Archaeological Assessment

Interstate 270 Corridor Improvements
Adams and Denver Counties, Colorado

January 2021

Prepared For:
CDOT Region 1
2829 West Howard Place
Denver, CO 80204

CDOT Project No.
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Prepared by
ERO Resources Corporation

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Acronyms and Abbreviations

Acronym	Definition
APE	Area of potential effect
EA	Environmental assessment
bgs	Below ground surface
CDOT	Colorado Department of Transportation
ERO	ERO Resources Corporation
GLO	General Land Office
MWRP	Metro Wastewater Reclamation Property
NEPA	National Environmental Policy Act
NETR	Nationwide Environmental Title Research
NHPA	National Historic Preservation Act
NRHP	National Register of Historic Places
OAHP	Office of Archaeology and Historic Preservation
OSL	Optically stimulated luminescence
USGS	U.S. Geological Survey

1.0 Introduction

The Colorado Department of Transportation (CDOT) and the Federal Highway Administration, in conjunction with local partners Adams County and Commerce City, are proposing improvements to 6 miles of Interstate 270 (I-270) in Adams County, Commerce City, and the City and County of Denver, Colorado, between Interstate 25 (I-25) and Interstate 70 (I-70).

CDOT and Jacobs Engineering Group, Inc. (Jacobs) are initiating design for the proposed improvements to implement transportation solutions that would modernize the I-270 corridor and address the safety, reliability, and freight movement needs through a combination of roadway infrastructure and technology improvements. CDOT is leading this project and will be preparing a template environmental assessment (EA) and conceptual design for the proposed action alternative.

ERO Resources Corporation (ERO), on behalf of CDOT and Jacobs, conducted limited, non-intensive reconnaissance level surface inspection and exploratory subsurface testing to assess the potential for archaeological sites along the I-270 corridor. ERO archaeologists Jonathan Hedlund (field director), Shayleen Ottman, Katherine Mayo, and Mason Seymore conducted the pedestrian survey and exploratory testing on August 13 and 14, 2020.

The archaeological resource survey and exploratory testing program was conducted in compliance with the National Environmental Policy Act (NEPA) and Section 106 of the National Historic Preservation Act (NHPA, 1966, as amended; 54 United States Code § 300101 et seq.). Despite significant historical disturbances along the I-270 corridor (described in detail below), the archaeological assessment was predicated and initiated on the fact that the study area includes natural contexts conducive to containing buried archaeological deposits, including along Sand Creek, the confluence of Sand and Clear Creeks, and the crossing of the South Platte River.

2.0 Project Setting

I-270 is a 6.5-mile-long controlled-access interstate highway with two through lanes in each direction, providing a direct connection from I-25 to I-70 between the northern and eastern Denver metro communities (Figure 1). I-270 is a key link to the Denver International Airport and large business clusters from the energy, manufacturing, and freight distribution centers, and is a major truck corridor, providing access to adjacent industrial areas. Between I-25 and I-70, I-270 has partial interchanges at Interstate 76 (I-76), York Street, Vasquez Boulevard, and Quebec Street. The posted speed limit on the freeway is 55 mph. The highway crosses over both the UPRR and BNSF railroads, as well as the South Platte River, Clear Creek, and Burlington Ditch, and parallels Sand Creek.

