	No	—	13,000 RPM Medium 14ft channel
SD19	06/24/18	11:46	DT9-SD19-01-062418	No	—	13,000 cpm Fine 9ft channel
SD20	06/24/18	11:53	DT9-SD20-01-062418	No	—	11,000 cpm Medium 20ft channel

Notes to field team:
Samples will be taken at approximate 100 m transects

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TETRA TECH

ERG

Sediment Sampling Field Form

Drainage Name: Cove Wash Middle
Drainage ID: DT9
Sampling Team: JB, JM, KD, AB

Date: 06/24/18
Weather: Sunny 85°
GPS Color: Blue

Example Sample ID: DT9-SD1-01-042218
Example Duplicate ID: DT9-SD1-02-042218

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
SD21	06/24/18	12:00	DT9-SD21-01-062418	No	—	12,000 GPM 25Ft channel Fine Red-Brown
—						
—						

Notes to field team:
Samples will be taken at approximate 100 m transects

Sediment Sampling
Field Form

Drainage Name: Middle 2
Drainage ID: DC2
Sampling Team: KTD, JM, MS, MW,

Date: 6/21/18
Weather: Cleary & hot
GPS Color: ~~Blue~~ Orange

Example Sample ID: DT9-SD1-01-042218
Example Duplicate ID: DT9-SD1-02-042218

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
SD1	6/21/18	1005	DC2-SD1-01-062118	N		11,000 CPM. Sample f/mid-channel bar. Moist. Poorly sorted sand & gravel
SD2	6/21/18	1015	DC2-SD2-01-062118	N		12,000 CPM. Moist. Brown. Poorly sorted sand to gravel.
SD3	6/21/18	1022	DC2-SD3-01-062118	N		12,000 CPM. Dry. Beige. Poorly sorted sand to pebble.
SD4	6/21/18	1026	DC2-SD4-01-062118	N		12,000 CPM. Dry. Beige. Poorly sorted sand to gravel
SD5	6/21/18	1032	DC2-SD5-01-062118	N		13,500 CPM. Dry. Beige/Lt. Brown. Poorly sorted sand to gravel
SD6	6/21/18	1036	DC2-SD6-01-062118	N		14,000 CPM. Dry. Beige/Lt. Brown. Poorly sorted sand to gravel
SD7	6/21/18	1041	DC2-SD7-01-062118	N		13,000 CPM. Dry to slightly moist. Tan. Fine to med. sand.
SD8	6/21/18	1046	DC2-SD8-01-062118	N		12,000 CPM. Slightly moist. Tan to lt. brown. Poorly sorted sand to gravel.
SD9	6/21/18	1050	DC2-SD9-01-062118	N		14,000 CPM. Slightly moist. Tan to lt. brown. Poorly sorted sand to gravel.
SD10	6/21/18	1055	DC2-SD10-01-062118	N		14,000 CPM. Dry to slightly moist. Tan. Fine to med. sand.

Notes to field team:
Samples will be taken at approximate 100 m transects

Sample Bag Label
Sample ID
Date
Time
Initials
0-6"

TETRA TECH

ERG

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Sediment Sampling Field Form

Drainage Name: Middle 2
Drainage ID: DC2
Sampling Team: KTB, JM, MS, M

Date: 6/21/18
Weather: Clear + hot.
GPS Color: Orange

Example Sample ID: DT9-SD1-01-042218
Example Duplicate ID: DT9-SD1-02-042218

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
SD11	6/21/18	1100	DC2-SD11-01-062118	N		10,000 CPM. Slightly moist. Tan. Fine to med. sand.
SD12	6/21/18	1104	DC2-SD12-01-062118	N		11,000 CPM. Moist. Brown. Poorly sorted sand to gravel.
SD13	6/21/18	1130	DC2-SD13-01-062118	N		12,000 CPM. Moist to slightly moist. Brown. Poorly sorted sand w/ some gravel.
SD14	6/21/18	1136	DC2-SD14-01-062118	N		15,000 CPM. Slightly moist. Lt. brown. Poorly sorted sand & gravel
SD15	6/21/18	1142	DC2-SD15-01-062118	N		13,000 CPM. Moist. Brown. Poorly sorted sand to gravel.
SD16	6/21/18	1148	DC2-SD16-01-062118	Y	DC2-SD16-02-062118 @ 1148	13,000 CPM. Slightly moist. Tan. Fine to med. sand.
SD17	6/21/18	1155	DC2-SD17-01-062118	N		15,000 CPM. Most. Brown to reddish brown. Fine to med. sand.
SD18	6/21/18	1202	DC2-SD18-01-062118	N		16,000 CPM. Moist. Lt. brown. Poorly sorted sand to gravel.

Notes to field team:
Samples will be taken at approximate 100 m transects

Sediment Sampling
Field Form

Drainage Name: Middle 2A
Drainage ID: DC2A
Sampling Team: KTD, JM, MS, MW

Date: 6/21/18
Weather: Sunny, lt. breeze
GPS Color: Orange

Example Sample ID: DT9-SD1-01-042218
Example Duplicate ID: DT9-SD1-02-042218

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
SD19	6/21/18	1220	DC2A-SD19-01-062118	N		17,000 CPM - Slightly moist Tan to lt. brown. Poorly sorted Sand & gravel.
SD20	6/21/18	1226	DC2A-SD20-01-062118	N		18,000 CPM. Slightly moist. Lt. brown. Poorly sorted sand to gravel.
SD21	6/21/18	1230	DC2A-SD21-01-062118	N		10,000 CPM. Slightly moist, Lt. brown. Sand w/ gravel.
SD22	6/21/18	1237	DC2A-SD22-01-062118	N		9,000 CPM. Dry. Tan. Med. sand.
SD23	6/21/18	1242	DC2A-SD23-01-062118	N		10,000 CPM. Slightly moist, Tan. Fine to med. sand.

Notes to field team:
Samples will be taken at approximate 100 m transects

Sediment Sampling Field Form

Drainage Name: Middle 2B
Drainage ID: DC2B
Sampling Team: KS, CA, NW, PA

Date: 06/22/18
Weather: Sunny, high 80s
GPS Color: Green

Example Sample ID: DT9-SD1-01-042218
Example Duplicate ID: DT9-SD1-02-042218

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
SD2	6/22/18	11:55	DC2B-SD2-01-062218	N	—	Gamma = 12,000 cpm Dry light brown sand. Channel width is ~5 feet.
SD3	6/22/18	12:05	DC2B-SD3-01-062218	N	—	gamma = 35,000 cpm, Dry light brown sand. Channel width = 10 ft.
SD4	6/22/18	12:12	DC2B-SD4-01-062218	N	—	gamma = 12,000 cpm Dry light brown silty sand. Channel width = ~15 ft
SD5	6/22/18	1218	DC2B-SD5-01-062218	N	—	gamma = 60,000 cpm Dry light brown to reddish brown soil (sand) Channel width ~ 25 ft.
SD6	6/22/18	1225	DC2B-SD6-01-062218	N		gamma = 27K cpm Channel width ~ 25ft Dry light brown gravelly sand.

Notes to field team:
Samples will be taken at approximate 100 m transects

Note: Eliminated SD1 due to waterfall / cliff.

