Twin Tunnels Environmental Assessment Regulated Materials and Solid Waste Technical Memorandum

May 23, 2012

Twin Tunnels Environmental Assessment
Idaho Springs-Clear Creek County

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Acronyms

AAS	Atomic Absorption Spectroscopy
ACM	Asbestos-Containing Materials
AES	Atomic Emission Spectroscopy
AST	Above-Ground Storage Tank
ATMS	Advanced Traffic Management Systems
CBM	Colorado Bureau of Mines
CDOT	Colorado Department of Transportation
CDPHE	Colorado Department of Public Health and Environment
CERCLIS	Compensation and Liability Information System
CR 314	County Road 314
CSEV	Colorado Soil Evaluation Value
CSP	Colorado State Patrol
CSQG	Conditionally Exempt Small Quantity Generator
CWA	Clean Water Act
DRMS	Colorado Division of Reclamation, Mining and Safety
DWS	Domestic Water Supply
EA	Environmental Assessment
ELPAT	Environmental Lead Proficiency Analytical Testing
ERNS	Emergency Response Notification System
FHWA	Federal Highway Administration
ICP	Inductively Couples Plasma
ITS	Intelligent Transportation Systems
LQG	Large Quantity Generator
LUST	Leaking Underground Storage Tanks
mg/L	Milligram per Liter
MOU	Memorandum of Understanding
MP	Mile Point
NFRAP	CERCLIS No Further Remedial Action Planned
NPL	National Priority List
OPS	Colorado Division of Oil and Public Safety
OU	Operational Unit
PAT	Proficiency Analytical Testing
PEIS	Programmatic Environmental Impact Statement
Phase I ESA	Phase I Environmental Site Assessment
RCRA	Resource Conservation and Recovery Act
REC	Recognized Environmental Condition
ROD	Record of Decision
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act
SCAP	Sediment Control Action Plan
SM	Standard Method

SQG	Small Quantity Generator
SWEEP	Stream and Wetland Ecological Enhancement
TCLP	Toxicity Characteristic Leachate Procedure
TSD	RCRA Transfer, Storage and Disposal
TVS	Table Value Standards
USDA	United States Department of Agriculture
USFS	United States Forest Service
USGS	United States Geological Survey
UST	Underground Storage Tank
VCRA	Colorado Voluntary Cleanup and Redevelopment Act
WTP	Water Treatment Plant

Section 1. Purpose of the Memorandum

The Federal Highway Administration (FHWA), in cooperation with the Colorado Department of Transportation (CDOT), is preparing an Environmental Assessment (EA) for proposed changes to the eastbound lanes of I-70 and the eastbound bore of the Twin Tunnels between MP 241 and MP 244 in Clear Creek County, Colorado. The Twin Tunnels area is one of the most congested locations along the I-70 Mountain Corridor. Improvements are necessary to improve safety, operations, and travel time reliability in the eastbound direction of I-70 in the project area. Additionally, the improvements will be consistent with the I-70 Mountain Corridor PEIS Record of Decision, I-70 Mountain Corridor Context Sensitive Solutions process, and other commitments of the PEIS (CDOT, 2011).

This technical memorandum discusses the regulatory setting and describes the affected environment and the impacts of the Proposed Action on regulated materials and solid waste within the identified study area. The memorandum also documents mitigation measures, including applicable measures identified in the I-70 Mountain Corridor PEIS that would reduce any impacts during construction and operation. The I-70 PEIS identified comprehensive improvements for the corridor. The Proposed Action would immediately address safety, mobility, and operations in the eastbound direction at the Twin Tunnels, but would not address all of the needs in the Twin Tunnels area. The Proposed Action would not preclude other improvements needed and approved by the I-70 PEIS ROD.

Section 2. How does the analysis relate to the Tier 1 PEIS?

The *I-70 Mountain Corridor Final PEIS* committed to conducting specific additional analysis and coordination regarding regulated materials and solid waste impacts during Tier 2 projects. The following commitments from the I-70 PEIS are applicable to this Tier 2 project:

- Involve stakeholders in the discussion of mine waste and regulated materials mitigation and develop specific mitigations and best management practices for each project.
- Consider alignments that avoid hazardous materials.
- Conduct a thorough analysis of the potential disturbance of acid mine drainage and acid rock drainage and recommend construction methods and best management practices in areas of mineralized rock.
- Provide a comprehensive listing and description of current regulations for regulated materials, including regulatory requirements for Superfund and historic mining materials.
- Look at road construction as a source of metal loading from disturbance of mineralized veins in further detail and provide mitigation strategies to minimize or reduce metal loads from road construction.
- Provide procedures on identifying, characterizing, and handling waste in the study area. Information on contacting local authorities will also be provided in the event waste is encountered.
- Update information on regulated materials and historic mining.

CDOT has followed the I-70 Mountain Corridor Context Sensitive Solutions process for this project, establishing a Project Leadership Team and Technical Team composed of community

and agency stakeholders. Through these forums, CDOT has consulted early and often with community representatives regarding the proposed improvements, thereby allowing them to make timely regulated materials and solid waste decisions.

Section 3. What process was followed to analyze resource?

3.1 Methodology

Regulated materials are hazardous substances, hazardous waste, and/or petroleum products. Regulated materials are transported on the I-70 highway, and may exist at sites within the project vicinity that generate, store, and dispose of these substances, or have been the location of past releases of these substances. Examples of regulated materials are asbestos; lead-based paint; heavy metals such as arsenic, lead and cadmium; dry-cleaning solvents; and petroleum hydrocarbons (e.g., gasoline and diesel fuels). The project will also likely use regulated materials during construction.

Historic mining is included in this discussion of regulated materials because mining activities are prevalent in the project vicinity, and mine tailings, mine wastes, tunnel drainage, and mineralized rock have the potential to release contaminants before, during and after construction. The main contaminants of concern related to mining are heavy metals and acid drainage/runoff. In the project vicinity, the metals arsenic, lead and cadmium are of particular concern. Encountering contaminants in soils, groundwater, and surface water can complicate construction, and impact nearby residents, workers, and the environment if appropriate steps to mitigate and contain them are not taken.

Regulated materials were previously evaluated during completion of the Tier 1 PEIS. The Tier 1 PEIS provided an overall assessment of regulated materials and sites that may be encountered during construction. Due to the methods utilized during that evaluation, the dynamic nature of regulated sites, and the time lapse in evaluations, further evaluation was recommended.

A Phase I Environmental Site Assessment (Phase I ESA) was performed in accordance with ASTM E1527-05 “Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process” (Pinyon, 2012). The Phase I ESA was completed to evaluate the potential presence of regulated materials, also known as Recognized Environmental Conditions (RECs), to be located within or near the project, based on standard search radii. The search radii included sites listed in several federal and state databases, including the following records:

- Federal National Priority List (NPL) - The NPL is the U.S. Environmental Protection Agency’s (EPA's) database of uncontrolled or abandoned contaminated sites listed for priority cleanup under the Superfund Program.
- Delisted NPL - These are former NPL sites that have been removed from the NPL because they were cleaned up or no longer qualify for the NPL.
- The Resource Conservation and Recovery Act (RCRA) Corrective Action Sites - The RCRA database lists facilities where EPA is requiring "corrective action" due to a release of hazardous materials.

- RCRA Transfer, Storage and Disposal (TSD) Sites – The EPA RCRA database lists facilities that treat, store, or dispose (TSD) of hazardous waste.

- RCRA Generator List - EPA's RCRA database lists facilities that generate hazardous waste. Large quantity generators (LQG) produce more than 1,000 kilograms of waste per month; small quantity generators (SQG) generate between 100 and 1,000 kilograms of waste per month; and conditionally exempt generators (CSQG) generate less than 100 kilograms of waste per month.

- RCRA "Other" List - The RCRA database lists facilities that are former generators, transporters, non-generators that were inspected, etc.

- Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) - The CERCLIS lists sites that EPA is investigating for contamination, and are could be proposed for the NPL.

- CERCLIS No Further Remedial Action Planned (NFRAP) - The CERCLIS NFRAP database lists sites that were evaluated for CERCLIS and that did not qualify for the NPL, and were evaluated by EPA and were not deemed to have an environmental issue.

- Engineering/Institutional Controls List - These sites have controls in place (e.g., impermeable covers, covenants, etc.) to keep contaminants from being exposed to the environment.

- Emergency Response Notification System (ERNS) List – The ERNS lists all spills that were called in to the EPA's and the Coast Guard's National Response Center.

- Voluntary Cleanup Program List – This list includes sites that have been identified for cleanup and redevelopment. Voluntary Cleanups are being cleaned up or have applied for a No Action Determination through the Colorado Voluntary Cleanup and Redevelopment Act and the Colorado Department of Public Health and Environment (CDPHE).

- Brownfields List – This list includes sites that have been identified for cleanup and redevelopment by the EPA. Often this list includes properties where EPA is involved, typically through funding or grants. In Colorado, Brownfields are typically addressed in the Voluntary Cleanup Program.

- Solid Waste Landfills – Solid waste landfills may include lists of disposal sites compiled by the CDPHE and from various local agencies. These sites are regulated by the CDPHE.

- Leaking Underground Storage Tanks (LUST) Sites – Leaking underground storage tanks and above-ground storage tanks regulated by the Colorado Department of Labor and Employment, Division of Oil and Public Safety (OPS).

- Tank Sites – Includes lists of underground storage tanks (USTs) and above-ground storage tanks (ASTs), regulated by the OPS.

- Spills – Includes spills reported to local agencies, the CDPHE, and often to the Colorado State Patrol (CSP), including those spills significant enough to require a response action.

This Regulated Materials and Solid Waste Technical Memorandum is an extension of the initial assessment completed during the Tier 1 PEIS.

3.2 Study Area

The project area for this Technical Memorandum includes all the area of land within the CDOT right of way from the East Idaho Springs interchange to the base of Floyd Hill (Figure 1). The study area is generally the area of land (including potential Right of Way acquisitions or easements) within ¼ and one mile of the centerline of I-70 from the East Idaho Springs Interchange to the base of Floyd Hill. At the time of this Technical Memorandum, final design of this project had not been completed. One parcel will be acquired in support of this project, the Salo Parcel. Therefore, the portion of the Salo Parcel that will be acquired has been evaluated in support of this Technical Memorandum. If needed, an updated Phase I ESA will be completed if Right of Way acquisitions change.

I-70 is currently being used as an interstate highway. The existing Clear Creek County Road 314 (CR 314) connects Idaho Springs (I-70 Exit 241) and the Hidden Valley Interchange (Exit 243). The CR 314 serves local access, emergency response, recreation access (rafting and fishing along Clear Creek) and bicycle and pedestrian mobility. CR 314 also serves as a frontage road or alternate route during accidents, construction, and other delays on I-70 near the Twin Tunnels. The Scott Lancaster Trail runs parallel with the frontage road and a portion of the trail shares the existing roadway.

Current uses for the Salo Parcel are as follows:

- Entire parcel zoned for light industrial use. The portion potentially acquired by CDOT is currently vacant land located between I-70 (on the north) and Clear Creek (on the south). High-tension power lines are located on this parcel in the study area.

3.2.1 Adjacent Site Uses

East Idaho Springs to Twin Tunnels - Adjacent uses north of I-70 from East Idaho Springs to the Twin tunnels include sparse residential use and undeveloped forested land. South of I-70, and west of the bridge over Clear Creek, adjacent uses include sparse residential use, forested land and Clear Creek to the south. To the west, several buildings are present that may have been a U.S. Forest Service (USFS) Civilian Conservation Corps facility in the past. East of the bridge over Clear Creek, and south of Clear Creek, commercial and light-industrial land uses are present north of CR 314. These uses include, from west to east, an outdoor yard for storage of various campers and boats, a small pond, a small self-storage facility, Ferrellgas propane distribution company, a commercial rafting company, an aggregate batch plant, and the City of Idaho Springs wastewater treatment plant. The City of Idaho Springs has indicated that large buried wastewater-related treatment tanks are located south of the west portal of the Twin Tunnels; south of Clear Creek.

Twin Tunnels to Hidden Valley - Lands adjacent to the project in this area were observed to be undeveloped steep forested land, with the exception of the residential property (Jordan Parcel).

Hidden Valley Interchange - Several single-family residences are located south of the project area and CR 314. Beyond those residences are undeveloped forested lands.

North of I-70, light-industrial properties are present, as well as the Central City Parkway. Uses include the City of Black Hawk potable water treatment plant, a commercial/industrial warehouse, and the CDOT Hidden Valley road and bridge shop.

Hidden Valley to Floyd Hill - Generally, adjacent uses include undeveloped steep, forested lands in this area.

3.3 Data Sources

Many data sources were utilized in support of the Technical Memorandum. Generally, data review was completed in accordance with the requirements of ASTM Standard 1527-05 "Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process E 1527-05." These data sources included a variety of databases maintained by local, state and federal regulatory agencies, as well as a variety of historical data sources.