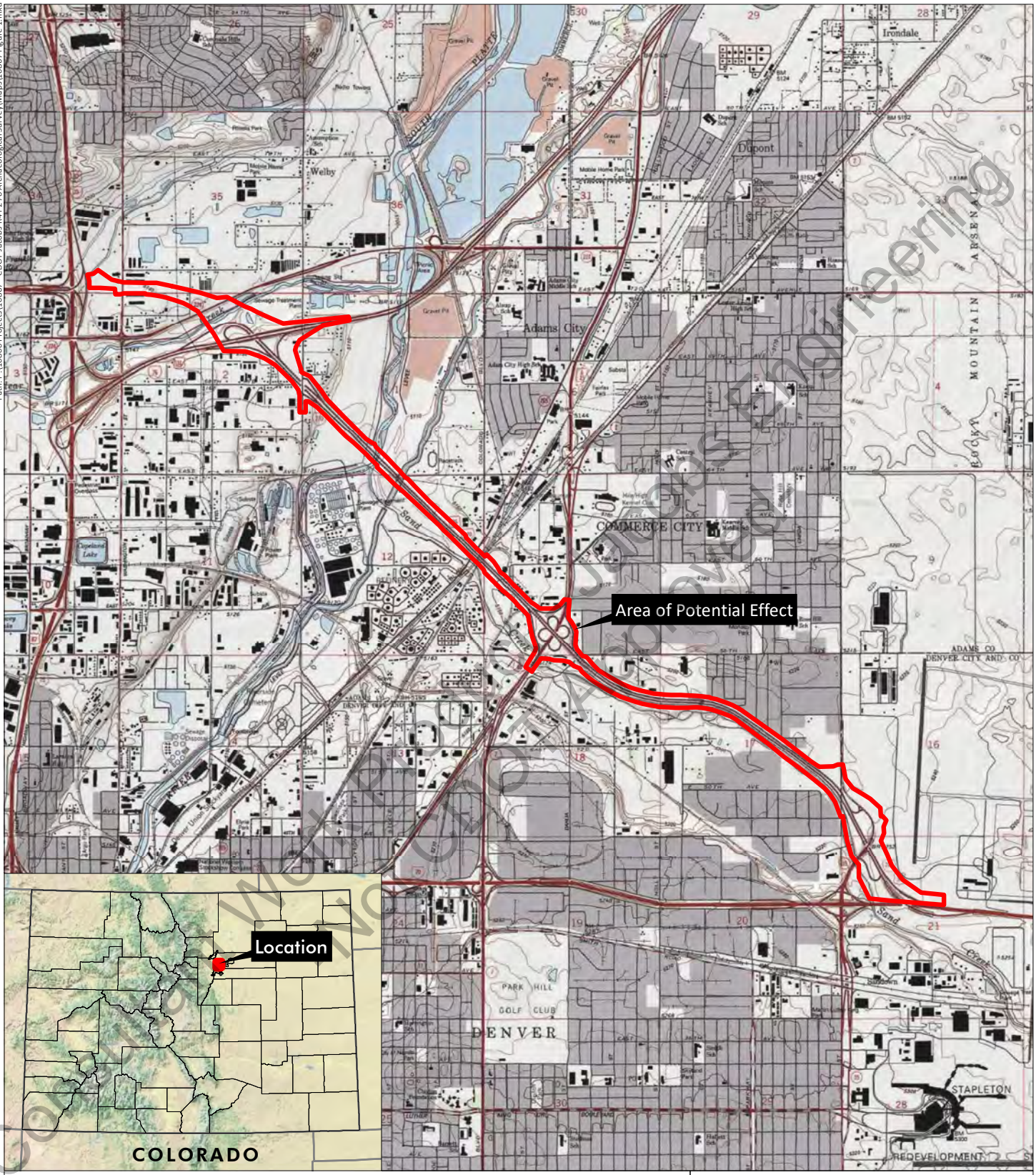
3.0 Project Description

The I-270 Corridor Improvements project would modernize the I-270 corridor and address the safety, reliability, and freight movement needs through a combination of roadway infrastructure and technology improvements. Along the 6.5-mile corridor extending from the I-270/I-25/US-36 interchange to the I-270/I-70 interchange (Figure 2), the I-270 mainline would be reconstructed and widened in both directions to accommodate one additional travel lane, full width (8-foot or greater) shoulders, and a 4-foot buffer for a potential express lane operating option. Twelve-foot wide auxiliary lanes may also be placed between interchanges to provide more merging distance for accelerating and decelerating traffic. The existing grassy median, which varies from 5 to 25 feet wide where present, would be graded and paved to accommodate the roadway widening. However, widening to the outside of the existing pavement edge would also be required in some areas, requiring minor amounts of right-of-way for construction and operation of the improved interstate. Most of the I-270 bridge structures would be replaced with new bridges to meet vertical clearance requirements. The structures not being replaced have been constructed more recently and are still within their expected service life.

The four interchanges within the corridor (not including I-270's interchange with I-25) would be modernized through construction of new on- and off-ramps that would increase the acceleration and deceleration lengths, increase turning radius and superelevation (i.e., banking), and reduce the number of weave points between interstate traffic and local traffic accessing and entering I-270. Auxiliary lanes between the interchanges would further reduce weaving by separating interstate traffic from local traffic and providing more time for heavy trucks to accelerate to interstate speed before merging. The full cloverleaf interchange at I-270/Vasquez Boulevard would be replaced with a partial cloverleaf interchange design to improve safety and connectivity with the local roadway network.

The project would also improve multimodal travel and the local roadway network at York Street, 56th Avenue, and potentially Holly Street. Where it ties into the I-270 eastbound on-ramp, York Street would be widened to accommodate an expanded roadway template, including addition travel lanes and a multi-use trail, as identified in the Adams County York Street Phase III Project. Additionally, 56th Avenue would be improved via widening, curve flattening, and sidewalk extension. Holly Street may also be extended approximately 1,200 feet south of its current terminus at 56th Avenue to a new, partial I-270 interchange providing on- and off-ramp movements to westbound I-270.