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Sediment Sampling Field Form

Drainage Name: Middle 2B
Drainage ID: DC2B
Sampling Team: KS, CA, DW, NW, PA

Date: 6/22/18
Weather: High 80s, Sunny
GPS Color: Green

Example Sample ID: DT9-SD1-01-042218
Example Duplicate ID: DT9-SD1-02-042218

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
SD7	6/22/18	1235	DC2B-SD7-01-062218	N	—	gamma = 26,000 cpm channel width = 15 feet
						Dry light brown sand below pink sandstone
SD8	6/22/18	12:40	DC2B-SD8-01-062218	N	—	gamma = 20,000 cpm Dry light brown sand
						channel width ≈ 15 feet,
SD8A	6/22/18	1245	DC2B-SD8A-01-062218	N	—	gamma = 73,000 cpm Added sample due to
						elevated gamma. Dry light brown sand. channel width ≈ 15 feet.
SD9	6/22/18	1257	DC2B-SD9-~~02~~ 01 KS -062218	Y	DC2B-SD9-02-062218	gamma = 28,000 cpm ~~Dry light brown sand~~,
					KS 6/22/18	channel width = ~30 feet, rusted truck panel
						directly below SD9, slightly damp light brown sand,

Notes to field team:
Samples will be taken at approximate 100 m transects

Sediment Sampling Field Form

Drainage Name: Middle ~~3~~ 3 DW
Drainage ID: DC3
Sampling Team: DW, MS, AO, JH, PA, LS

Date: 6/23/18
Weather: Clear, 90°
GPS Color: Green

Example Sample ID: DT9-SD1-01-042218
Example Duplicate ID: DT9-SD1-02-042218

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
✓ SD1	6/23/18	1000	DC3-SD1-01-062318	N	—	12K cpm, moist standing water near. ↓
						reddish brown sand well graded, 15' ~~width~~
✓ SD2	6/23/18	1005	DC3-SD2-01-062318	N	—	14K cpm, 15' channel Brown, silty sand, damp fine to medium
✓ SD3	6/23/18	1010	DC3-SD3-01-062318	N	—	13K cpm, 12' channel w. fine grain sand, w/silt moist, well sorted, near standing H_2O
✓ SD4	6/23/18	1015	DC3-SD4-01-062318	N	—	Offset due to standing water. 6' width
						12K cpm, Brown, Wet, sand w/ gravel
✓ SD5	6/23/18	1020	DC3-SD5-01-062318			15K, brown clayey-sand, wet, stand wtr above
						poorly sorted w/ gravel, 10'-50m downs
						at large rockfall,

Notes to field team:
Samples will be taken at approximate 100 m transects

Sediment Sampling Field Form

Drainage Name: Middle 3
Drainage ID: DC3
Sampling Team: AO, DW, LS, PA, MS, JH

Date: 6/23/18
Weather: Clear, 70°F
GPS Color: Green

Example Sample ID: DT9-SD1-01-042218
Example Duplicate ID: DT9-SD1-02-042218

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
✓ SD6	6/23/18	1030	DC3-SD6-01-062318	N	—	10K cpm - upstream of wide stream, wildlife
↓						evidence, organics, dark brown, silt, 30' width wet
✓ SD7	6/23/18	1035	DC3-SD7-01-062318	N	—	9K, Lt. Brown sand moist - fine grain
✓ SD8	6/23/18	1040	DC3-SD8-01-062318	N	—	18K, upstream of large overhang/owl habitat
↓						Base of depositional pile running water @ .05 cfs
↓						moist sand of brown color, w/ gravel
✓ SD9		1045	DC3-SD9-01-062318	N	—	30K, near ore rock 20' width ~~DS~~/CB ~~CB~~ DW
↓						depositional pile, 20' width wet brown sand, well sorte
✓ SD10	6/23/18	1050	DC3-SD10-01-062318	N	—	16K, ~~70~~ DW 50' width wet fine grain sand, well s
✓ SD11	6/23/18	1105	DC3-SD11-01-062318	N		27K, 40' width wet, poorly sorted sand w/ gravel. FG

Notes to field team:
Samples will be taken at approximate 100 m transects
fine grained = FG

Sediment Sampling
Field Form

Drainage Name: Middle 3
Drainage ID: DC3
Sampling Team: DW, MS, AO, JHBA, LS

Date: 6/23/18 **Example Sample ID:** DT9-SD1-01-042218
Weather: Clear 70°F **Example Duplicate ID:** DT9-SD1-02-042218
GPS Color: Green

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
✓ SD12	6/23/18	1110	DC3-SD12-01-062318	N	—	23K, LB (OS), 15', sand w/gravel. FG. Moist
✓ SD13	6/23/18	1125	DC3-SD13-01-062318	N	—	22K, flowing H_2O moist sand w/ gravel. FG.
✓ SD14	6/23/18	1140	DC3-SD14-01-062318	N	—	20K - standing H_2O moist sand w/gravel. FG.
✓ SD15	6/23/18	1145	DC3-SD15-01-062318	N	—	22K - flowing. 60' width moist sand w/gravel FG
✓ SD16	6/23/18	1150	DC3-SD16-01-062318	N	—	shifted upstream. 20K - 15' width. DAMP med. to coarse sand w/gravel
✓ SD17	6/23/18	1155	DC3-SD17-01-062318	N	—	18K, flowing H_2O FG, sand, brown, damp
✓ SD18	6/23/18	1200	DC3-SD18-01-062318	N	—	40K, 20' FG. sand wet

Notes to field team:
Samples will be taken at approximate 100 m transects

FG = fine grained

* At end of drainage - bottom of Mesa | Mine 12 or 14 - waste pile pushed off cliff; however, is not depositing into drainage yet.

Sediment Sampling Field Form

Drainage Name: Middle 3
Drainage ID: DC3
Sampling Team: MS, AO, SK, LS, CL, MW, AB, RK

Date: 08/21/18
Weather: 80°F overcast, slight breeze
GPS Color: Blue

Example Sample ID: DT9-SD1-01-042218
Example Duplicate ID: DT9-SD1-02-042218

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
SD10	08/21/18	1030	DC3-SD10-01-082118	N	—	Brown silty sand, saturated. 15ft wide, ~6-8in drop ✓
SD18A	08/21/18	1150	DC3-SD18A-01-082118	N	—	Brown silty sand, saturated 5ft wide. ~6in drop ✓

Notes to field team:
Samples will be taken at approximate 100 m transects

Sediment Sampling Field Form

Drainage Name: MIDDLE 3
Drainage ID: DC3A
Sampling Team: AO/KD/LS/JM

Date: 6/18/18
Weather: SUNNY, 75°F
GPS Color: GREEN

Example Sample ID: DT9-SD1-01-042218
Example Duplicate ID: DT9-SD1-02-042218

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
SD 9 ✓	6/18/18	1140	DC3A-SD9-01-061818	N		10,000 cpm shallow (fusa) bedrock 2-4" standing water present
SD 10 ✓	6/18/18	1150	DC3A-SD10-01-061818	N		17,000 cpm, dry in channel; note: hill above has higher gamma from potential flood deposition
SD 11 ✓	6/18/18	1200	DC3A-SD11-01-061818	NO		11000 CPM DRY PALE FINE GRAIN SAND
SD 12 ✓	6/18/18	1210	DC3A-SD12-01-061818	NO		12,000 CPM & BEDROCK SURROUNDING DRY PALE YELLOW FINE GRAIN CENTER 10' TRAP
SD 13 ✓	6/18/18	1220	DC3A-SD13-01-061818	NO		35,000 cpm DRY, FINE GRAIN SAND (MOIST) GRAY MUD STONE
SD 14 ✓	6/18/18	1230	DC3A-SD14-01-061818	NO		DRY, 12,000 CPM PALE YELLOW FINE GRAINED, PINE NEEDLES
SD15 ✓	6/18/18	1235	DC3A-SD15-01-061818	NO		DRY, 35000 cpm fluvial deposit upland forest above has bg + some boulder on left DS side
SD16 ✓	6/18/18	1240	DC3A-SD16-01-061818	NO		11,000 cpm, fine sand, beige, slightly moist
SD17 ✓	6/18/18	1300	DC3A-SD17-01-061818	NO		11,000 CPM ADDED SAMPLE DRY-DOWID VERY FINE GRADLE SAND (BELOW DOUBLE FORK)