3.4 Regulations

This section identifies the relevant federal, state, regional, and local regulations, guidelines, and/or laws that apply to regulated materials and solid waste.

3.4.1 Federal

A number of federal regulations exist pertaining to Regulated Materials and Solid Waste. The following table presents information on regulations applicable to the Twin Tunnels project:

Table 1
Federal Regulations

Regulation	Description
RCRA (1976)	Administered by the CDPHE with oversight by the EPA, RCRA provides comprehensive regulation of hazardous wastes, defining certain materials that pose a potential threat to public health and the environment. This regulation includes a waste management system to address the generation, transportation, use and disposal of hazardous wastes. Subtitle C of RCRA established a system for controlling hazardous substances from the time of generation to disposal. Subtitle D of RCRA focuses on state and local governments for primary authority for management of non-hazardous solid wastes, including household garbage and non-hazardous industrial solid waste.
CERCLA (1980)	This regulation is generally referred to as Superfund. The purpose of this regulation is to fund cleanups and emergency response for the most seriously contaminated sites in the country. In 1986, this regulation was revised and expanded in the Superfund Amendments and Reauthorization Act (SARA), which requires reporting for extremely hazardous substances.
Hazardous Materials Transportation Act (HMTA, 1974)	The U.S. Department of Transportation is responsible for administration of this regulation, with the goal of protecting against risk from transportation of hazardous materials.
Toxic Substances Control Act (TSCA, 1976)	TSCA gives the EPA authority to require reporting and other restrictions regarding many chemical substances and/or mixtures. Some substances are excluded from this Act, including food, drugs and cosmetics.

3.4.2 State

A number of state regulations exist pertaining to Regulated Materials and Solid Waste. The following table presents information these regulations:

Table 2
State Regulations

Regulation	Description
Colorado Hazardous Waste Regulations (6 CCR 1007-3) (Effective 9/30/2011)	Regulated by the CDPHE to ensure proper handling of hazardous wastes. Regulations included provisions for tracking and regulation of hazardous wastes from point of generation to transportation and disposal. This is the Colorado equivalent to Subtitle C of RCRA.
Colorado Solid Waste Regulations (6 CCR 1007-2) (Effective 12/30/2011)	Regulated by the CDPHE, which requires that all solid waste be disposed, treated or recycled at designated facilities approved by the CDPHE and local jurisdictions. This is the Colorado equivalent to Subtitle D of RCRA.
Colorado Petroleum Storage Tank Regulations (7 CCR 1101-14) (Effective 8/1/2008)	Regulated by the OPS Regulations establish rules for the design, installation, registration, construction and operation of storage tanks used to store regulated substances including petroleum. These regulations do not pertain to hazardous substances.
Colorado Voluntary Cleanup and Redevelopment Act (VCRA) (1994)	Administered by the CDPHE, this act was created in 1994 with the objective of facilitating cleanup of contaminated properties, or "Brownfields." Cleanups are completed under this program by property owners, and generally must meet promulgated standards of the hazardous or solid waste regulations.

3.4.3 Local

Clear Creek County and the City of Idaho Springs do not have any applicable regulations regarding regulated materials or solid waste that are applicable to this project, although both entities do consider regulated materials and solid waste in land use decisions.

Section 4. Description of the Proposed Action

The Proposed Action would add a third eastbound travel lane to the I-70 highway for approximately three miles between the East Idaho Springs interchange and the base of Floyd Hill. The Proposed Action would provide a consistent 10-foot outside shoulder throughout the project area. CDOT is considering a range of widths for the inside shoulder between the west project limits and the Hidden Valley interchange. A 4-foot inside shoulder would be provided east of Hidden Valley. The eastbound bore of the Twin Tunnels would be expanded to accommodate the wider roadway section, and two tunnel widths are being evaluated. CDOT is also considering whether the additional capacity will operate exclusively as a general purpose lane or as a tolled lane during peak periods (also called a managed lane). The Proposed Action would provide a consistent 50 mph design speed and 55 mph posted speed.

Section 5. What are the regulated materials or solid wastes are in the study area?

A Phase I ESA was completed for this project, with the purpose of evaluating the potential presence of hazardous substances and/or petroleum products (otherwise known as "Recognized Environmental Conditions" (Pinyon, 2012). Numerous information sources were reviewed in support of the Phase I ESA, including federal and state databases regarding the compliance history within the study area (Satisfi, 2011), other resources maintained by federal and state agencies for documented soil and/or groundwater contamination, historical resources, and other information regarding the physical setting of the project area and study area. For the Phase I ESA, the study area was consistent with this Technical Memorandum, and included the project foot print and area within existing CDOT right of way; the study area included an area between ¼ and one mile of the centerline of I-70.

As an additional service to the Phase I ESA, lead paint was evaluated on the two bridges in the study area that will be rehabilitated or replaced, and a Limited Phase II ESA was completed. Early research supporting the Phase I ESA, early agency coordination, and review of the I-70 PEIS indicated that mine wastes could be a REC, as a result of significant mineral extraction and processing that historically occurred in the project vicinity. Therefore, the Limited Phase II ESA was designed to identify mine-related waste that may have been utilized as fill during highway construction.

CDOT previously evaluated asbestos-containing materials (ACMs) which could be located on the I-70 Bridge over Clear Creek west of Hidden Valley (Structure F-18-BH) and the Doghouse Rail Bridge (structure CLR314-W0.7) (Walsh, 2011a and 2011b, respectively). Those results are discussed in this Technical Memorandum.

The following sections present the findings of the Phase I ESA, Limited Phase II ESA and ACM evaluations regarding Regulated Materials and Solid Waste.

5.1 Federal and State Environmental Records Reviews

Several databases were researched in accordance with the ASTM standard (Satisfi, 2011). It should be noted that the Satisfi report notes that the data was "filtered." The filtering is in regard to unmappable sites; specifically those that could potentially be referenced based on partial address, especially those elsewhere on I-70 outside the ASTM search radii. Satisfi "filtered" the unmappables by zip code to eliminate unnecessary, non-related listings outside the ASTM search radius. The sites that were mappable were included in the database, based on the required ASTM search radii based on site type. Table 3 presents the summary of the database research.

Table 3
Summary of Database Search

Type of Database	Number of Listings in Specified Search Radius based on ASTM standard (Miles)			
	<0.13	0.13-0.25	0.25-0.5	0.5-1
NPL	1	0	0	0
RCRA Corrective Action	0	0	0	-
CERCLIS	0	0	0	-
CERCLIS NFRAP	0	0	0	-
State Voluntary Cleanup	0	0	0	-
RCRA TSD	0	0	0	-
RCRA GEN	1	0	-	-
RCRA NLR	1	1	-	-
Landfills	0	0	0	-
Tanks	5	0	-	-
LUST	2	0	6	-
Spills	3	-	-	-
ERNS	10	-	-	-
Brownfields	0	0	-	-

Source: Satisfi, 2011
- Hash mark indicates distance beyond that required to meet the ASTM-required search distance

Each database listing was reviewed for the potential to impact the project, based on the following criteria: distance from project area, use of hazardous substances and/or petroleum hydrocarbons, reported releases, data obtained during review of regulatory files, topographic position and estimated depth and direction of groundwater flow. Table 4 presents a summary of details on the facilities identified in the agency database.

Table 4
Details of Identified Agency Listings

Facility Name	Facility Address	Distance (feet) / Direction	Database	Potential to Impact Project
Mile Marker 242 On Interstate 70	Mile Marker 242 On Interstate	On-Site	ERNS	Yes; however, location of this spill as reported is not clearly defined.
WB I-70, Exit Ramp At MP 244	WB I-70, and Exit Ramp	On-site	ERNS	Yes; however, location of this spill as reported is not clearly defined.
Interstate 70 At Mile 243	Interstate 70 At Mile 243	On-site	ERNS	Yes; however, location of this spill as reported is not clearly defined.
Idaho Springs Old Water Plant	10 County Road 314	100 feet south	ERNS	Yes. Several releases of sewage at Idaho Springs Treatment Plant temporarily impacted Clear Creek, but impacts were temporary. Future releases could occur at this facility, but generally are not considered RECs according to the ASTM standard.
Camas	1039 East Idaho Springs Road	300 feet south	UST	No, tank registration is for liquid-petroleum gas (propane) tank.
Hidden Valley Texaco	I-70 and Exit 243	Adjacent to north	UST, LUST	No. This facility operated at the location of the existing CDOT Hidden Valley facility, northeast of the I-70/Hidden Valley exit (Figure 4). This filling station historically maintained five above-ground storage tanks which have been removed. Remedial activities have been completed; however, low-level contamination was left in place, including near I-70. Contaminant concentrations were documented to decrease over time, and the Colorado Department of Health (now the CDPHE) issued a No Further Action letter on March 25, 1991. At the time of this Phase I ESA, construction activities in the vicinity of this facility are limited to re-striping; therefore, there is not an anticipated exposure issue to construction workers with residual contamination that may remain in this area.

Facility Name	Facility Address	Distance (feet) / Direction	Database	Potential to Impact Project
Clear Creek Distributing	I-70 and Exit 243	Adjacent to north	UST, LUST	No. This facility is the large commercial/light industrial property located north of the Central City Parkway, east of the Black Hawk potable water treatment facility (Figure 4). A petroleum release was reported on April 13, 1990. Files were reviewed at the OPS. Files indicate that petroleum contamination was remediated to the satisfaction of the OPS. Minor petroleum impacts were noted to remain on this property, but are not located off-site. Groundwater was demonstrated to flow north from this facility towards Clear Creek, and away from I-70. The OPS issued a No Further Action letter on April 19, 2005. Residual contaminants are not likely to impact the project.
CDOT - Hidden Valley	Exit 243 Hidden Valley I-70	Adjacent to north	UST, RCRA GEN	No. AST located in secondary containment, and no evidence of release. No violations regarding RCRA registration. Chemicals of concern included lead, likely the result of lead battery uses.
USDA Forest Service	County Road 314 (unspecified)	1100 West	RCRA GEN	No. Incomplete address; however, this is likely the historic Civilian Conservation Corps facility located approximately 350 feet west of the Site. This facility is listed as a RCRA facility which is no longer reporting. No enforcement or violation information was identified related to this facility.
CDOT Idaho Springs	3000 Colorado Boulevard	2000 West	LUST	No. Release remediated and issued No Further Action on 12/24/1992.
CDOT Idaho Springs	2931 Colorado Boulevard	2100 West	LUST	No. Release remediated and issued No Further Action on 10/18/1991.
Spring Station LLC	2900 Colorado Boulevard	2100 West	LUST	No. Release remediated and issued No Further Action on 8/23/2005.
Scorpion Shell	2808 Colorado Boulevard	2500 West	LUST	No. Release remediated and issued No Further Action on 5/26/2004.
Tall Country Idaho Springs	2806 Colorado Boulevard	2600 West	LUST	No. Two releases remediated and issued No Further Action on 4/1/1999 and 7/22/2003.

Source: Satisfi, 2011

5.1.1 Non-Listed Sites

Two sites were identified that were not included in the regulatory database. The Central City/Clear Creek NPL site was intentionally omitted from the database. Satisfi reviewed specific discrete Operational Units (OUs) within the appropriate search radius, and no pertinent OUs associated with the Central City/Clear Creek NPL site applied to this project, since important OUs that could impact the project are located outside the search radii. However, detailed discussion of this NPL site is included in Section 5.4 of this Technical Memorandum.

The current Kermitts Roadhouse is located at the base of Floyd Hill at the intersection of I-70 and U.S. Highways 6 and 40 (Figure 6). A filling station was reported to have been developed at this property around 1946, and was called the Tunnel Inn Service Station (Centennial, 2011). This facility is no longer operating as a service station. The OPS does not have files related specifically to this facility; however, the OPS does have a file regarding a facility called Clear Creek Village Conoco located at the junction of "I-70 and Hwy 6." It is possible that this is the same property, although this was not confirmed. Records show that four permanently closed USTs were located at the Clear Creek Village Conoco facility, reportedly installed in the 1960s and 1970s. No information regarding the exact location of these tanks, or potential environmental conditions, was identified. Kermitts Roadhouse is located topographically lower, and likely hydraulically down-gradient of the project, and any residual petroleum hydrocarbon contamination is not likely to impact the project.

5.2 Colorado State Patrol Records

Charlotte Smith with the CSP was contacted regarding records pertaining to response actions for releases that have occurred on I-70 (Smith, 2011). Ms. Smith provided database listings for Clear Creek for CSP response actions. She indicated that CSP records are only available starting in 1997. A total of 18 responses were noted within the project area on or near I-70 (Table 5). The provided information did not include exact locations of incidents, with location descriptions based on approximate mile points (MPs), or approximate distances from mile points. Materials released included diesel fuel, hot asphalt and carwash soap. Fuel spills were generally in relatively small quantities. The CSP is responsible for cleanup of spills that occur on Colorado highways, and although no additional records were provided, CSP hazardous response crews generally clean these spills up quickly to protect the environment. No indication of investigation or cleanup beyond initial report of release was identified in the environmental database, or from investigation completed as part of the Phase I ESA.