To facilitate drainage of the widened interstate and protect the adjacent watercourses, the project would include permanent water-quality features such as sediment vaults, drop inlets, outfalls, and water-quality ponds. Intelligent transportation system infrastructure would be installed to provide driver information and equip the roadway to leverage current and future technology, such as variable message signs that provide drivers with accident and roadway condition information. The express lane operating option would also include tolling-related technology and signage that is not required for the general purpose lane operating option.



Archaeological Assessment, Interstate 270 Environmental Assessment and Conceptual Design, Adams and Denver Counties, Colorado

Sections 7, 16-18, and 21, T3S, R67W; Sections 1-3, and 12, T3S, R68W; Sections 34 and 35, T2S, R68W; 6th PM

USGS Commerce City, CO Quadrangle (1:24,000, 1978)

0 2,000 4,000 Feet

1:48,000

N

Figure 1
Area of Potential Effect

Prepared for: Jacobs Engineering Group Inc.
File: 10867 Figure 1.mxd (GS)
November 23, 2020

ERO Resources Corp.

4.0 Area of Potential Effect

The area of potential effect (APE) includes the I-270 transportation corridor project limits between I-25 and I-70 for a total of 419.5 acres. The legal locations are shown in Table 1.

Table 1. APE Legal Locations

Township, Range 6th Principal Meridian	Sections
2 South, 68 West	34, 35
3 South, 67 West	7, 16, 17, 18, 21, 22
3 South, 68 West	1, 2, 3, 12

5.0 Methodology

To assist with project planning, design, and consultation requirements under NEPA and Section 106 of the NHPA (36 Code of Federal Regulations Part 800), ERO reviewed previous cultural resource surveys, resource documentation, and archival maps of the APE to first develop a land use history. The purpose of the land use history (Sanocki, Hedlund, and Larmore 2020) was to identify within the study area

- previously documented archaeological resources
- known but undocumented archaeological resources
- undisturbed landforms with the potential for archaeological resources
- geomorphological contexts with potential for archaeological deposits and the potential depth at which archaeological deposits may be buried

In addition, the land use history helps provide methodological recommendations for identifying potential archaeological resources.

Sources consulted include a file request with the Office of Archaeology and Historic Preservation (OAHP), review of existing regional contexts, and review of previously conducted cultural resource surveys in the study area. Archival sources included a review of Sanborn Fire Insurance Maps, the 1940 U.S. Federal Census Enumeration District maps, aerial photographs, General Land Office (GLO) plats, and U.S. Geological Survey (USGS) topographic and geologic maps.

6.0 General Land Use History (AD 1860 to 1980s)

The study area has been subjected to recurring natural and human-caused events that have affected the appearance of the landscape and the condition of existing and potentially unknown archaeological resources. An example of a natural event is the 1965 flood that may have impacted terraces along Sand Creek. Human-caused events include 19th century settlement and agricultural development and mid- to late 20th century industrial and transportation development. During the 20th century, dramatic changes occurred to the landscape as a result of commercial and industrial development, including the conversion of private land for highway construction and the development of large-scale landfills, stormwater management infrastructure, and commercial gravel pit operations and reclamation.

Euro-American settlement and land development began with the GLO's issuance of military and homestead patents in the study area as early as the 1860s. Wagon roads along either side of the South Platte River and Clear Creek and that cross Sand Creek were established at the time of the GLO's original surveys of the area in the 1860s. Settlers claimed nearly all the land along the study area by the early 1900s (GLO 1862a, 1862b, 1865; USGS 1890, 1938). Exploration and immigrant trails include the Long

Expedition Trail (5AM126), the Platte River Trail (5AM130), and the Overland Trail and Stagecoach Route (5AM132), further described below in section 9.0 Assessment Results. Today, the alignment of U.S. Highway 85 and active railroads roughly parallel these trails. Homestead improvements included breaking land for cultivation, constructing buildings and structures for livestock, blading roads and driveways, and excavating irrigation ditches.

In 1870, the Denver Pacific Railroad Company and, in 1882, the Burlington & Missouri River Railroad Company completed railroad links to transcontinental lines north and east from Denver. Both railroads cross Sand Creek near the center of the study area and are currently in operation (Fraser and Strand 1997). The railroads overlap named exploratory/immigrant trails. Wagon roads are depicted in the study area by 1890 (USGS 1890, 1938, and 1965). However, it is unlikely that any associated cultural deposits associated with the early wagon roads or with late 19th century/early 20th century construction and operation of the railroads are extant due to industrial redevelopment of the area after 1965–1970 and construction of I-270.

Investors began to develop along transportation corridors within the study area between 1870 and 1900. Relevant to the study area and especially to Commerce City were smelters, warehouses, stockyards, and processing plants for ore, and production centers for produce, meat, and building materials. After 1930, oil refineries account for large areas of disturbance near the center of the study area around Brighton Boulevard. Industrial development stimulated the expansion of the Denver city limits to construct housing for those who worked in the commercial and industrial centers surrounding Commerce City (Mead & Hunt 2019).