Notes to field team:
Samples will be taken at approximate 100 m transects

Sediment Sampling Field Form

Drainage Name: Middle 3A
Drainage ID: DC3A
Sampling Team: AO, DW, LS, PA, MS, JH

Date: 6/23/18
Weather: Clear, 80°F
GPS Color: Green

Example Sample ID: DT9-SD1-01-042218
Example Duplicate ID: DT9-SD1-02-042218

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
✓ SD1	6/23/18	1230	DC3A-SD1-01-062318	N	—	14K, 70' width Dry, FG sand w/gravel
✓ SD2	6/23/18	1320	DC3A-SD2-01-062318	N	—	18K cpm, tan FG sand 15' U.S. MSO horseshoe cave
✓ SD3	6/23/18	1325	DC3A-SD3-01-062318	N	—	13K cpm. U.S. of 4 15' horseshoes. Dry, tan sand. FG
✓ SD4	6/23/18	1330	DC3A-SD4-01-062318			14K cpm. Dry, tan F.G. sand. 15' Mine above
↓						not hydrologically connected
✓ SD5	6/23/18	1335	DC3A-SD5-01-062318	N	—	20K cpm, 1st depositional area. ~~below~~ Waste rock/
↓						conglomerate. sandy silt fine to medium w/ gravel
✓ SD6		1340	DC3A-SD6-01-062318	N	—	rock canyon. 13K cpm 60' width (top), 15' bottom
↓						damp, FG sand
✓ SD7		1345	DC3A-SD7-01-062318			15K, 40' top 15' bottom med. grain sand w/gravel moist

Notes to field team:
Samples will be taken at approximate 100 m transects
FG = fine grained

Sediment Sampling
Field Form

Drainage Name: Middle 3A
Drainage ID: DC3A
Sampling Team: AO, DW, LS, PA, JH, MS

Date: 6/23/18
Weather: Clear, 80°F
GPS Color: Green

Example Sample ID: DT9-SD1-01-042218
Example Duplicate ID: DT9-SD1-02-042218

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
SD8	6/23/18	1350	DC3A-SD8-01-062318	N	—	Slot canyon. 111K cpm FG damp sand below water fall, standing H2O, Vegetation

Notes to field team:
Samples will be taken at approximate 100 m transects

Sediment Sampling Field Form

Drainage Name: Middle 3B
Drainage ID: DC3D + DC3B
Sampling Team: KJD, BE, SB

Date: 6/19/18
Weather: Clear. Lt. breeze
GPS Color: Green

Example Sample ID: DT9-SD1-01-042218
Example Duplicate ID: DT9-SD1-02-042218

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
DC3D-SD01	6/19/18	1050	DC3D-SD01-01-061918	N		11,500 CPM, med. to fine Sand, brown, slightly moist
DC3D-SD02	6/19/18	1100	DC3D-SD02-01-061918	N		13,000 CPM, med. to fine Sand, slightly moist. Beige to brown
DC3D-SD01A	6/19/18	1135	DC3D-SD01A-01-061918	N		33,000 CPM, med. sand, slightly moist, Beige to brown
DC3B-SD01	6/19/18	1150	DC3B-SD01-01-061918	N		14,500 CPM. Running water. Wet/Very moist, Sand w/gravel
DC3B-SD02	6/19/18	1200	DC3B-SD02-01-061918	N		24,000 CPM. Dry/slightly moist. Sand w/gravel.
DC3B-SD03	6/19/18	1215	DC3B-SD03-01-061918	N		35,000 CPM. Fine sand with gravel. Slightly moist. Beige.
DC3B-SD04	6/19/18	1225	DC3B-SD04-01-061918	N		33,000 CPM. Fine sand with gravel/pebble. Slightly moist. Beige.
DC3B-SD05	6/19/18	1235	DC3B-SD05-01-061918	Y	DC3B-SD05-02-061918	21,000 CPM. Fine to med. Sand w/gravel. Slightly moist. Tan/Beige
DC3B-SD06	6/19/18	1250	DC3B-SD06-01-061918	N		31,000 CPM Fine sand, tan color, slightly moist

Notes to field team:
Samples will be taken at approximate 100 m transects

6-20-18 RJ Remove leading Ø (zero)

Sediment Sampling Field Form

0706
0612
18 24

Drainage Name: MIDDLE 3
Drainage ID: DC3C
Sampling Team: AG / KD / LS / JM

Date: 6/18/18
Weather: WARM, BREEZY
GPS Color: GREEN

Example Sample ID: DT9-SD1-01-042218
Example Duplicate ID: DT9-SD1-02-042218

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
SD1 ✓	6/18/18	1310	DC3C-SD1-01-061818	NO		25,000 cpm, poorly sorted, fine sand to gravel, tan to beige
SD2 ✓	6/18/18	1325	DC3C-SD2-01-061818	NO		12000 cpm, poorly sorted, fine sand to gravel, tan to beige
SD3 ✓	6/18/18	1345	DC3C-SD3-01-061818	NO		23,000 CPM DRY TO MOIST FINE SAND YELLOW TO LIGHT BROWN
SD4 ✓	6/18/18	1350	DC3C-SD4-01-061818	NO		16000 cpm, fine to med. Sand, beige, slightly moist
SD5 ✓	6/18/18	1400	DC3C-SD5-01-061818	NO		14,500 CPM FINE TO MED SAND, BEIGE, DRY
SD3A ✓	6/18/18	1415	DC3C-SD3A-01-061818	NO		28,000 cpm. Fine to med. sand, slightly moist, beige.

Notes to field team:
Samples will be taken at approximate 100 m transects

Sediment Sampling Field Form

Drainage Name: Middle 3B
Drainage ID: DC3D + DC3B
Sampling Team: KJD, BE, SB

Date: 6/19/18
Weather: Clear. Lt. breeze
GPS Color: Green

Example Sample ID: DT9-SD1-01-042218
Example Duplicate ID: DT9-SD1-02-042218

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
DC3D-SD01	6/19/18	1050	DC3D-SD01-01-061918	N		11,500 CPM, med. to fine Sand, brown, slightly moist
DC3D-SD02	6/19/18	1100	DC3D-SD02-01-061918	N		13,000 CPM, med. to fine Sand, slightly moist. Beige to brown
DC3D-SD01A	6/19/18	1135	DC3D-SD01A-01-061918	N		33,000 CPM, med. sand, slightly moist, Beige to brown
DC3B-SD01	6/19/18	1150	DC3B-SD01-01-061918	N		14,500 CPM. Running water. Wet/Very moist, Sand w/gravel
DC3B-SD02	6/19/18	1200	DC3B-SD02-01-061918	N		24,000 CPM. Dry/slightly moist. Sand w/gravel.
DC3B-SD03	6/19/18	1215	DC3B-SD03-01-061918	N		35,000 CPM. Fine sand with gravel. Slightly moist. Beige.
DC3B-SD04	6/19/18	1225	DC3B-SD04-01-061918	N		33,000 CPM. Fine sand with gravel/pebble. Slightly moist. Beige.
DC3B-SD05	6/19/18	1235	DC3B-SD05-01-061918	Y	DC3B-SD05-02-061918	21,000 CPM. Fine to med. Sand w/gravel. Slightly moist. Tan/Beige
DC3B-SD06	6/19/18	1250	DC3B-SD06-01-061918	N		31,000 CPM Fine sand, tan color, slightly moist

Notes to field team:
Samples will be taken at approximate 100 m transects

6-20-18 RJ Remove leading Ø (zero)

Sediment Sampling
Field Form

Drainage Name: Middle 3 E
Drainage ID: DC3E
Sampling Team: AO, DW, JH, MS, PA, L

Date: 6/23/18
Weather: Clear, 90°F
GPS Color: Green

Example Sample ID: DT9-SD1-01-042218
Example Duplicate ID: DT9-SD1-02-042218

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
✓ SD1	6/23/18	1430	DC3E-SD1-01-062318	N	—	16K cpm, FG sand, damp reddish brown, 15' width
✓ SD2	6/23/18	1435	DC3E-SD2-01-062318	N	—	Vegetated. 21K cpm Wet, dark brown, FG sand
✓ SD3	6/23/18	1440	DC3E-SD3-01-062318	N	—	16K, slot canyon. Vegetated organics, brown FG sand
↓						0.5 L in: 6.4 sec 8.1 sec, 8.1 sec
↓						AVG= 0.06 L/sec
✓ SD4	6/23/18	1450	DC3E-SD4-01-062318	N	—	26K cpm, between 2 horseshoe canyons
↓						FG sand w/organics wet. 3.5 sec/0.5 L
✓ SD5	6/23/18	1455	DC3E-SD5-01-062318	N	—	FG sand wet 12K cpm, slot canyon 50' in width.
↓						
✓ SD5A	6/23/18	1500	DC3E-SD5A-01-062318	N	—	Reddish brown FG sand, wet. Below waterfall 14K cpm