Table 5
Summary of CSP Incidents on I-70

Location	Date	Description
0.5 mile east of MP 243	10/28/1999	Abandoned drum
0.4 mile east of MP 244	11/22/1999	5 gallons of diesel fuel
2134 County Road 314	5/7/2000	Possible methamphetamine lab
0.3 mile west of MP 242	5/12/2000	5 gallons of diesel fuel
0.35 mile east of MP 244	1/8/2000	20 gallons of diesel fuel
Exit 244	8/7/2001	150 gallons of diesel fuel
0.56 mile west of MP 243	10/15/2001	35 gallons of gasoline
0.5 mile east of MP 244	1/27/2002	2000 gallons of elevated temperature material (asphalt)
MP 243	7/9/2004	25 gallons of diesel fuel
0.8 mile east of MP 242	10/11/2005	80 gallons of diesel fuel
MP 244	7/12/2006	25 gallons of diesel fuel
MP 243	8/18/2006	ABS cell core pipe
MP 244	11/15/2006	30 gallons of diesel fuel
MP 244	11/26/2006	30 gallons of diesel fuel
164 feet west of MP 244	6/16/2007	40 gallons of diesel fuel
MP 244	10/25/2010	45 gallons of carwash soap
MP 244	8/5/2011	30 gallons diesel fuel

Source: Charlotte Smith, CSP

The CSP database listed the possible location of a methamphetamine lab at 2134 CR 314 (Figure 5). No additional information was identified regarding this facility, or response actions related to

this listing. Typically, the environmental conditions with these types of sites are confined to within the building or other structure. This address is located across Clear Creek from I-70, and is hydraulically disconnected from the project.

5.3 Environmental Conditions Based on Site Observations

The following discussion presents the results of site observations by the environmental professionals who conducted the Phase I ESA.

5.3.1 Solid Waste Disposal

Solid waste related to residential uses is likely generated at the developed properties located within the study area. It is likely that a disposal-service company removes garbage from those properties, as no visual evidence of on-site disposal was observed from public ROW.

5.3.2 Drains and Sumps

Two drainage discharges were observed inside a three-sided box culvert immediately east and under I-70 at the Twin Tunnels (Figure 3). These discharges likely drain groundwater that infiltrates through bedrock and into the tunnels. As part of the water quality analysis documentation for the Twin Tunnels Environmental Assessment, water samples from these two discharge points were collected for laboratory analysis. Detailed discussions of the sampling methods, analytical methods, and sampling results are included in Section 5.6.2. Original laboratory data are attached to the Phase I ESA report.

5.3.3 Fill Material

The majority of I-70 has been constructed on embankment fill, which was confirmed during geotechnical investigations completed by Yeh and Associates in support of this CDOT project. Their geotechnical investigations included drilling 10 vertical soil borings in locations where structural elements are anticipated (e.g., retaining walls and new bridge abutments). During those drilling activities, representative soil samples of fill material were collected to evaluate potential environmental conditions. Detailed discussion of the sampling methods, analytical methods, and sampling results is included in this Technical Memorandum in Section 5.6.1. Geological logs of the borings are included with the geotechnical studies completed for this project.

United States Department of Agriculture (USDA) maps indicate that surficial soils in two large areas within the project area are potentially derived from mine-related waste (Figures 2 through 4).

Fill material was visually observed during the site visits between I-70 and Clear Creek near the I-70/U.S. 40/U.S 6 interchange (Figure 6). Fill material appeared to be a mixture of road sand, soil and asphalt.

Potential fill material may be located at the East Idaho Springs on-ramp to I-70, based on review of geological maps, and north of I-70 between the interstate and Clear Creek approximately 0.25 mile east of the western project boundary, based on site observations (Figure 2).

5.3.4 Hazardous Substances or Petroleum Product Use

There was no visual evidence of hazardous material use or storage, or hazardous waste generation, within the project area. The project is not listed on an agency list for hazardous material use or hazardous waste generation, treatment, storage or disposal (Satisfi, 2011). However, limited chemical uses are likely for commercial processes, such as the Idaho Springs

Water Treatment Plant, Black Hawk Water Treatment Plant, and various commercial properties near or within the study area.

5.4 Mine and Mill Sites

Gold was discovered in Idaho Springs in 1859, and hard rock and placer mining was a leading industry in the vicinity until the 1950s. Over 800 inactive mines and tunnels are located in Clear Creek and Gilpin counties (EPA, 1991). Initially, placer mining was conducted; however, deposits were quickly depleted. Mining activities then focused on hard rock sulfide ores through deep mines. Flooding problems required that the mines be drained through drainage shafts, many of which continue to drain water heavily contaminated with metals, and discharge into surface-water bodies. The Central City/Clear Creek Superfund site was added to the NPL in 1983. This listing includes multiple waste piles, tailing impoundments, milling sites and draining mine adits within a 400-square mile area in the Clear Creek watershed. Mining and ore processing left a legacy of contamination of soil, surface water and ground water in many areas in Clear Creek and Gilpin counties. Most significant is the impact to Clear Creek and its tributaries, which serve as a major drinking water source for the Denver area. The most significant contaminants are metals, in particular, lead, arsenic and cadmium (EPA, 1991).

The boundary of this Superfund site is not precisely defined due to the nature of the site, but generally includes approximately 400 square miles of the Clear Creek watershed west of Golden. Mining activities occurred at many locations across a broad area, leading to a wide distribution of mine waste, where many discrete locations contain small amounts of waste. In order to address concerns with different discrete facilities, the EPA organized work into separate working units, or OUs. Operable Units 1 and 2 specifically addressed five tunnels that were discharging acid mine drainage. Operable Unit 3 was designed initially to address surge events from the Argo Tunnel in Idaho Springs; however, was expanded to include all areas not specifically addressed in OUs 1 and 2 within the 400-square mile Superfund site boundary, specifically where impacts to Clear Creek and its tributaries are identified (Clear Creek watershed). The Twin Tunnels project is included within the boundaries of OU 3. In 1991, the U.S. EPA issued a Record of Decision (ROD) with the intention of describing the final response action (EPA, 1991). However, the ROD was prepared to maintain some flexibility, and was not intended to be the final decision document, as subsequent studies and corrective action plans would supersede the ROD. The ROD considered on-site consolidation of waste rock and tailings; however, individual capping was selected at the time due to cost considerations. The ROD was updated in 2006 (CDPHE, 2006). The updated ROD added a remedial action component, the addition of an on-site repository where materials subject to remedial actions could be consolidated.

The most recent Five-Year Review Report for this Superfund site was reviewed (CDPHE, 2009). This report describes several specific sites selected for remedial activities. Of all the specific sites identified, only one had a potential to impact the project. The Virginia Canyon Ground Water/Big Five Project included investigation of zinc loading from Virginia Canyon to Clear Creek in Idaho Springs, up-stream of the Twin Tunnels project. The source of contamination was identified, and a cut-off wall was constructed to capture impacted groundwater and convey it to the Argo Tunnel Water Treatment Plant (WTP) in Idaho Springs; therefore, this issue is not likely to impact the Site. In 2005, a pipeline was constructed to convey discharge from the Big Five Tunnel to the Argo Tunnel WTP. Additional projects have been planned; however, funding issues have delayed implementing further remedial actions. EPA has noted that construction of a new bulkhead in the Argo Tunnel may occur at the same time as the Twin Tunnels project will be constructed. The purpose of the bulkhead project is to allow for interruption of discharge from the Argo Tunnel in the event that maintenance of the treatment plant is needed, and to control surge events from the tunnel.

Several information sources were reviewed pertaining to mines and/or mills which may have operated in the vicinity of the project. These sources included the Colorado Division of Reclamation Mining and Safety (DRMS) online mapping application (DRMS, 2011); the United States Geological Survey (USGS) 7.5-Minute Squaw Pass Topographic Quadrangle (USGS, 1957); the geologic map of the Squaw Pass Topographic Quadrangle (Sheridan and Marsh, 1976); the I-70 Mountain Corridor PEIS Regulated Materials and Historic Mining Technical Report (CDOT, 2011); historic information from the Colorado Bureau of Mines provided by Clear Creek County (CBM, 1959 and 1967); the Centennial Archaeology survey of the Twin Tunnels project (Centennial, 2011); and files maintained by the CDPHE. Several site-specific studies have been completed for CDOT in the project vicinity, one of which is applicable. That study included the completion of three soil borings and collection of soil samples near the western edge of the project area (Yeh, 2005). Additionally, a subsidence study was completed by CDOT in 1981 in I-70 at the Hidden Valley Interchange (CDOT, 1981), with several engineering geology plan sheets reviewed.

Based on the resources reviewed, the following summary is presented regarding potential mining activities near and within the Twin Tunnels project:

- The alluvium material located within the Clear Creek floodplain has likely been reworked during gold dredging activities early in the Colorado gold rush (Sheridan and Marsh, 1976; Rapp, 2012).

- A strip mine was located in the commercial area south of Clear Creek, and west of the Twin Tunnels (USGS, 1957; Sheridan and Marsh, 1976). Review of historic aerial photographs indicates that this area was heavily disturbed after 1938 and before 1956. The disturbance area appeared to encompass the existing commercially-developed area, and may have extended to a small area beneath I-70 (Figures 2 and 3). Subsequent to mining it is likely that fill material was used to regrade this area. The source of the fill is unknown.

- Information collected from the DRMS indicates several permits for mines and/or prospects in the vicinity of the project; however, there is no information that mining actually resulted at the permit locations noted in that database (DRMS, 2011).

- The Gold Bar Placer Mine historically operated at the location of the current Hidden Valley Interchange in the late 1800s (Mine Plat, 1884). Underground placer mining reportedly occurred in this area, and there were subsidence events reported at the Hidden Valley interchange resulting from failing underground roof supports (CDOT, 1981). CDOT completed a subsidence investigation, where significant underground voids were identified, as a result of past underground placer mining. Verbal discussions with CDOT staff indicate that the voids were subsequently mitigated beneath I-70. No information regarding the disposition of mine processes or mine waste was identified.

- Several small adit complexes were identified by Centennial Archaeology across the project area north of I-70 (Figures 2 through 6). These facilities are generally very small in nature, are likely small prospects or glory holes, and no evidence of ore processing was identified with these facilities. Small waste-rock piles are associated with these adits, but were located outside areas where significant construction would be completed.

- Two potential mill sites have been identified in the vicinity of the project, the Silver Spruce Mill, and the Dixie Mill (CDOT, 2011). The Silver Spruce Mill operated approximately 1,500 feet west of the project, and the Dixie Mill operated approximately

100 feet north of I-70 at the general location of the start of the Central City Parkway (Figure 4).

Review of Information Reports from the CBM (CBM, 1957 and 1969) indicates that the Dixie Mill operated near the Hidden Valley Interchange from at least the 1950s to the late 1960s. Discussions with Marjorie Bell of the Idaho Springs Historical Society indicate that the mill may have operated before this time; perhaps after World War II, as during the war mining activities not deemed essential to the war effort were prohibited (Bell, 2011). The information collected indicates that processes included the use of a tailings pond, a classifier, ore bins, crusher, concentrating tables and a rod mill at this facility. Ore was reportedly brought to the mill from the Dixie company mine (Dixie Mine), which was located southwest of Idaho Springs near Chicago Creek. Ore brought to the facility was dumped into one of four 50-ton crude ore bins, which fed ore by conveyor to a jaw crusher. The crushed ore was then conveyed to the rod mill. Fine-grained material was then run over a rag plant to extract free gold, and then flowed over a concentrating table to eight cell floats. An Allen Cone (classifier) was used to de-water concentrates before being dropped into a 45-ton bin. The mill reportedly produced gold, silver, lead, copper and zinc. These general processes were confirmed by Ms. Bell, who worked briefly at the mill in a gift shop in the mid-1950s.

The CDPHE also maintains a file related to the Concord Minerals facility at Hidden Valley, which is related to the Dixie Mill. This file was reviewed at the CDPHE Records Center. The file is related to an EPA Consent Agreement and Final Order issued in the early 1980s, related to the illegal storage of large quantities of hazardous waste, including sodium xanthate and sodium cyanide used to process gold at this facility. Concord reportedly handled volumes of waste in excess of that permitted under the Hazardous Waste Regulations. Moreover, the company reportedly attempted to illegally dispose of this waste at the landfill located near Empire. Inspection reports also suggested that process wastes may have leaked on the mill site; however, no information was available indicating cleanup of those materials. Eventually, Concord Minerals removed drums of waste for offsite disposal, and was levied a fine by the EPA. This facility was located at the current location of the Central City Parkway and City of Black Hawk Water Treatment Facility. Review of hydrogeological data related to the Clear Creek Distributing facility indicates that groundwater flows toward the north, as influenced by Clear Creek; therefore, this facility is not likely to impact the Twin Tunnels project.