After 1900, railroad companies and land investment companies such as the Denver-Laramie Realty Company began selling 5 to 80 acre tracts of land to increase cultivation east of the South Platte River and along Sand Creek within the study area. The town of Welby, located at the Clear Creek–South Platte River confluence, became an important hub for vegetable growers and stock raisers to access railroads and transport their produce to markets via Denver. These small-scale farmers included a variety of immigrant communities, most notably Italian, German, Scandinavian, and Japanese families (Mead & Hunt 2019). Aerial photographs from the 1960s and the 1940 census enumeration maps demonstrate that most land within the study area was used for grazing and agricultural cultivation throughout the first half of the 20th century with the exception of residential urban sprawl along Denver's north and east sides (Figure 2; Nationwide Environmental Title Research (NETR) 2020; U.S. Federal Census 1940). Maps and historical aerial imagery indicate that landowners cultivated nearly every possible acre of land on terraces of Sand Creek, Clear Creek, and the South Platte River. By the end of the 1930s, much of the land within the study area was subdivided into 5 to 160 acre plots; farmers used these plots for small-scale truck farming operations. State and federal governments collaborated during the 1930s to improve farm-to-market roads, including U.S. Highway 6, U.S. Highway 85, Brighton Boulevard (State Highway (SH) 265), and Colorado Boulevard (SH 2) through the study area to improve farm-to-market transportation (U.S. Federal Census 1940). These highways are still in use and have been expanded to handle increased traffic through the study area throughout the latter half of the 20th century. After 1900, farmers also collaborated to enlarge irrigation ditches and construct water storage projects to improve agricultural production.

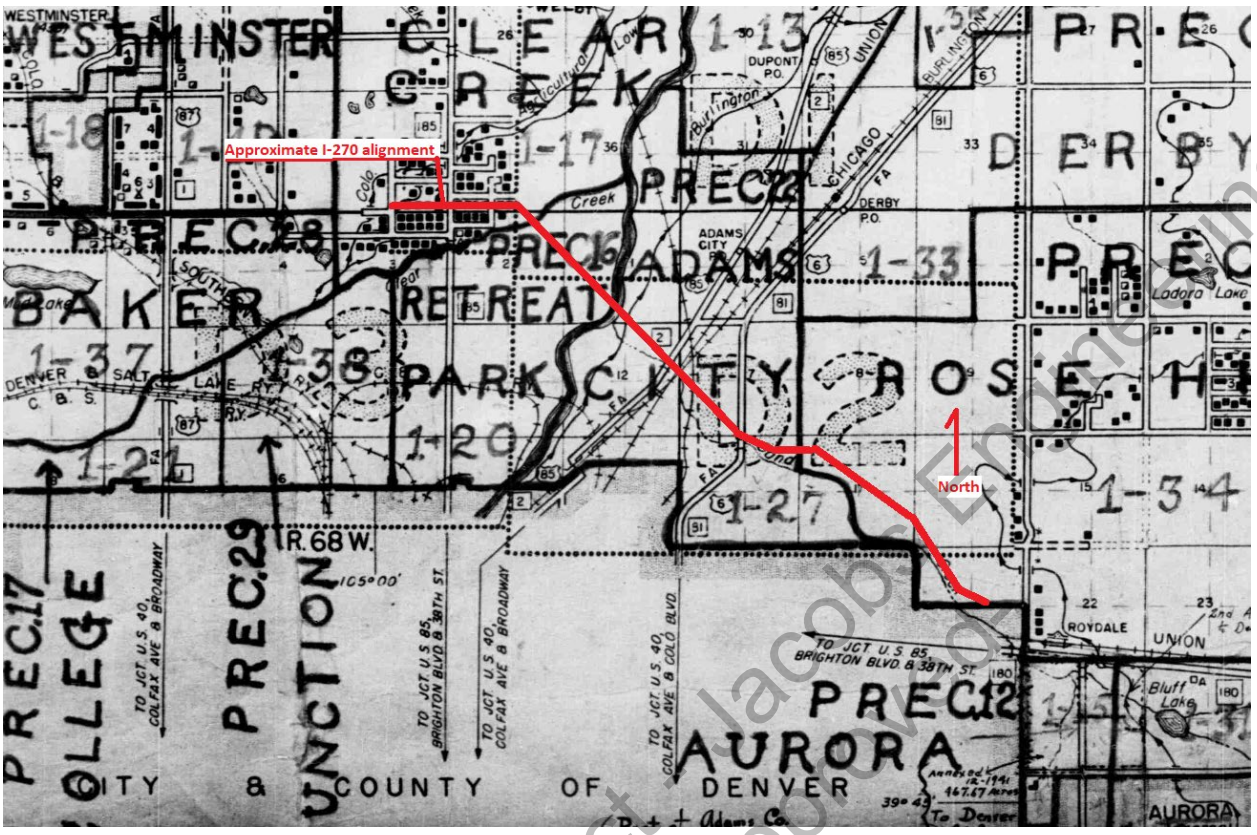


Figure 2. 1940 census map of study area (U.S. Federal Census 1940).