Notes to field team:
Samples will be taken at approximate 100 m transects

FG: fine grain

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Sediment Sampling Field Form

Drainage Name: MIDDLE 3E
Drainage ID: DC 3E
Sampling Team: A, JC, JS

Date: 8-17-18
Weather: PT 70°
'S Color: BLACK

Example Samp -042218
Example Duplica -042218

Sediment Sample Location	(I		e ID	Duplicate Collected?	Duplicate ID	lotes
SD6	8-17-18	9:20	DC3E-SD6-01-081718			ABOVE WATERFALL 18K-CENTER, 25K-BANK-SAMPLE ✓
SD7	8-17-18	9:55	DC3E-SD7-01-081718			19K-CPM ABOVE MID DRAINAGE ✓
SD8	8-17-18	10:00	DC3E-SD8-01-081718			25K-CPM, DIRECTLY DOWNSTREAM OF MID DRAINAGE. ✓
SD9	8-17-18	10:20	DC3E-SD9-01-081718			13K-CPM -17K SANDY CLAY LOAM ✓
SD10	8-17-18	10:35	DC3E-SD10-01-081718			13K-CPM SANDY CLAY LOAM ✓
SD11	8-17-18	10:40	DC3E-SD11-01-081718			10K-CPM
SD12	8-17-18	10:46	DC3E-SD12-01-081718			10K-CPM
SD13	8-17-18	11:00	DC3E-SD13-01-081718			10K-CPM
SD14	8-17-18	11:05	DC3E-SD14-01-081718			10K-CPM
SD15	8-17-18	11:20	DC3E-SD15-01-081718			10K-CPM

Notes to field team:
Samples will be taken at

Sediment Sampling
Field Form

Drainage Name: Middle 3E
Drainage ID: DC3E
Sampling Team: MS, AO, SK, RS, CL, MW, AB, RK
Date: 8/21/18
Weather: overcast, 80°F, slight breeze
GPS Color: Blue
Example Sample ID: DT9-SD1-01-042218
Example Duplicate ID: DT9-SD1-02-042218

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
SD1	8/21/18	1220	DC3E-SD1-01-082118	N	—	ft width Brown silty sand, saturated
SD5A	8/21/18	1250	DC3E-SD5A-01-082118	N	—	AT WATERFALL OF DC3E

Notes to field team:
Samples will be taken at approximate 100 m transects

Sediment Sampling Field Form

Drainage Name: Mesa 1 MINE 12 DRAINAGE #1) (M1-04)
Drainage ID: ~~M6~~ MS ~~SD1-01~~ /M7
Sampling Team: AO

Date: 6/23/18
Weather: Clear 90°F
GPS Color: Green

Example Sample ID: DT9-SD1-01-042218
Example Duplicate ID: DT9-SD1-02-042218

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
SD1	6/23/18	1220	MS ~~M6~~-SD1-01-062318	N	—	100,000+ cpm; pale yellow sandy silt potential mine waste; collected below confl of M6
SD1	6/23/18	1510	M7-SD1-01-062318	N	—	Dry drainage. 88K cpm below potential mine waste
↓				N	—	~~Gravel~~ PW F-G ~~Sandy~~ SW gravelly sand

Notes to field team:
Samples will be taken at approximate 100 m transects

Sediment Sampling Field Form

Drainage Name: Mesa 1 MINE 12 DRAINAGE #1) (M1-04)
Drainage ID: ~~M6~~ MS ~~SD1-01~~ /M7
Sampling Team: AO

Date: 6/23/18
Weather: Clear 90°F
GPS Color: Green

Example Sample ID: DT9-SD1-01-042218
Example Duplicate ID: DT9-SD1-02-042218

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
SD1	6/23/18	1220	MS ~~M6~~-SD1-01-062318	N	—	100,000+ cpm; pale yellow sandy silt potential mine waste; collected below confl of M6
SD1	6/23/18	1510	M7-SD1-01-062318	N	—	Dry drainage. 88K cpm below potential mine waste
↓				N	—	~~Gravel~~ PW F-G ~~Sandy~~ SW gravelly sand

Notes to field team:
Samples will be taken at approximate 100 m transects

Sediment Sampling
Field Form

Drainage MI0
Drainage MI0
Sampling C, A, S

Date: 8-17-18 **Example Sam**
Weather: PT **Example Duplic**
iPS Color: Black

Sedim Sample L			le ID	Duplicate Collected?	Duplicate ID	
SD1	8-17-18		MI0-SD1-01-081718			Woods MI0 ✓
SD2	8-17-18		MI0-SD2-01-081718			DRAINAGE ABOVE SD8 ✓

Notes to field
Samples will

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Sediment Sampling Field Form

pg 1

Drainage Name: Middle 3F
Drainage ID: ~~Middle 3F~~ JB. DC3F
Sampling Team: MH, JM, KD, JB, SB

Date: 06/23/18
Weather: Sunny
GPS Color: Pink

Example Sample ID: DT9-SD1-01-042218
Example Duplicate ID: DT9-SD1-02-042218

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
SD1	06/23/18	9:45	DC3F-SD1-01-062318	No	—	29,000 CPM (yellow) Fine Sand-Gravel
SD2	06/23/18	9:53	DC3F-SD2-01-062318	No	—	43,000 CPM (yel.) Fine Sand
SD3	06/23/18	10:00	DC3F-SD3-01-062318	No	—	19,000 (yel.) CPM Fine-Coarse Red-Brown
SD4	06/23/18	10:07	DC3F-SD4-01-062318	No	—	12,000 CPM (yell.) Fine-Silt Red-Brown
SD5	06/23/18	10:16	DC3F-SD5-01-062318	No	—	24,000 cpm (yell.) Fine Red-Brown 5Ft channel width
SD6	06/23/18	10:29	DC3F-SD6-01-062318	No	—	16,000 cpm (yell.) Fine, Red-Brown 25ft-Sandstone channel
SD7	06/23/18	10:40	DC3F-SD7-01-062318	Yes	DC3F-SD7-02-062318 ✓	48,000 cpm (yell.) Fine Red-Brown 12ft channel
SD8	06/23/18	10:56	DC3F-SD8-01-062318	No	—	33,000 CPM Red-Brown Organics 10ft channel Moist
SD9	06/23/18	11:05	DC3F-SD9-01-062318	No	—	24,000 cpm Red-Brown Fine 12ft channel
SD10	06/23/18	11:12	DC3F-SD10-01-062318	No	—	21,000 cpm Fine-Silt Red-Brown 8ft channel

Notes to field team:
Samples will be taken at approximate 100 m transects

Sample Bags
Sample ID
Date
Time
Initials
Depth

Sediment Sampling Field Form

Pg 2

Drainage Name: Middle 3F
Drainage ID: DC3F
Sampling Team: MH, JM, KD, JB, SB

Date: 06/23/18
Weather: Sunny
GPS Color: Pink

Example Sample ID: DT9-SD1-01-042218
Example Duplicate ID: DT9-SD1-02-042218

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
SD8A	06/23/18	11:29	DC3F-SD8A-01-062318	No	–	145,000 cpm (cell.) Silt-Coarse dry Red-Brown