- Yeh and Associates, Inc. (Yeh), previously completed a limited investigation along the east-bound on-ramp to I-70 from Idaho Springs in 2005 (Yeh, 2005). Three shallow borings (ES-08, ES-09 and ES-10) were advanced with a hand auger near the western edge of the project to depths between one and four feet below the ground surface (Figure 2). Soil samples were collected and analyzed for the RCRA eight metals (arsenic, barium, cadmium, chromium, lead, selenium, silver and mercury). These results were compared to the 2011 CDPHE Colorado Soil Evaluation Values (CSEVs) (CDPHE, 2011a). The concentrations of all metals from all samples were below the current CSEVs for those metals, with the exception of arsenic. The concentrations of arsenic in those samples ranged from less than 5.2 milligrams per kilogram (mg/kg) to 9 mg/kg. These concentrations are below the CDPHE action level of 11 mg/kg (see Section 5.6.1 for further discussion). Geological logs of the borings are included with the geotechnical studies completed for this project.

- It is possible that mine wastes have been utilized as roadway embankment beneath I-70 and/or CR 314, as well as nearby areas within the study area. Mapping information from the USDA indicates that at least two large areas beneath the project may include mine waste (USDA, 2011; Figures 2 through 4). Based on dates of mining operations in the project vicinity, the lack of environmental regulations during those times, and the limited availability of data regarding the disposition of mine-related wastes for the time period in question, there is a possibility that mine wastes are located in the project area, and could be encountered during construction activities. However, soil sample results from areas of I-70 where significant soil disturbing activities will be completed did not indicate the presence of mine wastes (see Section 5.6.1 for further discussion). Therefore, it is possible that mine wastes could be encountered, although the likelihood is low, and quantities are likely limited.

- Mr. Ed Rapp with the Clear Creek Watershed Foundation was interviewed in support of this assessment (Rapp, 2012). Mr. Rapp was formally a District Engineer with the U.S. Army Corps of Engineers, is an expert regarding mine-waste related environmental conditions in the project vicinity, having worked on many local projects to improve the water quality in Clear Creek, and is a major stakeholder regarding public projects that could impact the creek from mining-related wastes. Mr. Rapp stated that the project area is located outside the main ore body that was economically mined historically near Idaho Springs. However, dredging likely occurred within the Clear Creek floodplain as previously described. Mr. Rapp stated that dredging activities utilized mechanical means to extract gold from the ore, and chemical extraction was not historically utilized in those processes. Mr. Rapp stated that in his opinion, there was relatively low risk of mine waste to be located in the project vicinity in significant quantities, as most mining and processing of mineralized rock took place west of the project vicinity. Mr. Rapp indicated that the small amounts of waste could be encountered, although that scenario was unlikely in his opinion.

5.5 Idaho Springs Wastewater Treatment Plant

The City of Idaho Springs has expressed concern that blasting activities associated with expanding the Twin Tunnels bore could have a negative impact on buried storage tanks which are located south of Clear Creek, and southwest of the west portal of the Twin Tunnels. Those tanks are associated with the City of Idaho Springs Wastewater Treatment Plant. Of particular concern is the potential that excessive vibration resulting from blasting activities could cause damage to those buried structures.

5.6 Limited Phase II ESA

Early investigation supporting the Phase I ESA, including review of the I-70 PEIS, indicated that mine wastes could be a REC, based on significant mineral extraction and processing that historically occurred in the project vicinity. Several non-scope (ASTM) services were completed in a Limited Phase II ESA to evaluate the potential RECs. Additional services were added to the ASTM standard to evaluate these potential RECs. The following sampling and analysis services were completed:

- The methodology utilized to support the soil and water sampling was included in a Sampling and Analysis Plan (SAP) (Pinyon, 2011). The SAP presents the protocols to sample and analyze potential regulated materials, specifically those related to mine-related waste.

- Soil samples were collected concurrently during geotechnical drilling activities in order to identify mine-related waste that may have been utilized as fill during highway construction. It should be noted, however, that there are unquantifiable limitations to completing environmental investigations concurrently with geotechnical investigations. These limitations include the increased potential for cross-contamination between samples and borings, due to a lack of decontamination of drill tooling. However, sample results did not indicate cross-contamination issues, as results from sample to sample were relatively similar and below regulatory action levels (Section 5.6.1).

- Exposed and potentially mineralized rock at the surface above the west portal of the southern tunnel was sampled and analyzed.

- Two tunnel drainage discharge points were identified in the box culvert immediately east of the east portal of the Twin Tunnels. Water samples were collected for analysis from these discharge points.

- Additionally, paint on the Doghouse Rail Bridge (structure CLR314-W0.7) and the I-70 eastbound bridge over Clear Creek west of Hidden Valley (structure F-15-BH) was analyzed for lead content.

5.6.1 Soil Sampling

Representative soil samples were collected at locations where regulated materials could be encountered during construction, such as cut areas, retaining wall excavations and bridge abutments. A soil sample was also collected of exposed and outcropped mineralized rock located above the west portal of the south tunnel. Soil samples were collected concurrently at geotechnical boring locations during drilling activities completed by Yeh. Drilling was completed using ODEX techniques. During ODEX drilling, a carbide-tungsten drill bit is hammered vertically down the boring while an outer casing is simultaneously extended. The drill spoils are blown through the casing using highly compressed air to the surface where bulk samples may then be collected.

One or more composite samples of soil was collected at each boring location, and analyzed for totals concentrations of the 13 Priority Pollutant Metals (antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium and zinc) by EPA Method 6010/7471. Depending on the total concentration results for each of those metals, selected samples were to be analyzed using the Toxicity Characteristic Leaching Procedure (TCLP). Samples were also analyzed for pH by EPA Method 9045. During drilling activities, a representative sample of material from each five-foot interval from each boring was collected for visual evaluation of the potential for mine waste. Once the interval (thickness) of fill material was identified by a field geologist, an equal amount of soil (by volume) of the fill material from each five-foot interval within the fill was then combined, mixed thoroughly, and submitted for laboratory analysis. Samples were placed in appropriate pre-cleaned containers provided by the laboratory. Samples were visually described, the colors evaluated using Munsell Soil Color Charts (Munsell, 2000), and placed in the appropriate containers. Proper chain-of-custody procedures were followed during the sampling process. All samples were submitted for analysis to Origins Laboratory, Inc. (Origins), of Denver, Colorado. Soil sample results, including soil descriptions and observed colors, are attached to this Technical Memorandum as Appendix A.

One duplicate sample per day was collected to evaluate sampling and analytical precision during the geotechnical sampling activities.

The results were compared to the CDPHE CSEVs (CDPHE, 2011a), to evaluate potential worker health risks that may be present, as well as to assess potential disposition of excavated material (i.e., reuse on site or disposal).

Soil samples from 10 geotechnical borings were collected (Figures 3 through 6). A total of 12 soil samples and six field duplicate samples were collected for laboratory analysis. One sample of the outcropped mineralized rock was also submitted for laboratory analysis (Figure 3).

In general, the material encountered during drilling included varying depths of fill material composed of sandy, angular to subangular gravel sidecast with cobbles and boulders derived from presumably local metamorphic rock sources. This material overlaid rounded gravels, cobbles and boulders, assumed to be alluvium associated with Clear Creek. The color of this material ranged from dark grayish brown, to olive brown and brown. No visual evidence of mineralized material or potential mine waste was observed during drilling operations.

The mineralized outcropped material was weak, fractured altered porphyritic rock that was easily crushed with hand pressure. The Munsell color (2.5YR 6/8, olive yellow) was indicative of potential mineralization.

The concentrations of the metals detected in the soil samples collected were all below both the residential-use (unrestricted) and commercial-use (worker safety) CSEVs, with the exception of arsenic (Appendix A). The concentrations of arsenic detected ranged from below the laboratory reporting limit to 7.2 milligrams per kilogram (mg/kg). The average concentration (where detected) was 5.3 mg/kg. The current residential (unrestricted) and commercial (worker safety) CSEVs for arsenic are 0.39 and 1.6 mg/kg, respectively.

In Colorado, arsenic occurs naturally, and often at concentrations greater than that observed during this investigation. The CDPHE recently released guidance related to evaluating arsenic concentrations in soil, specifically regarding screening data collected from sites where historical use does not indicate the potential for arsenic contamination (CDPHE, 2011b). The guidance is based on the collection of over 2,700 samples from 44 counties in Colorado. The average concentration of arsenic in soils based on this sampling was 11 mg/kg. The CDPHE has adopted a policy that if arsenic concentrations are lower than 11 mg/kg and releases of arsenic could not have occurred at the site, the CDPHE will require no further action to address arsenic in soil. The highest result observed during this investigation (7.2 mg/kg) is lower than the CDPHE average of 11 mg/kg. Visual evaluation of the material encountered during drilling activities indicates that the subgrade at the locations where significant excavation will be completed (e.g., retaining walls, bridge abutments, bridge piers), is composed of processed blast rock derived from local metamorphic rock source upslope of the Interstate, likely placed when I-70 was initially constructed. No evidence of mine wastes was observed. Therefore, the arsenic concentrations detected during this investigation are likely naturally-occurring, and would not likely require additional investigation or corrective actions.

The pH of the geotechnical samples ranged from 4.08 to 9.06, with an average of 8.3.

Metals concentrations in the sample collected of the mineralized outcrop material were very similar to those of the roadway embankment material, with all concentrations below the residential and commercial CSEVs, except arsenic (Appendix A). The concentration of arsenic was 4.7 mg/kg, below the average concentration of the roadway embankment material, and below the 11 mg/kg CDPHE evaluation criteria.

The pH of the outcrop material was measured at 2.7, significantly lower than that measured in the other samples collected. Although low, this pH is not low enough for the material to be considered a characteristically hazardous waste under RCRA, when disturbed and removed.

5.6.2 Groundwater Sampling

Groundwater samples were collected from each of the two discharge points from within the box culvert which is located beneath I-70 east of the Twin Tunnels (Figure 3). Initially, the southern-most discharge point was sampled (December 7, 2011), and subsequently both pipes were sampled during a separate event (January 30, 2012). Additionally, the rate of discharge from each pipe was measured.

The samples were analyzed for total recoverable metals and potentially dissolved metals. The metals that were analyzed were aluminum, antimony, arsenic, barium, beryllium, cadmium, chromium (III and VI), copper, iron, lead, manganese, molybdenum, mercury, nickel, selenium, silver, thallium, uranium and zinc. These analytes were analyzed using EPA Clean Water Act (CWA) Methods 200.7, 200.8; or EPA SW846 Method 245.1. Additionally, phosphorus was analyzed by Standard Method (SM) 4500-P, pH was analyzed by SM 4500-H, and total suspended solids was analyzed by SM 2540D. All samples were submitted to Origins for laboratory analysis. A summary of the analytical results for these water samples is attached to this Technical Memorandum as Appendix B.

The results of the metals analysis were compared to the appropriate CDPHE surface-water standards (Appendix B). Based on the project location, discharge is to Segment 11 of Clear Creek, and the first hierarchal regulation is Regulation 38 for inorganic constituents (metals) (CDPHE, 2011d), followed by Regulation 31 (CDPHE, 2011c). Using CDPHE protocols, only chronic standards were examined during this investigation.

If no value was listed for a given metal, table value standards (TVS) from Regulations 31 and 38 for acute aquatic life impacts were used. For example, Segment 11 has a numeric limitation for arsenic, whereas other metals such as cadmium and lead have a TVS from Regulations 31 and 38. If no numeric value from Regulation 38, or acute TVS from Regulations 31 and 38, are given for a specific constituent, then either the Regulation 31 “water+fish” standard or the domestic water-supply (DWS) standard applies (depending on use classification), in that order. This segment of Clear Creek is classified for water supply; therefore, surface water standards are generally very stringent. Many of the Regulation 31 and 38 TVSs are based on a mathematical formula with the current stream hardness as the variable. CDOT has provided a current hardness value for Clear Creek of 61 milligrams per liter (mg/L), which was utilized as the variable. It is possible that more recent hardness data is available from another source; however, at the time of this investigation, no other data was identified. Potential permit limits could be amended with more appropriate hardness data.

Groundwater sample results collected at the Site indicate that groundwater seeping from the Twin Tunnels contains very low concentrations of several metals. The results from the most recent sampling event indicate that permit limits for the following metals are exceeded: arsenic, iron, lead, manganese and selenium (Appendix B).

The pH of the water samples was measured at between 7.6 and 7.85 standard units. This measurement is nearly neutral, and does not indicate that the water has been affected by potentially mineralized rock, and is not considered acidic.