During World War II, redevelopment of lands traditionally used for agriculture in the east half of the study area included the Department of Defense's establishment of the Rocky Mountain Arsenal chemical weapons plant and expansion of the Stapleton Airport (originally constructed 1929–1930). However, the viewshed of the South Platte River and Sand Creek drainages did not change dramatically until after the end of World War II, when suburban growth resulted in the infill of industrial, commercial, and residential developments between the east side of Denver and Commerce City and the west side of the arsenal and airport. Census records indicate the number of homes and industrial processing facilities in the study area tripled between 1936 and 1971 as the result of trends in post–World War II population growth, suburban expansion, and transportation development (NETR 2020; U.S. Federal Census 1940; USGS 1890, 1938, and 1965). After World War II, Denver and Commerce City expanded their limits to encompass expanded industries such as oil refining, water treatment, and new suburban residential neighborhoods and commercial centers. U.S. Highway 6, U.S. Highway 85, SH 265, and SH 2 remained the primary transportation arteries for workers and residents in Commerce City and Adams County throughout the 1940s, 1950s, and 1960s.

As the result of the Eisenhower administration's efforts to improve interstate highway connections, state and federal governments began to redevelop neighborhoods and farmland on both ends of the study area with construction of I-25 and I-70. New interstate construction, especially I-25, resulted in the division of farmlands and preexisting neighborhoods and demolition of houses, warehouses, and processing facilities on the west end of the study area during the 1950s. Along Sand Creek, in the east half of the study area, most land was used for cultivation and feedlots during the 1950s, prior to the 1965–1970 construction of I-270. Aerial photographs and topographic maps indicate little new construction in the east half of the study area between 1950 and 1970 (NETR 2020; USGS 1938, 1965).

During construction of I-270 (1965 to 1970), state and commercial interests developed gravel pits along Sand Creek and the South Platte River. Aggregate extraction within the study area was conducted to support construction of I-270 and other nearby highways and resulted in rechannelization of Sand Creek along nearly half of the study area. The lower terraces were also mechanically regraded for construction of batching plants and equipment staging areas. The extent of land disturbed from gravel pit operations are overlapped by the I-270 road complex and commercial industrial complexes constructed after 1980. Prior to gravel pit reclamation, many of the open pits were also used as sanitary landfills by local industrial operations and domestic property owners throughout the late 1960s, 1970s, and 1980s. To facilitate construction of I-270 and new industrial complexes, the state capped or reclaimed many of the gravel pits turned sanitary landfills during the 1980s and 1990s (Marin 2019).

Construction of I-270 also caused the abandonment or demolition of rural domestic and agricultural properties (Table 3) and development of pastures and cultivated fields for residential and commercial use. Completion of I-270 in 1970 signified the end of agricultural practices in the study area and ushered in increased industrial and suburban housing development, resulting in the infilling of nearly all undeveloped land along the I-270 corridor. In addition to new residential and industrial developments, the city of Denver expanded its raw and wastewater treatment facilities, resulting in construction of a water treatment facility near the South Platte River–Sand Creek confluence and construction of new water infrastructure during the late 1960s and early 1970s (Mead & Hunt 2019). Areas not developed for industrial or residential uses are predominantly areas used for gravel extraction and sanitary landfills and are not suitable for redevelopment.

7.0 File and Literature Review

ERO reviewed OAHP records to identify previously conducted surveys and previously documented archaeological sites in the study area. Previously conducted intensive archaeological surveys are listed in Table 2. All previous surveys are related to undertakings overseen by the U.S. Army Corps of Engineers or CDOT.