Notes to field team:
Samples will be taken at approximate 100 m transects

Sediment Sampling Field Form

Drainage Name: Middle 36
Drainage ID: DC36
Sampling Team: MH, JM, KD, JB, SB

Date: 06/27/18
Weather: Sunny
GPS Color: Pink

Example Sample ID: DT9-SD1-01-042218
Example Duplicate ID: DT9-SD1-02-042218

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
SD1	06/23/18	13:23	DC36-SD1-01-062318	Yes	DC36-SD1-02-062318	Poorly sorted silt-pebble 15,000 cpm 15ft channel
SD2	06/23/18	13:35	DC36-SD2-01-062318	No	—	14,000 cpm Red-Brown poorly sorted silt-pebbles 8ft
SD3	06/23/18	13:41	DC36-SD3-01-062318	No	—	15,000 cpm Red-Brown Silt 10ft channel Dry
SD4	06/23/18	13:47	DC36-SD4-01-062318	No	—	11,000 cpm Red Brown Silt 15ft channel Dry
SD5	06/23/18	13:52	DC36-SD5-01-062318	No	—	17,000 cpm Red Brown Silt 12ft channel Dry
SD6	06/23/18	14:01	DC36-SD6-01-062318	No	—	13,000 cpm Red Brown Silt 8ft channel Dry

Notes to field team:
Samples will be taken at approximate 100 m transects

Sediment Sampling
Field Form

Drainage Name: KNIFE EDGE
Drainage ID: DM 33
Sampling Team: ALYSSA, CYNTHIA, SEAN, MITCH

Date: 8/18/18 **Weather:** SUNNY 70° CLEAR SKY **GPS Color:** ORANGE

Example Sample ID: DT9-SD1-01-042218
Example Duplicate ID: DT9-SD1-02-042218

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
~~DM33~~ SD16	8/18/18	0942	DM33-SD16-01-081818	Y	DM33-SD16-02-081818	FINE SAND TO SMALL COBBLES (14m WIDE BOTTOM WIDTH)
SD 15	8/18/18	0959	DM33-SD15-01-081818 (VERIFY ID)	N		FINE TO MED SAND W COBBLES (BW IS 9m WIDE)
SD 14	8/18/18	1007	DM33-SD14-01-081818	N		SAME AS ABOVE (BW IS 18m WIDE)
SD 13	8/18/18	1012	DM33-SD13-01-081818	N		SAME SED (BW IS 13m WIDE)
SD 12	8/18/18	1018	DM33-SD12-01-081818	N		SAME SED (BW IS 7m WIDE)
SD 11	8/18/18	1025	DM33-SD11-01-081818	N		SAND W SOME SMALL BROKEN ROCKS ~1' (BW IS 7m)
SD 10	8/18/18	1030	DM33-SD10-01-081818	N		SAME SED (BW IS 6m WIDE)
SD 9	8/18/18	1035	DM33-SD9-01-081818	N		MED - COARSE SAND & BED ROCK (BW IS 4m m WIDE)
SD 8	8/18/18	1049	DM33-SD8-01-081818	N		SAME SED AS ABOVE (BW IS 5m WIDE)
SD 7	8/18/18	1059	DM33-SD7-01-081818	N	ONE 25' DROP TWEEN 7&8	SAME SED (BW IS 6m WIDE)

Notes to field team:
Samples will be taken at approximate 100 m transects

ıt Sampling
d Form

1/18/18 75° **Example Sample ID:** DT9-SD1-01-042218
LIGHT CALM **Example Duplicate ID:** DT9-SD1-02-042218
ORANGE

pling ALYSSA, CYNTH

				Duplicate collected?	**Duplicate ID**	**Notes**
~~DM33~~				N		SAND & COBBLES (BW IS 8m WIDE)
				N	15 DROP TWIXN 5 & 6	SAME SED (BW = 6m)
SD4				N	CHANNEL SPLITS TWIXN 4 & 5 (MUCH SMALLER HERE)	SED - SAND TO GRAVEL (BW = 2.5m)
SD3				N	SEVERAL SMALL (1-3') DROPS TWIXN 3 & 4	SAME SED (BW 3m WIDE)
SD2				N	SEVERAL SMALL DROPS TWIXN 2 & 3	SAME SED W CRACKED MUD (BW = 3m WIDE)
SD1			DM33-SD1-01-081818	N	NARROW & STEEP CANYON IN BTWIXN 1 & 2	SAME SED W MORE BEDROCK SANDSTONE
						BW = 5m WIDE

Notes field

KEPM (9-11) FOR ALL TRANSECTS *

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Sediment Sampling Field Form

FLAG MESA
Drainage Name: DM35
Drainage ID:
Sampling Team: SEW, ALYSSA, CATALINA, MITCH

Date: 8/18/18 LIGHT BRZ
Weather: 80° CLEAR
GPS Color: ORANGE

Example Sample ID: DT9-SD1-01-042218
Example Duplicate ID: DT9-SD1-02-042218

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
SD 21	8/18/18	1353	DM35-SD21-01-081818	N		SMALL COBBLES ARMOR SAND (BW = 3.5m)
SD 20	8/18/18	1358	DM35-SD20-01-081818	N	DM35-SD20-01-081818	FINE SAND TO BOULDERS (BW = 6M W102)
SD 19	8/18/18	13	INACCESIBLE AT THIS POINT LAYERS OF POOR QUALITY STE		STEEP LOOSE SLOPE WITH SEVERAL ER SANDSTONE LIMITS ACCESS	
—						
—						

Notes to field team:
Samples will be taken at approximate 100 m transects

FLAG DRAINAGE

Sediment Sampling Field Form

PK

Drainage Name:
Drainage ID: DM 35
Sampling Team: CYNTHIA, SEAN, MITCH

Date: 8/20/18
Weather: WARM & CLEAR
GPS Color: ORANGE

Example Sample -042218
Example Duplicate -042218

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
SD19 ✓	8/20/18	1042	DM35-SD19-01-082018	N		TO MED SAND 5 m WIDE)
SD18 ✓	8/20/18	1052	DM35-SD18-01-082018	N		& CEMENTED MUD 5m)
SD17 ✓	8/20/18	1100	DM35-SD17-01-082018	N		SMALL TO LARGE COBBLES m WIDE)
SD16 ✓	8/20/18	11:11	DM35-SD16-01-082018	N		AS ABOVE (SSAA) 5m WIDE)
SD15 ✓	8/20/18	1118	DM35-SD15-01-082018	N	1 6' DROP & 1 1' DR TWIN 15 & 16	2D (SSAA) m WIDE)
SD14 ✓	8/20/18	1135	DM35-SD14-01-082018	N	LOTS OF BEDROCK TWIN 14 & 15	& LARGE BOULDERS m WIDE)
SD13 ✓	8/20/18	1140	DM35-SD13-01-082018	N	LOTS OF BOULDERS TWIN 13 & 14	5M WIDE)
SD12 ✓	8/20/18	1146	DM35-SD12-01-082018	N		CEMENTED SAND, MED SAND . WIDE)
SD11 ✓	8/20/18	1151	DM35-SD11-01-082018	N		TO LARGE BOULDERS 4 m WIDE)
SD10 ✓	8/20/18	1310	DM35-SD10-01-082018	N	1 10' DROP & 50m BEDROCK TWIN 1	5m WIDE)

Notes to field team:
Samples will be taken at approximate 100 m transects

SSAA = SAME SEDIMENT AS ABOVE (SAMPLE LOCATION)

WIDTH

(1)