Concentrations of phosphorus and TSS were below the laboratory reporting limits.

Discharge rates were measured at 0.83 liter (0.22 gallon) per minute for the southern discharge point, and 0.67 liter (0.18 gallon) per minute for the northern discharge point.

5.6.3 Lead-Paint Sampling

Paint samples for the analysis of lead were collected from the Doghouse Rail Bridge (Structure CLR314-W0.7) and the eastbound bridge over Clear Creek west of Hidden Valley (Structure F-15-BH). The paint samples were collected using a chisel or a knife. The following samples were collected:

- Doghouse Rail Bridge – White Paint on Railing
- Doghouse Rail Bridge – Black Paint on Steel Girders
- Hidden Valley Bridge – Gray Paint on Steel Girders

One paint chip sample of each color of paint identified from the bridges was collected and submitted to Reservoirs Environmental Laboratory, Inc. (Reservoirs), for lead analysis. Reservoirs is accredited by the American Industrial Hygiene Association for metals analysis through the *Environmental Lead Proficiency Analytical Testing (ELPAT)-Environmental Lead Laboratory Accreditation Program* for environmental samples and the *Proficiency Analytical Testing (PAT) - Industrial Hygiene Laboratory Accreditation Program* for industrial hygiene samples. Reservoirs operates under AIHA Certificate #480 and laboratory ID #101533. The samples were analyzed using the Atomic Absorption Spectroscopy (AAS)/Atomic Spectroscopy (AES)/Atomic Emission Spectroscopy - Inductively couples Plasma (AES-ICP). Lead was detected in each of the paints identified on the two bridge structures. Table 6 presents a summary of results.

Table 6
Summary of Lead Content on Bridge Components

Sample Location/Designation	Lead Content in Paint (percent)
Doghouse Rail Bridge - White Paint on Railings	0.007 %
Doghouse Rail Bridge - Black Paint on Steel Girders	54.44 %
Hidden Valley Bridge - Gray Paint on Steel Girders	0.133%

5.6.4 Asbestos Sampling

CDOT contracted pre-demolition surveys for the two bridges in 2011 (Walsh, 2011a and 2011b). The sampling was conducted in accordance with standards of the EPA Asbestos Emergency Hazard Response Act and National Emission Standards for Hazardous Air Pollutants, OSHA Construction and General Industry Standards for asbestos, CDPHE Regulation No. 8, and industry standards.

As part of the inspections, bulk samples of homogenous materials were collected by accredited asbestos inspectors. Samples were collected by taking core samples that included all layers within the suspect material, or from soft material, by removing a small portion using wetting techniques. All samples were placed in sealed, labeled containers, and the sample descriptions and locations were recorded. The samples were delivered under chain of custody protocols to Reservoirs for analysis of asbestos content by polarized light microscopy. Table 7 provides information on ACMs identified on the two bridge structures.

Table 7
Summary of Asbestos-Containing Materials on Bridge Components

Bridge Structure/Sample ID	Material Description	Material Condition	Analytical Results	Approximate Quantity
Doghouse Rail Bridge F15I-EJM01-01	½"-inch thick, black, asphalt/tar impregnated material associated with bridge/retaining wall expansion joint	Good	20% - Chrysotile	80 Linear Feet
Hidden Valley Bridge F15BH-PFM01-01	Gray, fibrous paper-like guardrail joint padding	Good	55% - Chrysotile	10 Square Feet

The ACMs identified are required to be removed by a licensed asbestos abatement contractor prior to any renovation or demolition activities that may disturb these materials. CDOT has already contracted an asbestos abatement contractor to remove the ACM from the Hidden Valley Bridge; however, at the time of this Technical Memorandum, that work had not been completed.

5.7 Conclusions regarding regulated materials and/or solid waste

The following conclusions were developed regarding the potential for regulated materials and or solid waste to be located within the study area:

- Mining and milling activities occurred in the project vicinity from approximately 1859 to the 1980s. It is possible that mine-related wastes are located beneath the roadway on the project, which could be encountered during construction activities. It is likely that mine waste, if encountered, would be difficult to distinguish as it would likely have been mixed with "clean" embankment material beneath the roadway. If this is the case, chemical concentrations would be significantly diluted by those historic processes. No evidence of mine wastes was identified during the Limited Phase II ESA in key areas where significant ground disturbance would result from construction of the Proposed Action.

- Several small adits (horizontal or near-horizontal entrance to a mine) are located in the study area, and outside the project footprint. These are relatively small features where no evidence of mine processing was identified. Based on the limited nature of these features, it is unlikely that they would impact the project.

- Groundwater is discharging continuously from the Twin Tunnels into a box culvert immediately east of the tunnels. Water sampling indicates that this water contains concentrations of metals that exceed potential surface-water discharge limits. There is no evidence that these detections are the result of mine activities, but are likely the result of natural processes. The potential impacts of these discharge points are discussed more completely in the Water Quality Technical Memorandum.

- Lead has been identified in paint on components of both the eastbound Hidden Valley Bridge over Clear Creek, and the Doghouse Rail Bridge. Although this condition is a potential project liability as the lead will need to be abated to eliminate risk to workers health and the environment, by definition, this condition is not considered a REC under the ASTM standard.

- Asbestos has been identified on both bridge structures that will be either demolished or renovated during construction of this project. Disturbance of asbestos will require abatement by a licensed contractor prior to disturbance.

5.8 What agencies were involved in this analysis and what are their issues?

During completion of the regulated materials and solid waste analysis for the Twin Tunnels project, coordination was held with the Sediment Control Action Plan (SCAP) and the Stream and Wetland Ecological Enhancement Program (SWEEP) committees. Additionally, a coordination meeting was held between CDOT, EPA and CDPHE. At that meeting, EPA and CDPHE reported that the project area is not within any active area of ongoing or planned remediation, and is generally east of the recognized limits of current or formerly mined areas. Therefore, EPA and CDPHE concluded that the project area is generally devoid of mineralization of sulfides (primarily pyrite) that can react with water to create acidic drainage. EPA and CDPHE staff noted that the installation of a bulkhead system to control or improve flow from the Argo Tunnel, prior to its treatment (for removal of metals and pH adjustment) and eventual discharge to Clear Creek will be completed in the next two years. The project is upstream from the proposed project limits; however, construction of the bulkhead and the Twin Tunnels project may coincide. Based on information shared, it was agreed that there is no need for a funding agreement or memorandum of understanding (MOU) between the agencies. CDOT will comply with any identified permitting requirements that may relate to construction storm water runoff, potential dewatering operations, tunnel discharge, and other issues.

Coordination with the SCAP primarily involved providing the committee with information regarding previous spill locations and the results of the subsurface investigation, as identified during this analysis. This information was used by the SCAP committee to evaluate potential locations of spill and sediment control structures.

Similar information was provided to the SWEEP committee, along with the recommendation that a Materials Management Plan be developed and implemented during construction activities, in order to properly handle excavated material during construction. It was agreed that implementing surface water monitoring before and during construction activities would be prudent to document that the construction activities did not have an adverse effect on Clear Creek.

Section 6. What are the environmental consequences?

6.1 How does the No Action affect regulated materials and solid waste?

The No Action Alternative would include the following activities:

- Frontage Road Phase 1
- Private bus service on I-70
- Intelligent Transportation Systems (ITS)/ Advanced Traffic Management Systems (ATMS) improvements such as signage and speed harmonization or pacing (that is, setting driver speeds at a lower limit during periods of congestion, through the use of electronic signage or pace cars, to reduce congestion and improve travel time reliability)

- Replacement of the structurally deficient westbound I-70 bridge at the bottom of Floyd Hill
- Regular roadway maintenance
- The addition of lighting at chain stations near Georgetown and Silver Plume

It is possible that the No Action Alternative would interact to some degree with regulated materials or solid waste, such as at sites where potential mine waste is encountered, lead paint is identified (e.g., bridge at Floyd Hill or other painted surfaces), or residual spill material or spill sites on the Interstate, although those interactions are likely to be limited.

6.2 How does the Proposed Action affect regulated materials and solid waste?

6.2.1 What are the direct effects including a managed lane?

Direct impacts to regulated materials and solid waste associated with the Proposed Action with a managed lane would occur during construction. The Proposed Action would require construction in areas where potential mine wastes may be located, and on bridges where lead-based paint has been identified. Wider roadway profiles increase the likelihood that mine wastes would be encountered due to increased construction footprints in cut and fill areas. However, none have been identified in the primary construction areas within the roadway.

The direct effect of encountering mine wastes or mineralized rock is not only evident during construction, but could also cause a direct effect on water quality by increasing the possibility that these disturbances, if not properly managed, could cause a transport of pollutants through wind dispersion, leaching and drainage. However, information collected in support of this project indicates that the potential to encounter mine wastes is unlikely.

6.2.2 How does the Proposed Action change without tolling?

The Proposed Action without the tolling component would generate the same regulated materials and solid waste impacts as the Proposed Action with a managed lane.

6.3 What indirect effects are anticipated?

The Proposed Action will allow increased truck transport along the I-70 Corridor which could cause additional spills on the interstate; however, the Proposed Action will address significant safety issues and crash areas, thus decreasing the potential for crashes and spills. Therefore, these two issues tend to offset each other. Moreover, spill containment structure locations have been identified and best management practices will be initiated to reduce hazardous material discharge into Clear Creek.

6.4 What effects occur during construction?

Direct impacts to regulated materials and solid waste associated with the Proposed Action are most likely to occur during construction. Not only could existing regulated materials and solid waste in the affected environment be impacted during construction, but construction could also have an impact. Construction equipment would require the use of fuels and lubricants, which could have the potential to be released if not properly managed.

Section 7. What mitigation is needed?

7.1 Tier 1 Mitigation Strategies

The following Tier 2 mitigation approaches are relevant to this project from the Tier 1 PEIS:

- Minimize property acquisition and disturbance of mine wastes, tailings, and drainage tunnels and areas adjacent to or within active and inactive LUST sites.
- Minimize impacts on Clear Creek channel and floodplain both during and after disturbance of mine waste, tailings, and drainage tunnels.
- Manage mine waste and tailings materials onsite, when possible, to minimize potential disposal problems and costs.
- Minimize wind-blown dust from mine tailings on construction sites by wetting or other dust control measures.
- Manage mine waste and tailings materials under CDPHE and Environmental Protection Agency guidance and authority.
- Manage contaminated soil and groundwater under applicable CDPHE, Environmental Protection Agency, Colorado OPS, and CDOT regulations and guidance.
- Follow CDOT procedures and other applicable guidance for the storage and handling of regulated materials, as well as historic mine waste during construction activities.
- Work cooperatively with various local, state, and federal agencies and local watershed groups to help avoid further impacts on and possibly improve water quality.
- Any soil removed during trenching or augering will be conducted in accordance with specified health and safety regulations concerning the handling of soils with heavy metal content.

7.2 Twin Tunnels Mitigation

7.2.1 Operations Mitigation

Impacts from regulated materials and solid waste are anticipated during construction, and not during operations of the Proposed Action; therefore, no operations mitigation is required.

7.2.2 Construction Mitigation

Mitigation techniques to reduce identified impacts to regulated materials and solid waste are described in Table 8.

Table 8
Mitigation Measures for Regulated Materials under the Proposed Action

Activity	Location	Impact Type	Mitigation Measure for the Proposed Action[1]
Construction, including excavation associated with retaining walls and bridge abutments.	Throughout the study area.	Potential mine wastes located within areas of excavation.	• A project-specific Materials Management Plan should be completed that details site-specific standard operating procedures regarding the identification, sampling, handling and disposal of mine-related wastes that could be encountered during construction of this project. • The Contractor should complete a Health and Safety Plan to address potential mine wastes that could be uncovered during construction. • Best management practices should be implemented to prevent potential mine wastes from being exposed in the air (dust suppression), or to impact surface waters, in particular Clear Creek (SWMP). • Workers on this project must follow CDOT Specification 250 – Environmental, Health and Safety Management during excavation activities at this site.
Construction and maintenance of Twin Tunnels	Groundwater drainage discharging into box culvert east of Twin Tunnels.	Groundwater containing naturally-occurring metals that exceeds surface water standards continues to drain. The expanded bore may cause a change in discharge rate and chemistry of water.	• Seek opportunities to utilize adaptive mitigation during design to eliminate daylight discharge, thus avoiding permitting. • If discharge cannot be eliminated, then permitting through the CDPHE may be required.
Construction, including excavation and blasting.	Twin Tunnels expanded bore.	Naturally occurring mineralized rock located near the west portal of the Twin Tunnels.	• Encapsulating mineralized rock generated during blasting activities beneath the roadway pavement to prevent geochemical changes of the material from precipitation that could cause the release of contaminants and migration into Clear Creek.
Blasting of Twin Tunnels.	Twin Tunnels expanded bore.	Excessive vibration resulting from blasting activities could damage underground storage tanks associated with the Idaho Springs Wastewater Treatment Plant	• Contractor shall complete necessary modeling to characterize potential impacts to those structures, and complete appropriate monitoring during blasting activities to evaluate effects. Adjustments to blasting program may be necessary to eliminate impacts to those buried facilities.