Table 1. Previous Archaeological Inventories Overlapping the Study Area

State Project No.	Report Title (Date)	Institution/Agency
AM.AE.R9	*Cultural Resource Survey of the Cherokee Diversion Project, Commerce City, Adams County, Colorado* (2010)	Engineering-Environmental Management, Inc. for the Army Corps of Engineers
AM.CH.R40	*Inventory and Evaluation of Historic Resources State Highway 270 Extension (IM 2706-030)* (1999)	Pinyon Environmental Engineering Resources for CDOT
AM.CH.R43	*Project I-76-1 (68) US 36-I 270 Connection* (1983)	CDOT
AM.CH.R44	*Project M 7731(1), Washington Street, SH 224, North to 83rd Avenue, Cultural Resources Report for Historical Resources* (1980)	CDOT
MC.CH.NR33	*Cultural Resource Investigations for the Adesta/CDOT Fiber Optic Project I-25 Metro Segment, Adams and Denver Counties, Colorado* (2000)	SWCA Environmental Consultants for CDOT
MC.CH.NR63	*Archaeological Survey of IR 025-2(198), Denver and Adams Counties* (1987)	CDOT
DV.CH.NR13	*Quebec Street Improvements Environmental Review: Results of Cultural Resource Investigations* (2003)	URS Corporation for CDOT
MC.CH.NR61	*Archaeological Survey of Highway Project I-70-4(72) Denver & Adams County, Quebec St to I-270* (1986)	CDOT
MC.CH.R187	*I-70 East Cultural Resources Survey Report* (2007)	CDOT

The previous surveys did not identify archaeological sites in the study area for the current project. A cursory review of the previously documented architectural resources in the study area identified five historical properties demolished after 1990: 5AM74, 5AM75, 5AM76, 5AM1286, and 5AM3244 (Table 3). The Yantorno Farm/Center Greenhouse (5AM3244) was designated as a Centennial Farm and determined needs data for National Register of Historic Places (NRHP) eligibility in 2014, and the remaining resources were evaluated as not eligible for listing in the NRHP during the 1980s and 1990s. Aerial photographs taken of the study area in 2019 demonstrate that buildings at 5AM74, 5AM75, 5AM76, and 5AM1286 were demolished, and the properties were redeveloped during the 1990s or early 2000s (Google Earth 2019). Any associated features, foundations/basements, or archaeological deposits have been obliterated by terraforming for highway construction and commercial/industrial development. The 2019 aerial photographs demonstrate that most of the outbuildings historically located at the Yantorno Farm/Center Greenhouse (5AM3244, 1550 East 73rd Avenue, Denver) have been demolished and much of the property has been paved over; however, a portion of the southwest corner of the property appears undisturbed and has potential for surface and subsurface cultural deposits. However, this area is currently outside of the project limits and was not assessed.

OAHP records also identified early expedition, migrant, and wagon/stage trails crossing the study area near the confluence of the South Platte River and Sand Creek: Long Expedition Trail (5AM126), Platte River Trail (5AM130), and Overland Trail and Stagecoach Route (5AM132). These trails in the APE have been obliterated by modern transportation and industrial development (Google Earth 2019).

In addition to the general regional contexts, ERO reviewed one resource-specific context, *Historic Context – Denver's Brick Sewers, Denver, Colorado* (Keeley 2012) to determine potential for abandoned historic utilities in the study area. This context and the *Selective Historic Resources Inventory Report* (Mead & Hunt 2019) for this project demonstrate that there are no historically significant or abandoned buried water utilities in the study area. Other resource-specific contexts relevant to the study area are specific to architectural resources and historical structures still extant but not part of this assessment.

ERO reviewed the 1940 U.S. Federal Census Enumeration District maps, aerial photographs from the 1960s through 2000, GLO plats, and USGS maps. The purpose of this review was to identify undisturbed/undeveloped areas with potential for archaeological deposits, including precontact archaeology and historical foundations/basements, trash dumps, and any buried remains of abandoned/demolished historical structures.

ERO reviewed Sanborn Fire Insurance maps rendered from 1887 to 1930 from the Denver Public Library, University of Colorado Boulder, and Library of Congress online collections. D. A. Sanborn's company originally produced these maps for fire insurance underwriters and to depict roads, some water utilities, property boundaries, and the size, shape, and construction materials of buildings. However, Sanborn maps rendered for Denver do not overlap the study area, and no Sanborn Fire Insurance maps have ever been rendered for Commerce City or other population centers in Adams County besides the congested areas of the city of Brighton, outside the study area. Therefore, ERO reviewed the 1940 U.S. Federal Census (U.S. Federal Census 1940) and USGS topographic maps from 1890 to 1981 to identify the location of historic roads, structures, utilities, and buildings in the study area (USGS 1890, 1938, 1965, 1981). Aerial photographs from the 1960s through the 2000s also provided information about land use and development of the area in the latter half of the 20th century (NETR 2020).

The archival review also identified land in the study area that has potential for historic period archaeological deposits, including the remains of foundations and sanitary landfills (Table 3 and Appendix A). These areas include demolished architectural resources and early transportation networks identified in the OAHP file review: 5AM74, 5AM75, 5AM76, 5AM126, 5AM130, 5AM132, 5AM1286, 5AM3244 and demolished buildings constructed more than 50 years ago that have never been

evaluated. These sites are all located outside of the project limits and APE. Historic period resources not previously documented that are in areas that have been significantly disturbed and have no potential for archaeological materials are not included in Table 3 and Appendix A. These sites were determined to be totally obliterated, based on mechanical scars, push piles, or landforms visible on modern aerial photographs with evidence for the filling or inversion of landforms for transportation, gravel extraction, and stormwater management projects (NETR 2020). Additionally, records reviewed in the preliminary Environmental Assessment in 2019 demonstrate that gravel pits and sanitary landfills in the study area are associated with mid- to late 20th century industrial uses of the area and have been reclaimed or capped (Marin 2019). Historical landfills were not documented per CDOT direction.