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FLAG DRAINAGE

Sediment Sampling Field Form

Drainage Name: DM35
Drainage ID:
Sampling Team: CYNTHIA, SEAN, MITCH

Date: 8/20/18
Weather: 85° CLEAR
GPS Color: ORANGE

Example Sampl 1-042218
Example Duplicat 2-042218

Sediment Sample Location	Date (M/D/Y)	Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	Notes
SD9 ✓	8/20/18	1219	DM35-SD9-01-082018	N	14' & 12' DRO FWEEN 9 & 8	FINE SANDSTONE SOME BROKEN SANDSTONE (BW = 4 m WIDE)
SD8 ✓	8/20/18	1225	DM35-SD8-01-082018	N	SAMPLE LOCATION SLIGHTLY D/S DUE	m WIDE)
SD7 ✓	8/20/18	1232	DM35-SD7-01-082018	N	(BEDROCK) 1 DROP TWEEN 7	m WIDE)
~~SD6~~	~~8/20/18~~	NOT	DM35-SD6-01-082018	N	1 20' DROP TWE 7+6	~~(BW = m WIDE)~~
~~SD5~~	~~8/20/18~~	SAMPLED	DM35-SD5-01-082018	N	* CANYON	ST U/S FROM
~~SD4~~	~~8/20/18~~	DUE TO INATTENTIVE	DM35-SD4-01-082018	N	SD7 DUE TO ST DROP JUST U/S	WALLS & 20'
~~SD3~~	~~8/20/18~~	& STILL UNSTABLE	DM35-SD3-01-082018	N		
~~SD2~~	~~8/20/18~~	SLOPE	DM35-SD2-01-082018	N		
~~SD1~~	~~8/20/18~~		DM35-SD1-01-082018	N		

Notes to field team:
Samples will be taken at approximate 100 m transects

Sediment Sampling
Field Form

Drainage Name: TOMMY JAMES MINE
Drainage ID: DM 39
Sampling Team: SEAN, CORA, JOHN DODGE, LEM, MITCH
Date: 8/16/18
Weather: SUNNY 70° CALM
GPS Color: ORANGE
Example Sample ID
Example Duplicate ID

Sediment Sample Location	Date (M/D/Y)	Sample Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate ID	
~~DM38~~_SD17	8/16/18	09:54 ~~10:09~~	DM39-SD17-01-081618	N	~~4' CHANNEL WIDTH OH W~~ (10 M BANKFULL)	9 SAND W/ BROKEN ANDSTONE BITS
SD16	8/16/18	10:03	DM39-SD16-01-081618	Y	DM39-SD16-02-081618 ✓ *****	9 INE BAN (IDE BANKFULL)
SD 15	8/16/18	10:11	DM39-SD15-01-081618	N		F SAND (DE BF)
SD 14	8/16/18	10:20	DM39-SD14-01-081618	N		SAND DE BF)
SD 13	8/16/18	1027	DM39-SD13-01-081618	N		F :BF)
SD 12	8/16/18	1034	DM39-SD12-01-081618	N	25' HIGH FALLS JUST U/S OF SAMPLE LOC.	CPM (6 SAND (CRACKED) WIDE BF)
SD 11	8/16/18	1124	DM39-SD11-01-081618	N	LOOKS LIKE 2 DROPS BETWEEN 11 & 12) B DROP	( ) PAN CEMENTED AND & STONE
SD10	8/16/18	1135	DM39-SD10-01-081618	N	DROP BETWEEN 10 & 11 (15' DROP)	(6m BF) H HEARD PAN (LITTLE SAND)
SD9	8/16/18	1146	DM39-SD9-01-081618	N		ID SAND BANKFULL) 10 KCPM
SD8	8/16/18	1206	DM39-SD8-01-081618	N	10' DROP TWEEN 9 & 8	~~10 KCPM~~ 9 KCPM (:BF) CEMENTED SAND

Notes to field team:
Samples will be taken at approximate 100 m transects

* SE WI

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Sediment Sampling Field Form

Drainage Name: Tommy James Mine DM39
Drainage ID:
Sampling Team: SEAN, CORA, LEM, JAKE DODGE, MITCH
Date: 8/16/18 **Example Sa**
Weather: 75 SUNNY CLEAR CALM **Example Dup**
GPS Color: ORANGE

Sediment Sample Location	Date (M/D/Y)	Sample Time (MST)	Field Sample ID	Duplicate Collected?	Duplicate	
SD7	8/16/18	1215	DM39-SD7-01-081618	N	1) 10' DROP TW SD7	
SD6 IS AT A POINT THAT WOULD BE TRICKY TO GET OUT OF - A						ON HERE
SD06 IN GPS IS VANTAGE POINT (NOT SAMPLED - NOT AC						

Notes to field team:
Samples will be taken at approximate 100 m transects

Surface Water Sampling Field Form

Site Type: Drainage
Site Name: ~~EMS~~ Middle 3
Tetra Tech ID: DC3
Sampling team: MS, AO, SK, LS, CL, MW, AB, RK

Date: 08/21/18
Weather: 80F, slight breeze, overcast
GPS Color: Blue
Page: 1 of 1

DC3
Example Lab Sample ID: ~~M14~~-SW1-01-MMDDYY
Example Lab Sample Duplicate ID: ~~M14~~-SW1-02-MMDDYY
DC3

Sample Location	Date (M/D/Y)	Time (MST)	Lab Sample ID	Field Measurements						Notes
				pH	Temp (°C)	Specific Conductance (µshos/cm)	Turbidity (NTU)	Dissolved Oxygen (DO) (mg/L)	Oxidation-Reduction Potential (ORP) (mV)	
SW10	08/21/18	0955	DC3-SW10-01-082118	8.60	15.99	447.45	26.19	7.86	194.2	ST: 1000
SW10	08/21/18	0955	DC3-SW10-02-082118	↓	↓	↓	↓	↓	↓	ST: 1000 Duplicate *
SW18A	08/21/18	1121	DC3-SW18A-01-082118	8.31	16.43	502.38	185.88	7.44	239.3	ST: 1145 slightly downstream of CW13

Notes to field team:
Before water sampling takes place, a water quality meter will be submerged in the waterbody to obtain measurements of the above parameters.
The meter will be left in place until all parameters have stabilized, and the measurement will be recorded.
(after 3 successive measurements fall in the range of ±0.1 for pH; ±3 percent for conductivity; ±10 millivolts for ORP; ±10 percent or ±0.3 milligrams per liter for DO).

Surface Water Sampling Field Form

Site Type: Drainage
Site Name: Middle 3E
Tetra Tech ID: DC3E
Sampling team: MS, MO, SK, LS, CL, MW, MB, RK

Date: 8/21/18
Weather: Overcast, 80°F, sight breeze
GPS Color: Blue
Page: ~~1~~ 2 of 2

DC3E
Example Lab Sample ID: ~~M14~~-SW1-01-MMDDYY
Example Lab Sample Duplicate ID: ~~M14~~-SW1-02-MMDDYY
DC3E

Sample Location	Date (M/D/Y)	Time (MST)	Lab Sample ID	Field Measurements						Notes
				pH	Temp (°C)	Specific Conductance (µshos/cm)	Turbidity (NTU)	Dissolved Oxygen (DO) (mg/L)	Oxidation-Reduction Potential (ORP) (mV)	
SW1	8/21/18	1158	DC3E-SW1-01-082118	8.58	16.65	394.10	50.49	7.80	285.3	ST: 1215 ~~3ft width~~ MS ✓
SW5A	8/21/18	1230	DC3E-SW5A-01-082118	8.55	16.40	440.94	136.51	7.74	218.7	ST: 1245 ✓

Notes to field team:
Before water sampling takes place, a water quality meter will be submerged in the waterbody to obtain measurements of the above parameters.
The meter will be left in place until all parameters have stabilized, and the measurement will be recorded.
(after 3 successive measurements fall in the range of ±0.1 for pH; ±3 percent for conductivity; ±10 millivolts for ORP; ±10 percent or ±0.3 milligrams per liter for DO).

Site type: Drainage
Site Name: Middle 3E
Tetra Tech ID: DC3E

Surface Water Sampling Field Form

Date: 09/30/18
Weather: windy, partly cloudy, Mid 70s
GPS color: orange

Sampling team: AO, MS, KS, JD

Notes to field team:
Before water sampling takes place, a water quality meter will be submerged in the waterbody to obtain measurements of the above parameters.
The meter will be left in place until all parameters have stabilized, and the measurement will be recorded.
(after 3 successive measurements fall in the range of ±0.1 for pH; ±3 percent for conductivity; ±10 millivolts for ORP; ±10 percent or ±0.3 milligrams per liter for DO).