Activity	Location	Impact Type	Mitigation Measure for the Proposed Action[1]
Demolition or rehabilitation of bridge structures.	Clear Creek bridge west of Hidden Valley interchange and Doghouse Rail Bridge	Lead-based paint located on bridge components encountered by workers	• Contractor should be notified that lead-based paint is located on the Hidden Valley Bridge over Clear Creek and the Doghouse Rail Bridge. • The contractor should avoid sanding, cutting, burning, or otherwise causing the release of lead from paint on these structures. If this is not possible, the lead must be abated properly. • If possible, components that will require demolition should be removed carefully and properly recycled. • OSHA Regulation 1926.62 should be consulted for worker protection prior to work on these structures. Worker health and safety precautions in compliance with OSHA must be followed to limit worker exposure to lead. Work should be completed on these structures in accordance with CDOT Specification 250.04. • Workers on this project must follow CDOT Specification 250 – Environmental, Health and Safety Management during excavation activities at this site.
Demolition or rehabilitation of bridge structures.	Clear Creek bridge west of Hidden Valley interchange and Doghouse Rail Bridge	Asbestos-containing materials located on bridge components encountered by workers	• Any disturbance to regulated asbestos-containing materials will require proper abatement in accordance with CDPHE and EPA regulations prior to disturbance of that material.

1 Mitigation is not necessary if impact can be avoided through changes in the design or construction of the Proposed Action (i.e., the impact is avoided).

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Section 9. Resource Maps

The following six maps illustrate the location of regulated materials and solid waste within the study area. Figure 1 presents the boundaries of the project area evaluated during this evaluation, and Figures 2 through 6 illustrate specific features regarding regulated materials and solid waste located across the study area from west to east.