Table 2. Potential Historic Period Archaeological Sites Within the APE

Resource Name/Type	Smithsonian Site No.	Assessment Recommendation
Demolished dwelling/ commercial business	5AM74	Site is located under modern commercial building; no potential for archaeological deposits (Google Earth 2019).
Demolished agricultural property	5AM75	Site is located under modern commercial building; no potential for archaeological deposits (Google Earth 2019).
Demolished schoolhouse	5AM76	Site is located under modern commercial building; no potential for archaeological deposits (Google Earth 2019).
Long Expedition Trail	5AM126	Trail corridor is located under active railroad in heavily disturbed industrial area; no potential for archaeological deposits.
Platte River Trail	5AM130	Trail corridor is located under active railroad in heavily disturbed industrial area; no potential for archaeological deposits.
Overland Trail and Stagecoach Route	5AM132	Trail corridor is located under active railroad in heavily disturbed industrial area; no potential for archaeological deposits.
Demolished dwelling	5AM1286	Building site was converted into a pond for stormwater/water quality uses; no potential for archaeological deposits (Google Earth 2019).
Yantorno Farm/Center Greenhouse	5AM3244	Greenhouses and outbuildings have been demolished, and much of the property has been paved in asphalt; a portion of the southwest corner of the property may be undisturbed, however, but it is outside project limits/APE.
Demolished building	DB1	Two buildings appear on 1964 and 1971 aerial photographs; the buildings were demolished after 2015 (NETR 2020). No potential for archaeological deposits.
Gravel pit	GP1	Aerial photographs indicate the gravel pit was excavated between 1971 and 1991; the pit was reclaimed after 2005 (NETR 2020). No potential for archaeological deposits
Gravel pit/landfill	LF1	Aerial photographs indicate the gravel pit was excavated after 1971 and used for storage and/or waste disposal during the 1990s; the pit was reclaimed after 2005 (NETR 2020). No potential for archaeological deposits
Historic period rural properties demolished and extant	DB2	Extant historic period residence (constructed 1955) and foundation remains of two demolished historic period residences (Adams County Tax Assessor 2020) with potential for historical artifacts, ruins of historical buildings/structures, and trash deposits. The remains are outside of project limits/APE.

8.0 Geomorphology

The land use study identified six areas that appear to be relatively undisturbed or disturbed only by agricultural cultivation (Appendix A). ERO assessed the geomorphology of these areas by conducting exploratory testing to assess their potential to contain precontact archaeological sites buried in Holocene-age sediments. The following geomorphology review provides a synthesis of existing literature and ERO's ongoing research into terminal Pleistocene/Holocene–age sediments within the Denver Basin and Palmer Divide. The Denver Basin has not been subject to geomorphological studies: The data provided here is primarily derived from drainages emanating from the northern escarpment of the Palmer Divide.

Several Pleistocene- and Holocene-age deposits within the study area are relevant to the preservation of archaeological sites. The sequence of deposits used in this section was developed by Scott (1963), based on his original work and the previous work of Hunt (1954). The primary deposits are alluvia of low-order streams in chronological order: Broadway alluvium, pre–Piney Creek alluvium, Piney Creek alluvium, and post–Piney Creek alluvium. Several other non-fluvial deposits such as eolian sand and loess and colluvium of various ages are not spatially widespread or do not cover significant areas; many of these deposits do not meet the thickness or age criteria to have been recognized on geological maps of the area, but nevertheless they are important archaeologically. Often, smaller areas of Holocene sediments not identified on geological maps can be discerned on soil maps.

Recent geochronological work has exposed some of the difficulties in correlating alluvial units across different watersheds or drainages. The Palmer Divide has been carved by spring-fed permanent drainages such as Cherry Creek, Kettle Creek, and Jimmy Camp Creek; however, other permanent drainages such as Plum Creek and Monument Creek head in Rampart Range, to the west. Plum and Monument Creeks are also spring fed but have different hydrological cycles from the drainages that head on the Palmer Divide because the former are also affected by seasonal snowmelt. Drainages that head in the Palmer Divide are primarily characterized as flashy, intermittent, or low-flow perennial drainages, while snowpack-regulated drainages may maintain a more regular hydrological cycle. The alluvial units deposited in the various drainages with different hydrological cycles may therefore be incompatible (Hedlund 2019; Hedlund and Mayo 2019). Regardless, the alluvia defined by Scott (1963) and Varnes and Scott (1967) are used in this project to identify landforms, but the associated age ranges and correlates identified below may be revised in the future (Hedlund 2019).