Sample Location	Date (M/D/Y)	Time (MST)	Lab Sample ID	Field Measurements						Notes Which bottle/analyte?
				pH	Temp (°C)	Specific Conductance (µshos/cm)	Turbidity (NTU)	Dissolved Oxygen (DO) (mg/L)	Oxidation-Reduction Potential (ORP) (mV)	
SW14	09/30/18	1300	DC3E-SW14-01-093018							Sample collected below M9 from water flowing over rock
SW10	09/30/18	1340	DC3E-SW10-01-093018							Sample collected from water flowing off rocks
SW10	09/30/18	1340	DC3E-SW10-02-093018							Duplicate of sample SW10

ATTACHMENT J5

PHOTOGRAPHIC LOG

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LIST OF FIGURES

1.0 MIDDLE 1

The following photos were taken during the Middle 1 (DC1) visit to the Cove Chapter of the Navajo Nation on June 23, 2018.

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Figure J5-2. DC1: View of field team walking in drainage.

Figure J5-3. DC1: View of field team walking in drainage.

Figure J5-4. DC1: View of field personnel walking in drainage.

Figure J5-5. DC1: View of sandstone walls carved out in drainage.

Figure J5-6. DC1: View of drainage at SD23.

Figure J5-7. DC1: View of field team sampling the sediment in drainage at SD25.

Figure J5-8. DC1: View of field team sampling the sediment in drainage at SD31.

1.1 MIDDLE 1A

The following photos were taken during the Middle 1A (DC1A) visit to the Cove Chapter of the Navajo Nation on June 20, 2018.

Figure J5-9. DC1A: View of drainage at SD5

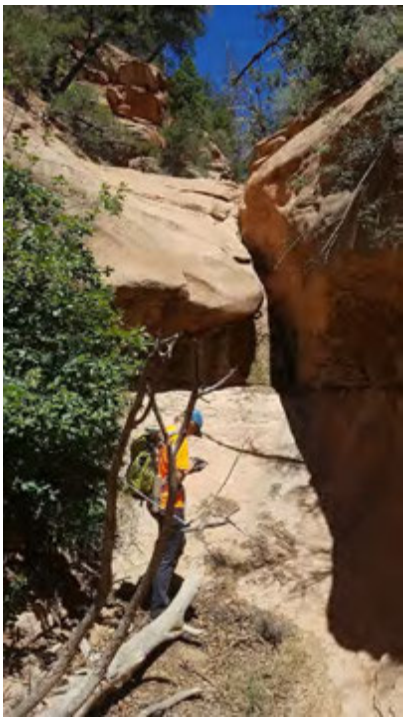

Figure J5-10. DC1A: View of the field team in drainage near sampling location SD4.

Figure J5-11. DC1A: Waste rock identified near SD6

Figure J5-12. DC1A: Uranium rock identified near SD6

1.2 MIDDLE 1B

The following photos were taken during the Middle 1B (DC1B) visit to the Cove Chapter of the Navajo Nation on June 21, 2018.

Figure J5-13. DC1B: View of outside drainage near SD8

Figure J5-14. DC1B: View of exposed uranium near SD4

Figure J5-15. DC1B: View of narrow drainage near SD4

Figure J5-16. DC1B: Field personnel taking sediment sample SD4.

Figure J5-17. DC1B: View of field personnel near opening of drainage near SD1.

1.3 MIDDLE 1G

The following photos were taken during the Middle 1G (DC1G) visit to the Cove Chapter of the Navajo Nation on June 21, 2018.

Figure J5-18. DC1G: The beginning of the drainage at DC1G

2.0 MIDDLE 2

The following photos were taken during the Middle 2 (DC2) visit to the Cove Chapter of the Navajo Nation on May 24, 2018.

Figure J5-19. DC2: Arial view of DC2 drainage.

2.1 MIDDLE 2B

The following photos were taken during the Middle 2B (DC2B) visit to the Cove Chapter of the Navajo Nation on June 22, 2018.

Figure J5-20. DC2B: View of the waste pile above Middle 2B drainage.

Figure J5-21. DC2B: Eliminated SD1 due to cliff.

Figure J5-22. DC2B: View of the field team in drainage near sampling location SD2.

Figure J5-23. DC2B: View of field personnel in drainage looking for SD1.

Figure J5-24. DC2B: View of the field team in drainage near SD5.

Figure J5-25. DC2B: View of the drainage near sampling location SD6.

Figure J5-26. DC2B: View of field personnel in drainage looking for SD2.

Figure J5-27. DC2B: View of the field team in drainage near SD3.

3.0 MIDDLE 3

The following photos were taken during the Middle 3 (DC3) visit to the Cove Chapter of the Navajo Nation on June 23, 2018 and August 19, 2018.

Figure J5-28. DC3: Opening of slot canyon near SD10

Figure J5-29. DC3: Water spring spotted near SD10

Figure J5-30. DC3: Water and sediment located near SD18.

Figure J5-31. DC3: Field personnel observing etchings into drainage near SD8.

Figure J5-32. DC3: View of slot canyon near SD8.

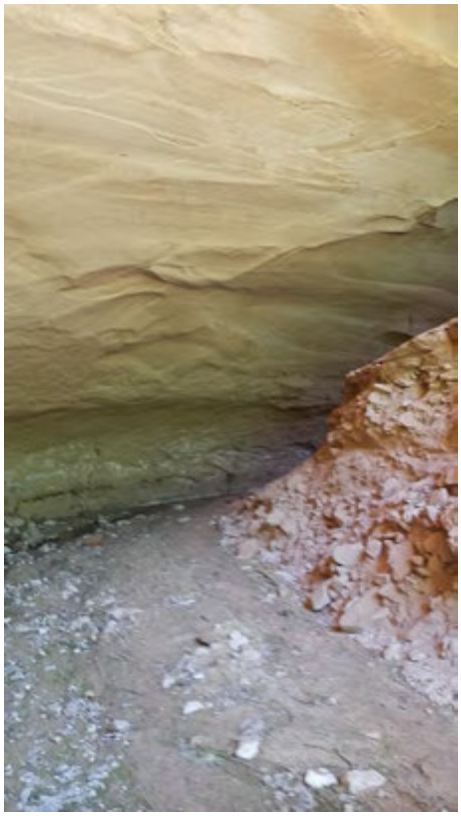

Figure J5-33. DC3: Waste rock spotted near SD8

Figure J5-34. DC3: View of field personnel in drainage taking SD13.

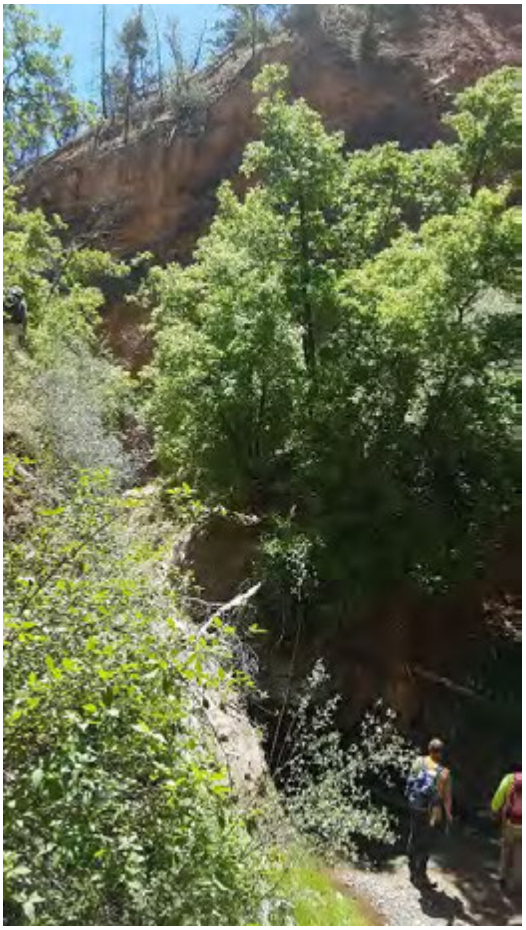

Figure J5-35. DC3: View of the field team in drainage near SD1.