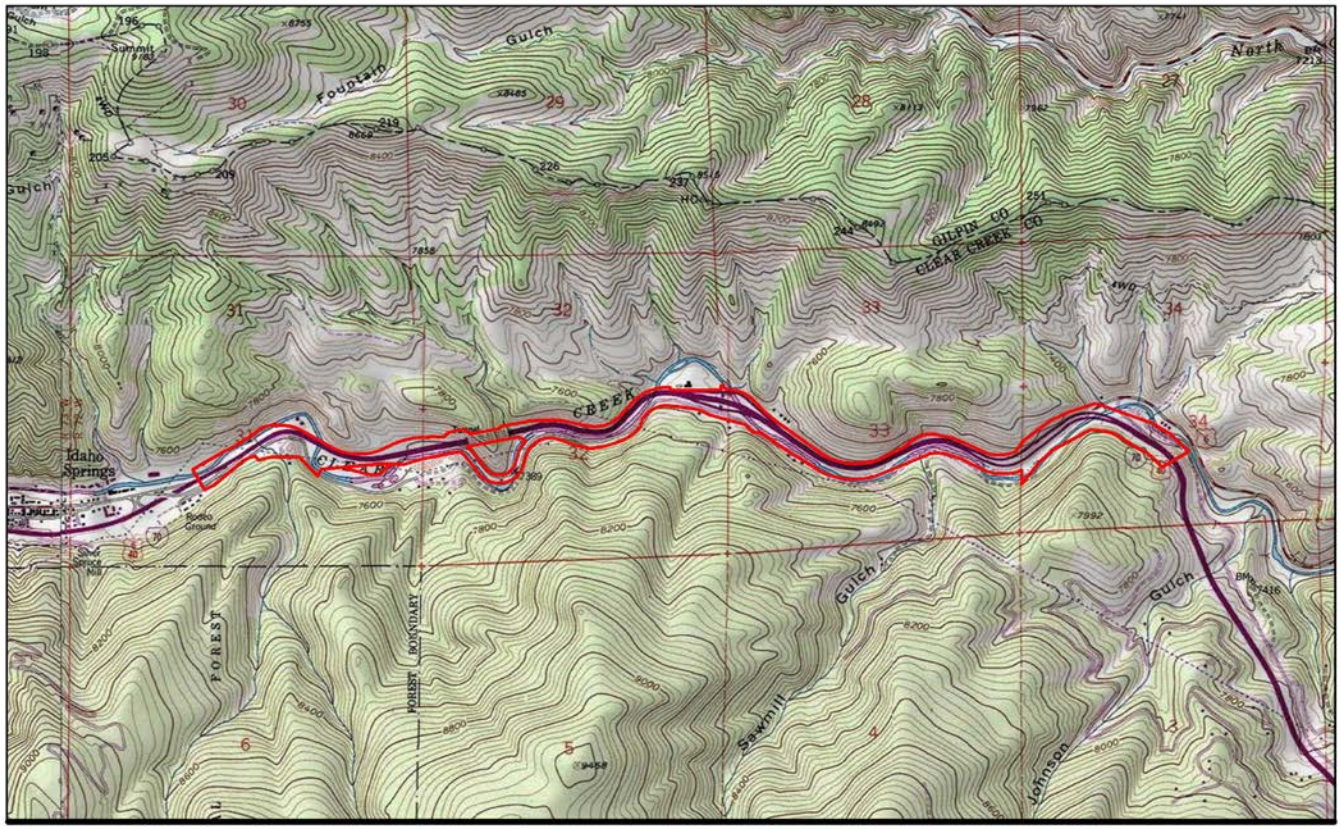

Figure 1. Location Map

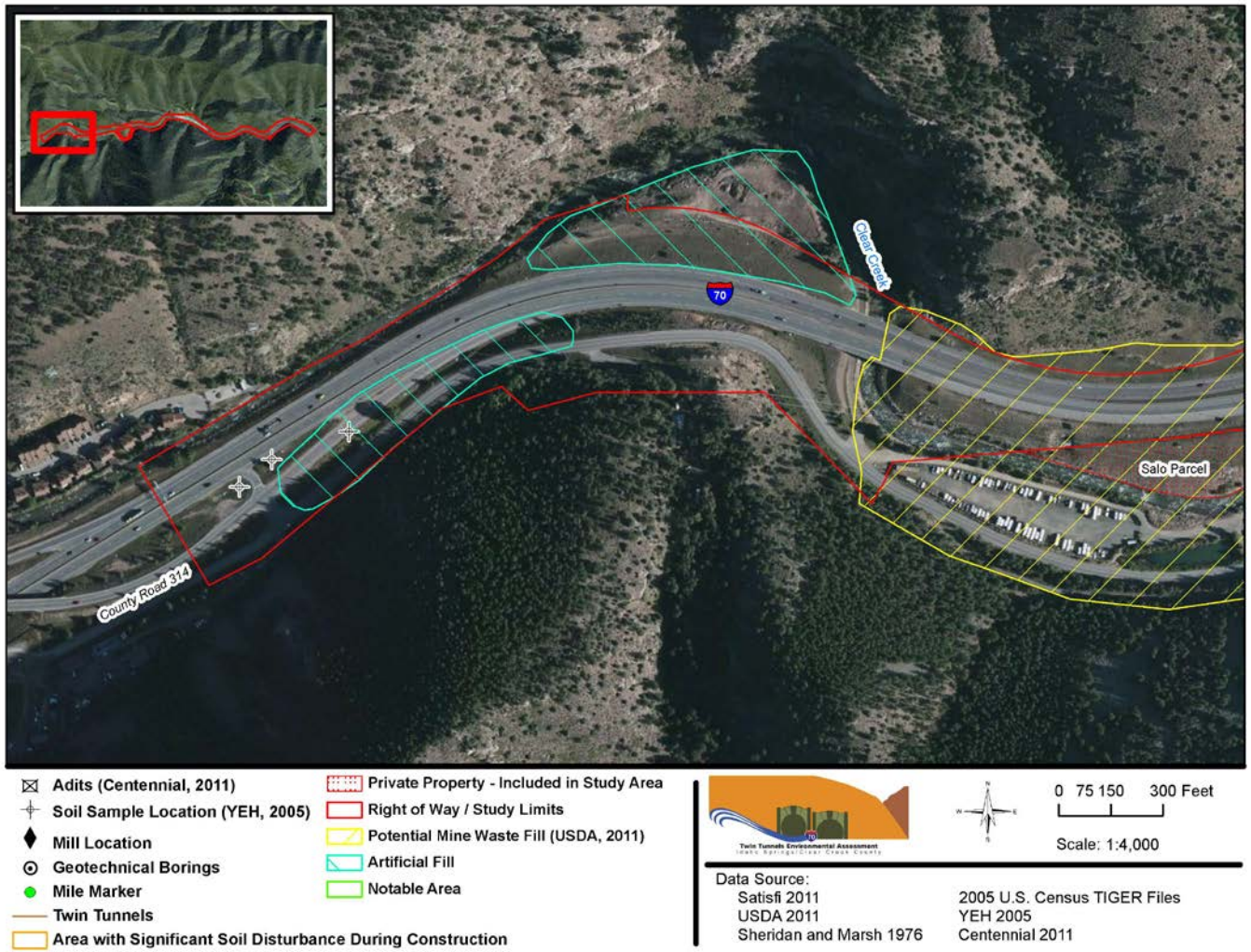

Figure 2. Site Plan 1 of 5

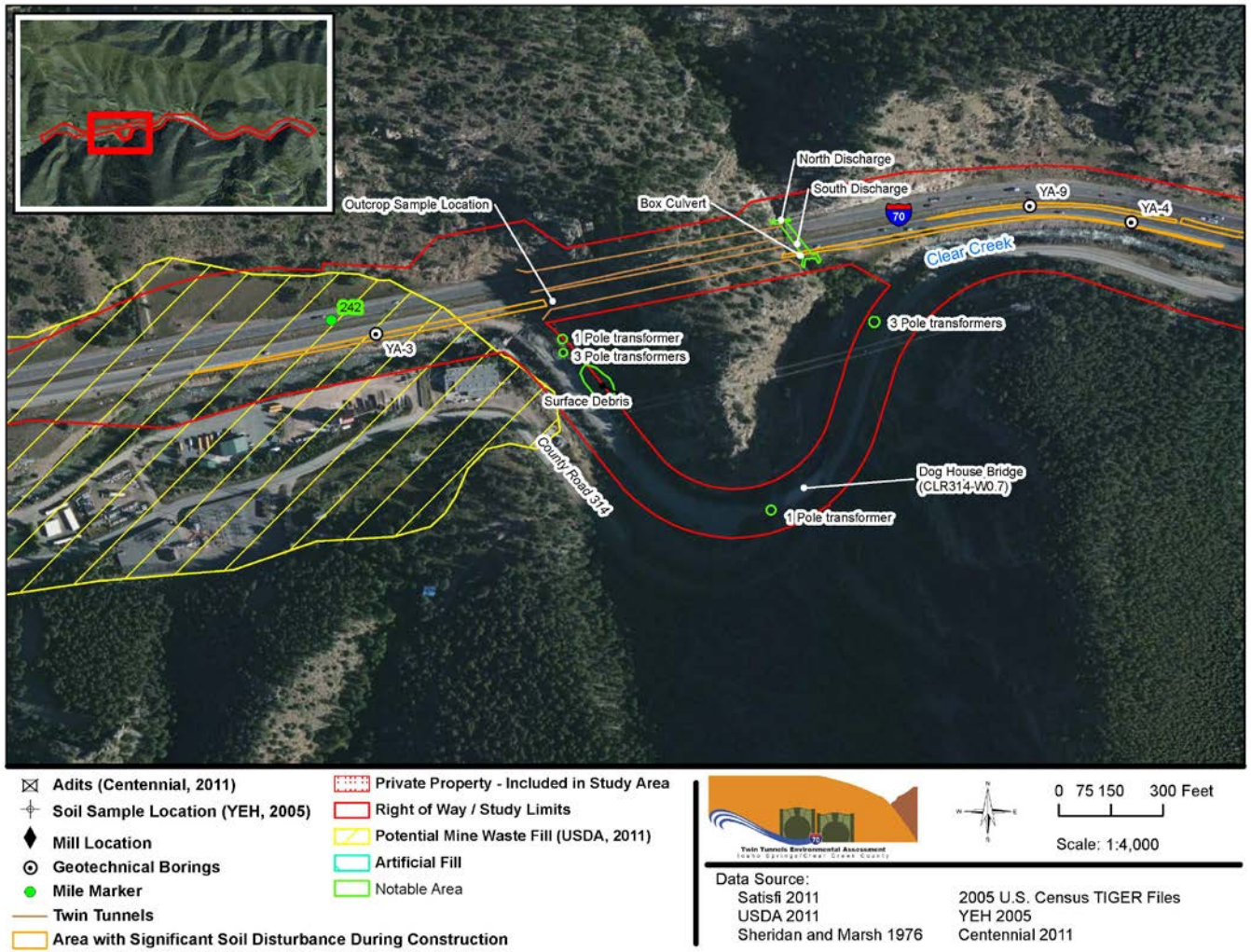

Figure 3. Site Plan 2 of 5

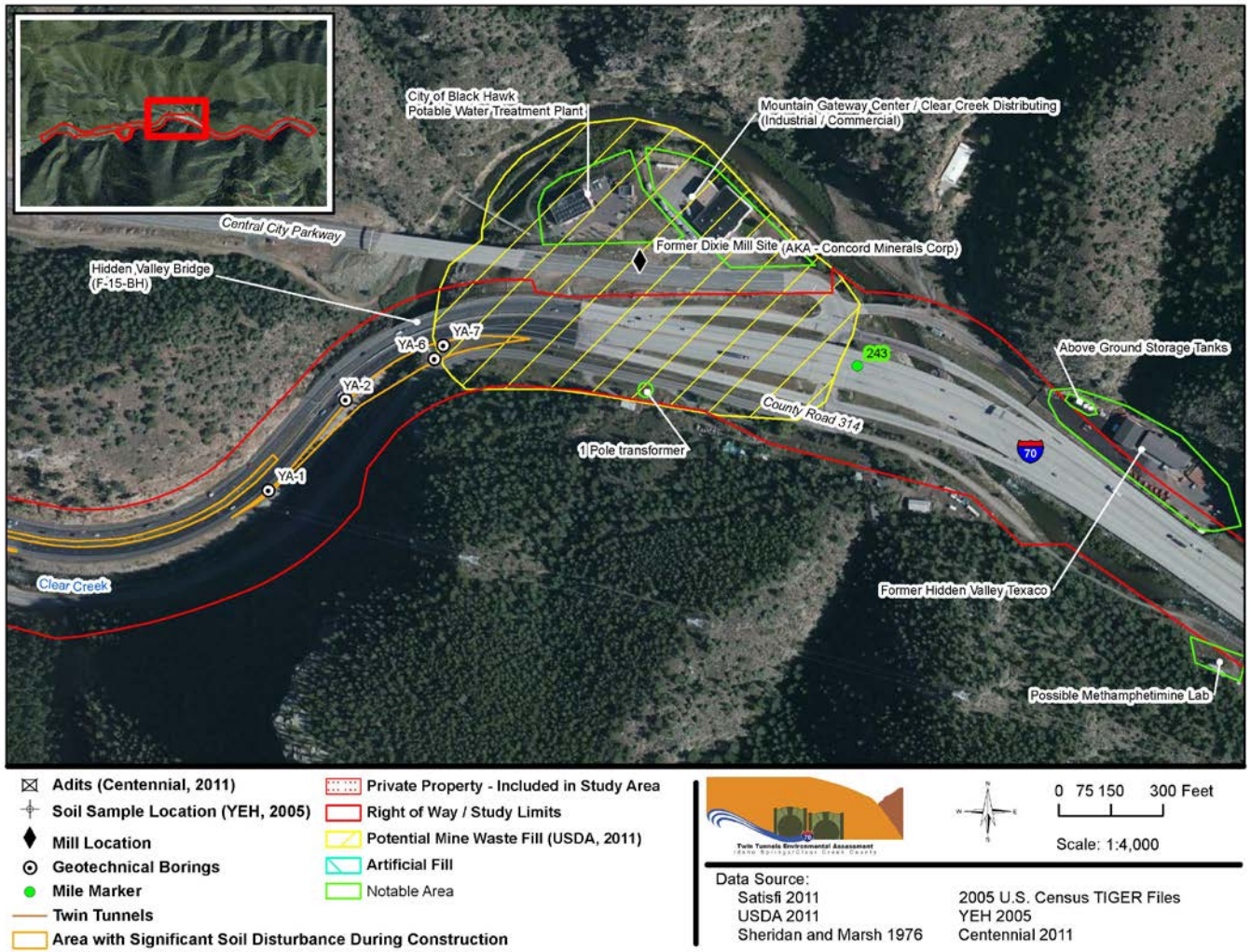

Figure 4. Site Plan 3 of 5

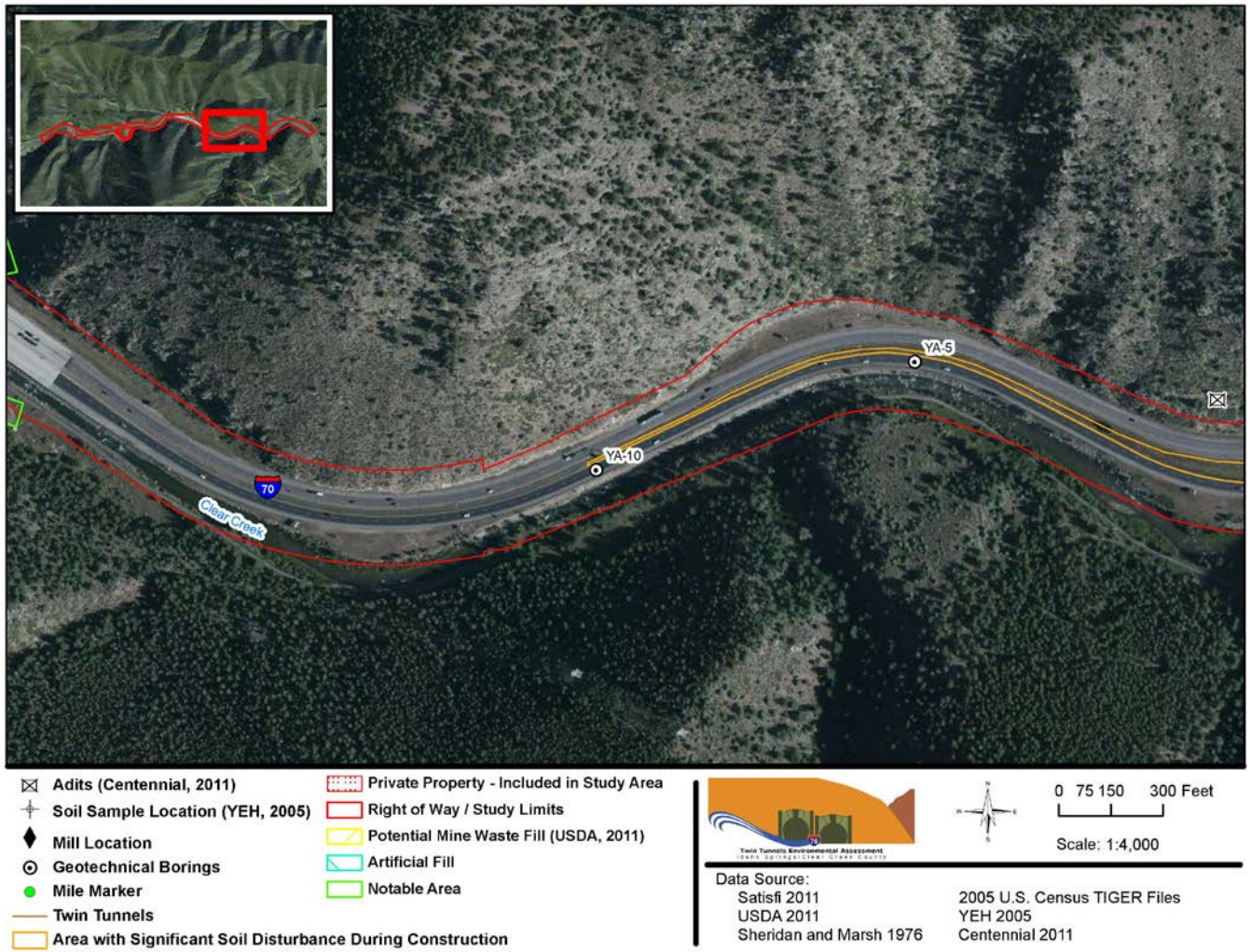

Figure 5. Site Plan 4 of 5

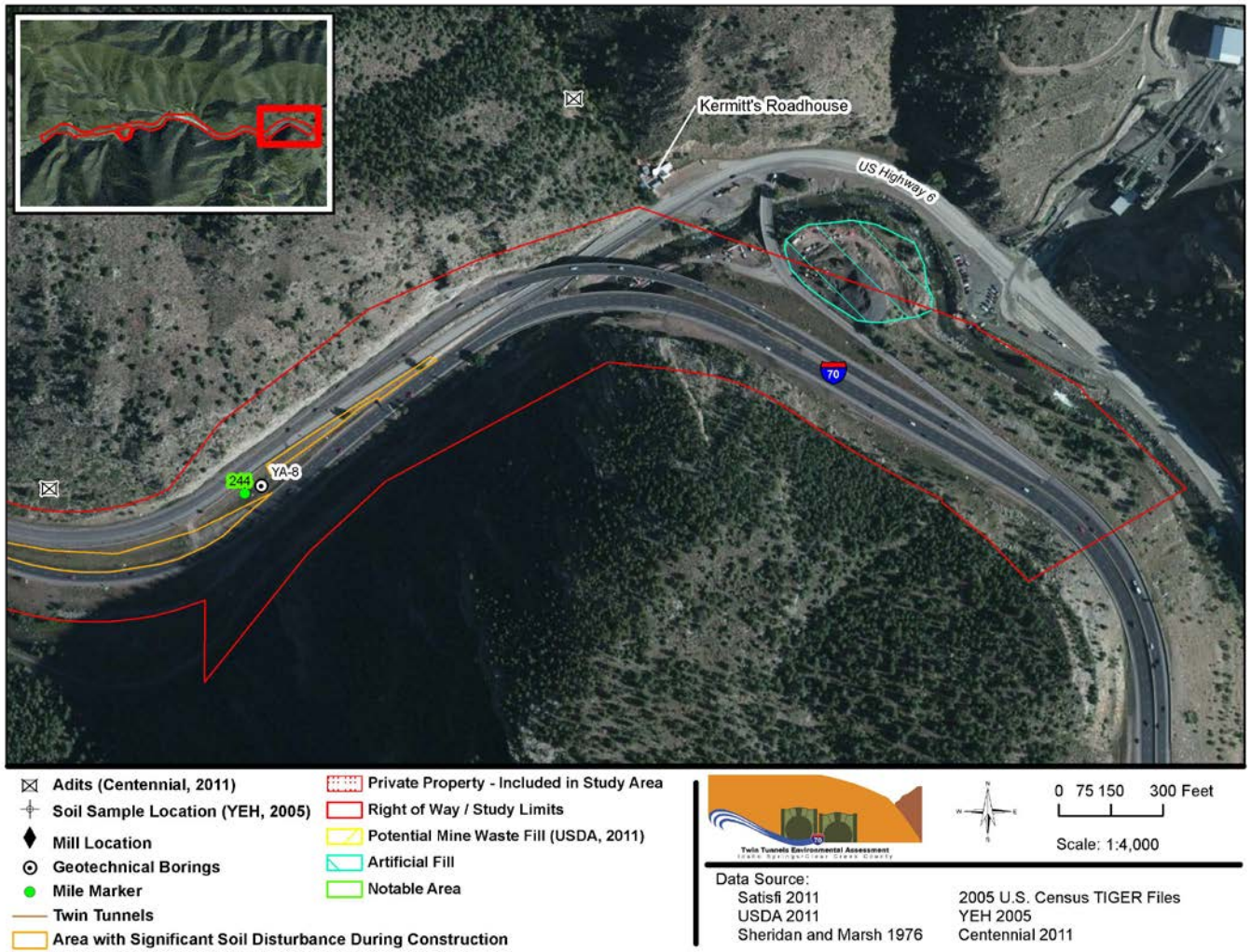

Figure 6. Site Plan 6 of 6

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APPENDIX A

Soil Sample Results

Appendix A: Soil Sample Results

Sample Location	Depth (feet)	Date	Comment	Metal Concentration (mg/kg)													pH
				Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc	
			Residential CSEV	31	0.39	160	70	120000	3100	400	13	1500	390	390	NS	23000	NS
			Commercial CSEV	410	1.6	1300	770	1500000	41000	800	160	12000	5100	5100	NS	310000	NS
YA-1	0-25	11/30/2011	Gravel fill, angular, sandy with cobbles, dark yellowish brown (10YR 3/4) to dark grayish brown (10YR 4/2)	<2.17	**<3.93**	<0.197	<0.212	14	72.6	20.2	0.009	11.5	<2.81	62.8	<3.23	104	8.69
YA-1	0-25	11/30/2011	Duplicate	<2.1	**<3.81**	<0.191	0.407	18.6	43.9	19	0.009	14.5	<2.72	90.5	<3.13	116	8.72
			Relative Percent Difference	NA	NA	NA	NA	-28.2%	49.3%	6.1%	0.0%	-23.1%	NA	-36.1%	NA	-10.9%	-0.3%
YA-2	0-10	12/6/2011	Gravel fill, angular, sandy with cobbles, brown (10YR 4/3)	<2.1	**<3.8**	<0.19	0.47	9.77	18.4	13.4	0.0143	10	<2.71	33.6	<3.12	73.1	8.29
YA-3	0-5	12/6/2011	Gravel fill, angular, sandy with cobble, dark grayish brown (10YR 4/2)	<2.04	**5.36**	<0.185	0.237	15.4	28.5	16.2	0.004	10.1	<2.64	62.9	<3.04	93.4	8.88
YA-3	5-20	12/6/2011	Possible native, gravel, sandy, sub-rounded to rounded, brown (10YR 4/3)	<2.09	**4.11**	<0.19	1.42	7.92	46.3	76.8	0.282	6.48	<2.71	50.6	<3.11	123	7.6
YA-3	5-20	12/6/2011	Duplicate	<2.08	**<3.77**	<0.189	0.343	8.48	77.7	78.4	0.245	5.57	<2.69	43.7	<3.09	123	7.31
			Relative Percent Difference	NA	NA	NA	122.2%	-6.8%	-50.6%	-2.1%	14.0%	15.1%	NA	14.6%	NA	0.0%	3.9%
YA-4	0-20	12/7/2011	Gravel fill, angular, sandy, dark grayish brown (10YR 4/2)	<2.15	**<3.89**	<0.195	6.62	18.7	119	29.4	0.008	17.4	<2.78	85.4	<3.2	1600	4.8
YA-5	0-15	12/7/2011	Gravel fill, angular, sandy, dark grayish brown (2.5YR 4/2)	<2.03	**6.13**	<0.185	<0.199	68.6	21.6	16.7	0.01	43.7	<2.63	199	<3.03	102	9.06
YA-6	0-10	12/1/2011	Gravel fill, angular, sandy, brown (10YR 4/3)	<2.14	**<3.88**	<0.194	0.486	11.3	23.8	24.1	0.017	8.46	<2.77	54.6	<3.16	82.7	8.54
YA-6	0-10	12/1/2011	Duplicate	<2.17	**<3.94**	<0.197	0.33	9.97	23.3	19.4	0.013	7.35	<2.81	61.9	<3.23	82.4	8.47
			Relative Percent Difference	NA	NA	NA	38.2%	12.5%	2.1%	21.6%	26.7%	14.0%	NA	-12.5%	NA	0.4%	0.8%
YA-6	10-20	12/1/2011	Possibly native gravel, sub-rounded to rounded, grayish brown (10YR 5/2)	<2.06	**<3.73**	<0.187	<0.201	13.8	27.3	25.1	0.013	9.54	<2.66	48.7	<3.06	82	8.31

Sample Location	Depth (feet)	Date	Comment	Metal Concentration (mg/kg)													pH
				Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc	
			Residential CSEV	31	0.39	160	70	120000	3100	400	13	1500	390	390	NS	23000	NS
			Commercial CSEV	410	1.6	1300	770	1500000	41000	800	160	12000	5100	5100	NS	310000	NS
YA-7	0-15	12/9/2011	Gravel fill, subangular, sandy, olive brown (2.5YR 4/3)	<2.21	**<4.01**	<0.201	0.911	11.2	20.2	14.7	0.007	9.45	<2.86	45.8	<3.29	72.8	8.61
YA-7	0-15	12/9/2011	Duplicate	<2.15	**<3.9**	0.195	0.21	9.92	21.6	15.5	0.007	7.17	<2.78	43.4	<3.2	66.4	8.49
			Relative Percent Difference	NA	NA	NA	125.1%	12.1%	-6.7%	-5.3%	0.0%	27.4%	NA	5.4%	NA	9.2%	1.4%
YA-8	0-15	12/7/2011	Gravel fill, angular, sandy, dark grayish brown (2.5YR 4/2)	<2.07	**7.2**	<0.188	<0.202	62.8	20.9	5.72	<0.001	39.6	<2.67	209	<3.07	91	8.28
YA-9	0-10	12/8/2011	Gravel fill, angular, sandy, olive brown (2.5YR 4/3) to gray (2.5YR 5/1)	<2.08	**<3.77**	<0.189	<0.203	8.05	27	5.61	0.002	5.35	<2.69	65.8	<3.1	69.6	8.57
YA-9	0-10	12/8/2011	Duplicate	<2.04	**<3.69**	<0.185	<0.199	8.85	32	4.7	<0.001	6.75	<2.63	53.3	<3.03	66.4	8.55
			Relative Percent Difference	NA	NA	NA	NA	-9.5%	-16.9%	17.7%	NA	-23.1%	NA	21.0%	NA	4.7%	0.2%
YA-10	0-10	12/7/2011	Gravel fill, angular, sandy, very dark grayish brown (2.5YR 3/2)	<2.06	**3.91**	<0.187	<0.201	21.2	77	23.6	0.026	14.6	<2.67	120	<3.07	105	8.74
YA-10	0-10	12/7/2011	Duplicate	<2.16	**<3.91**	<0.196	0.35	18	41.9	26.9	0.032	14.3	<2.79	114	<3.21	108	8.68
			Relative Percent Difference	NA	NA	NA	NA	16.3%	59.0%	-13.1%	-20.7%	2.1%	NA	5.1%	NA	-2.8%	0.7%
West Portal Outcrop	Surface	1/30/2012	Loose, very poorly cemented, silty sand outcrop material, potentially mineralized intrusive rock, olive-yellow color (2.5YR 6/8)	<1.9	**4.7**	<0.97	2.4	15.4	334	8.9	<0.039	10.3	52.5	<0.97	<1.9	1180	2.7

Notes:

CSEV - Colorado Soil Evaluation Value, Colorado Department of Public Health and Environment, Table 1, July 2011

J - Result is less than the reporting limit, but greater than the minimum detection limit, and the concentration is an approximate value

mg/kg - milligrams per kilogram

NS - No standard

NA - Not analyzed

< - Indicates concentration below the laboratory reporting

Bold - Indicates concentration exceeds regulatory standard

APPENDIX B