Figure J5-36. DC3: View of the field team in drainage near SD16.

Figure J5-37. DC3: Field personnel field mapping, and collecting sediment samples at SD17.

3.1 MIDDLE 3A

The following photos were taken during the Middle 3A (DC3A) visit to the Cove Chapter of the Navajo Nation on June 23, 2018.

Figure J5-38. DC3A: Field personnel mapping out the beginning of the drainage near SD1

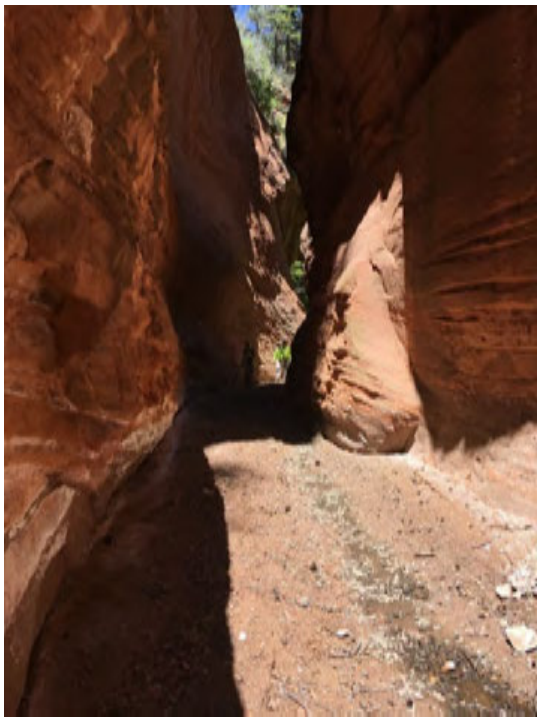

Figure J5-39. DC3A: View of the drainage from SD6

Figure J5-40. DC3A: Field personnel taking a sediment sample at SD7

Figure J5-41. DC3A: View of the drainage from SD8

Figure J5-42. DC3A: Ponded water in drainage near SD8

Figure J5-43. DC3A: View of drainage near SD9

Figure J5-44. DC3A: Field personnel taking a sediment sample at SD10

Figure J5-45. DC3A: View of drainage near SD11

Figure J5-46. DC3A: View of the drainage near SD12

Figure J5-47. DC3A: Field personnel taking a sediment sample at SD13

3.2 MIDDLE 3B

The following photos were taken during the Middle 3B (DC3B) visit to the Cove Chapter of the Navajo Nation on June 18, 2018.

Figure J5-48. DC3B: Feathers spotted in the drainage near SD1

Figure J5-49. DC3B: Trail through the drainage near SD3

Figure J5-50. DC3B: Remains of mining operations near SD2

Figure J5-51. DC3B: Remains of mining operations near SD1

3.3 MIDDLE 3C

The following photos were taken during the Middle 3C (DC3C) visit to the Cove Chapter of the Navajo Nation on June 18, 2018.

Figure J5-52. DC3C: Field personnel taking a sediment sample at SD1

Figure J5-53. DC3C: Trail through the drainage near SD5

Figure J5-54. DC3C: Field personnel field mapping the drainage near SD5

3.4 MIDDLE 3D

The following photos were taken during the Middle 3D (DC3D) visit to the Cove Chapter of the Navajo Nation on June 18, 2018.

Figure J5-55. DC3D: Field personnel mapping drainage near SD1

3.5 MIDDLE 3E

The following photos were taken during the Middle 3E (DC3E) visit to the Cove Chapter of the Navajo Nation on August 19, 2018 and September 30, 2018.

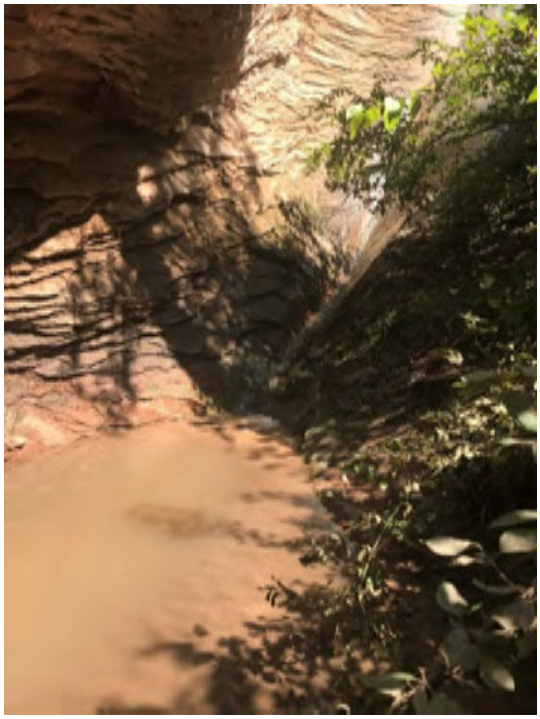

Figure J5-56. DC3E: View of the sediment and surface water sampling location at SD5A.

Figure J5-57. DC3E: View of inside drainage near SD6

Figure J5-58. DC3E: Field personnel mapping area near SD7

Figure J5-59. DC3E: View of inside the drainage near SD9

Figure J5-60. DC3E: Water sample taken at DC3E at SD10

Figure J5-61. DC3E: Drainage at DC3E near SD10

Figure J5-62. DC3E: Field personnel take a sediment sample at SD11

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Figure J5-65. DC3E: Water sample taken at DC3E near SD15

3.6 MIDDLE 3F

The following photos were taken during the Middle 3F (DC3F) visit to the Cove Chapter of the Navajo Nation on June 23, 2018.

Figure J5-66. DC3F: View of drainage at SD1.

3.7 MIDDLE 3G

The following photos were taken during the Middle 3G (DC3G) visit to the Cove Chapter of the Navajo Nation on August 19, 2018.

Figure J5-67. DC3G: View of the drainage near SD1.

4.0 COVE WASH NORTH

The following photos were taken during the Cove Wash North (DCWN) visit to the Cove Chapter of the Navajo Nation on June 24, 2018.

Figure J5-68. DCWN: View of the drainage near sampling location SD20.

Figure J5-69. DCWN: View of the drainage near sampling location SD1.

Figure J5-70. DCWN: View of the drainage near sampling location SD3.

Figure J5-71. DCWN: Field member in drainage near sampling location SD5.

Figure J5-72. DCWN: View of the drainage between sampling locations SD5 and SD6.

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Figure J5-74. DCWN: View of the drainage near sampling location SD16.

Figure J5-75. DCWN: View of rock pile in the drainage between SD17 and SD18.

Figure J5-76. DCWN: Standing water in the drainage between SD18 and SD19.

Figure J5-77. DCWN: View of cliff that separates access to the drainage.

5.0 COVE WASH MIDDLE

No field photographs are available for the Cove Wash Middle (DT9) drainage.

6.0 TSE TAH WEST

The following photos were taken during the Tse Tah West (DM1) visit to the Cove Chapter of the Navajo Nation on May 23, 2018.

Figure J5-78. DM1: View of beginning of drainage from M1.

7.0 KNIFE EDGE

The following photos were taken during the Knife Edge (DM33) visit to the Cove Chapter of the Navajo Nation on September 18, 2018.

Figure J5-79. DM33: View of the drainage from KE-01

Figure J5-80. DM33: View of the beginning of the drainage close to KE-01

8.0 BLACK MESA

The following photos were taken during the Black Mesa (DM35) visit to the Cove Chapter of the Navajo Nation on August 12, 2018.

Figure J5-81. DM35: View of the drainage from M34.

9.0 TOMMY JAMES

The following photos were taken during the Tommy James (DM39) visit to the Cove Chapter of the Navajo Nation on August 12, 2018.

Figure J5-82. DM39: View of the drainage from M38.