Twin Tunnels Discharge Analytical Results and Surface Water Discharge Permit Limits

Appendix B: Twin Tunnels Discharge Analytical Results and Surface Water Discharge Permit Limits

Metals	Sample Location: South Discharge; 12/7/2011				Sample Location: South Discharge; 1/30/12				Sample Location: North Discharge; 1/30/12				Potential Permit Limit (µg/l) Hierarchal Limits from Left to Right					
	Total Recoverable (µg/l)	Notes	Potentially Dissolved (µg/l)	Notes	Total Recoverable (µg/l)	Notes	Potentially Dissolved (µg/l)	Notes	Total Recoverable (µg/l)	Notes	Potentially Dissolved (µg/l)	Notes	Reg 38 Numeric (Chronic)	Reg 38 Numeric (Acute)	Chronic TVS (Reg 31 & 38)	Acute TVS (Reg 31 & 38)	water+fish (Reg 31)	DWS (Reg 31)
Aluminum	<200		<200		<50		74		18	J, B	42	J			248.15	1,738.26		
Antimony	<2.0		<2.0		<2.5		<2.5		<2.5		<2.5						5.6	6
Arsenic	0.98	J	<2.0		1.4	J	1.6	J	2.4		3.1		0.02	340.00			0.02-10 [1]	0.02
Barium	47		45		61.1		62		136		123							1,000
Beryllium	0.26	B, J	0.19	B, J	<0.5		<0.5		<0.5		<0.5							4
Cadmium	<0.06	U	<0.06	U	<0.2	U	<0.2	U	<0.2	U	<0.2	U	1.42		0.29	1.78		5
Chromium III	<10		NA		<25		NA		<25		NA			50.00	49.44	380.09		50
Chromium VI	<10		NA		<5.3		NA		<5.3		NA				11.00	16.00	100	50
Copper	2.87		2.42		3.1	J	5.4		<10		3.6		17.00		5.87	8.44	1,300	1,000
Iron	<200		<200		44	B, J	<60		486		428		1000					300
Lead	0.35	J	0.24	J	18		24.1		<0.4	U	7.5				1.46	37.56		50
Manganese	34		26		70		69		818		769				1,399.17	2,532.42		50
Mercury	0.41		0.404		<0.5	U	<0.5	U	<0.5	U	<0.5	U	0.01					2
Molybdenum	5.81		5.49		4.97		4.79		13.8		12.7							210
Nickel	3.39	J	3.32	J	6.4		7.1		4.1		3.9				34.23	308.22	610	100
Selenium	1.1	J	0.77	J	7.7		7.3		14.9		12.9				4.60	18.40	170	50
Silver	<0.1	U	<0.1	U	<0.2	U	<0.27	U	<0.27	U	<0.27	U			0.14	0.87		100
Thallium	<0.5		<0.5		<2.0		16.8		0.6	J	5.54				15.00		0.24	0.5
Uranium	97.7		81		<1.0		<1.0		<1.0		<1.0				870.26	1,393.25		16.8
Zinc	30.6		28.2	J	26.5		34.7		<2.0		4.9				77.31	102.07	7400	5,000
Phosphorus	NE				<50		NA		<50		NA				110			
pH	7.85				7.8				7.6						6.5-9.0			
TSS	NE				<4.0				<4.0						30			
Discharge Rate	0.83 liter/minute				0.83 liter/minute				0.67 liter/minute						NS			

Notes:

Hardness-Dependent Value for River Segment = 61 mg/L provided by Clear Creek County

Permit Limit highlighted in green

Value potentially exceeds discharge permit limit

Indicates the laboratory reporting and minimum detection limits are higher than the potential permit limit for this metal

TVS = table value standard

DWS - domestic water supply limit

dis = dissolved

< = indicates a result less than the reporting limit

J = Indicates a result greater than the method detection limit but less than the reporting limit

B = Indicates metal detected in method blank

U = Indicates a result lower than reporting limit and method detection limit

TSS - Total Suspended Solids

Hg - Reg 38 Numeric is for chronic

NE - Not Evaluated

NS - No Standard

NA - Not Applicable

µg/l - micrograms per liter

Metal	Formulas for TVS Values/Other Notes
Aluminum	Acute = e(1.3695[ln(hardness)]+1.8308) (applies to total recoverable results); Chronic = e(1.3695[ln(hardness)]-0.1158)
Antimony	
Arsenic	3.0 - Current interim chronic standard only for Segment 14 of the South Platte River
Barium	Note that only acute Ba level given is DWS
Beryllium	Note that only acute Be level given is DWS
Cadmium	Acute TVS = (1.136672-[ln(hardness) x (0.041838)])*e(0.9151[ln(hardness)]-3.1485); Chronic TVS = (1.101672-[ln(hardness) x (0.041838)])*e(0.7998[ln(hardness)]-4.4451) 1.42 ug/L temporary modification until 7/15/2015 (dissolved only)
Chromium III	Acute TVS = e(0.819[ln(hardness)]+2.5736); Chronic TVS = e(0.819[ln(hardness)]+0.5340)
Chromium VI	Acute (acute and chronic)=TVS
Copper	Acute TVS = e(0.9422[ln(hardness)]-1.7408); Chronic TVS = e(0.8545[ln(hardness)]-1.7428); Numberic standard from Reg 38 (chronic)=17
Iron	e(0.9422[ln(hardness)]-1.7408); Where an actual water supply use, the less restrictive of two options apply - existing quality or DWS (dissolved)
Lead	Acute TVS = (1.46203-[ln(hardness)*(0.145712)])*e(1.273[ln(hardness)]-1.46); Chronic TVS = (1.46203- ln(hardness)*(0.145712)])*e(1.273[ln(hardness)]-4.705)
Manganese	Acute TVS = e(0.3331[ln(hardness)]+6.4676); e(0.9422[ln(hardness)]-1.7408) Chronic TVS = e(0.3331[ln(hardness)]+5.8743); e(0.9422[ln(hardness)]-1.7408) Where an actual water supply use in stream, the less restrictive of two options apply - existing quality or DWS (dissolved)
Mercury	Total Recoverable
Molybdenum	
Nickel	Acute TVS = e(0.846[ln(hardness)]+2.253); Chronic TVS = e(0.846[ln(hardness)]+0.0554)
Selenium	
Silver	Acute TVS = ½ e(1.72[ln(hardness)]-6.52); Chronic TVS = e(1.72[ln(hardness)]-9.06); Trout TVS = (1.72[ln(hardness)]-10.51) (This value used instead of chronic as it is more conservative)
Thallium	
Uranium	Acute TVS = e(1.1021[ln(hardness)]+2.7088); Chronic TVS = e(1.1021[ln(hardness)]+2.2382)
Zinc	Acute TVS = 0.978 e(0.8537[ln(hardness)]+1.9467); Chronic TVS = 0.986e(0.8537[ln(hardness0]+1.8032)
Phosphorus	Proposed standard
pH	Standard units
TSS	30-day average