8.1 Broadway Alluvium

The Broadway terrace, originally defined by Hunt (1954:104), stands 40 feet or more above the South Platte River and is described as gravel and sand derived from glacial outwash from the Front Range. The Broadway alluvium composing the upper unit of the Broadway terraces was first defined by Scott (1960). Scott describes the alluvium in the Kassler quadrangle as exhibiting a moderately strong developed Brown soil (or what would today be known as a mollisol) of fine- to coarse-grained sand with pebbles (Scott 1963:38). Beds range from coarse to fine, and the thickness is estimated at about 25 feet.

In the Castle Rock North quadrangle, Thorson (2005) suggests the T3 terrace may be associated with the Broadway alluvium of Maberry and Lindvall (1972) and describes it as a "pale-brown to light grayish-brown, extremely poorly sorted sand, gravel, and cobbly or boulder gravel that underlies terrace remnants" (Thorson 2005:7). The latter part of the description departs from most of the other geologists' descriptions, and Thorson may be combining the Louviers and Broadway alluvium (discussed below). Maberry and Lindvall (1972) mapped Broadway alluvium south of Happy Canyon Creek as well as broader terraces on the western flank of Cherry Creek. Maberry and Lindvall describe the alluvium as a "dark-yellowish brown to light brown fine to coarse pebbly sand" and note that the terrace may stand as low as 10 feet above principal streams.

Geologists have long recognized an unconformity at the base of the Broadway alluvium. Hunt attributes the cobbly basal unit to an older "pre-Wisconsin age" alluvium (Hunt 1954:104) while others suggest it should be associated with the late-Wisconsin Louviers alluvium (Scott 1960:1542, 1963:18), and Maberry and Lindvall (1972) map the Louviers alluvium below the Broadway, Piney, and post–Piney Creek terraces across the Cherry Creek valley. Soil development is dependent on lithology (Birkeland 1999:143), but different localities have been described as exhibiting A-Bt-Bk-C/Ck horizons, and some B horizons have been gleyed (Holliday 1987:322; Madole 1991:459; Zier et al. 1993). Multiple buried A horizons have also been identified (Madole 1991:459).

Downstream of Denver on the South Platte River, the Broadway terrace is correlated with the Kersey terrace (Scott 1963:32). The Kersey terrace primarily consists of bedded sand and gravel, but different localities contain greater deposits of clay and silt (Holliday 1987). This variation is the result of proximity to parent material and stream channel behavior (e.g., braided or meandering channels; Holliday 1987:322).

Associated age ranges for Broadway alluvium are diverse. Hunt associates Broadway alluvium with the late-Wisconsin, based on the presence of fossils of extinct mammals (1954:106). Hunt also suggests that Broadway alluvium may contain Folsom Paleoindian deposits. Scott agrees with the late-Wisconsin ages argued by Hunt and supports this assessment because Broadway alluvium is bracketed between the Louviers and pre–Piney Creek alluvium. Thorson assigns a late middle Pleistocene age for Broadway alluvium (2005:7) but provides no evidence for his designation, which is earlier than cited in all other documentation. Maberry and Lindvall assign the alluvium a late Pleistocene age (1972), and there is general consensus that the alluvium is associated with the Pinedale glaciation. The most recent age assessment for the alluvium ranges from 30,000 to 12,000 BP (Lindsey et al. 2005:3–4).

Evidence from archaeological sites provides finer-resolution chronological information. Holliday concludes that the Kersey terrace downstream of the study area ceased aggregation during the Clovis Paleoindian period (about 11,000 BP) because of diagnostic Clovis artifacts (Klein site) recovered from soils on the surface of the terrace (Holliday 1987:322; Zier et al. 1993). Archaeological sites on—but not in—the Kersey terrace have yielded radiocarbon dates from soil organic matter of 9600±130 BP at the Frazier site and 9070±90 BP at the Jurgens site (Holliday 1987:323–324). While these dates are not associated with the Broadway alluvium, they do provide relative dates for when the surface of the terrace became available for occupation.

The bottom of a Broadway deposit on Big Dry Creek, north of Denver, yielded a radiocarbon date of more than 38,440 BP (Machette 1977, cited in Madole 1991:461). However, this date predates the Pinedale glaciation, and Madole suggests there may have been an undocumented unconformity "not well expressed stratigraphically" (1991:461). Szabo (1980:98) provides three additional dates associated with the Lindenmeier and Dent sites; however, the dates are incorrectly associated with the Broadway alluvium (Holliday 1987:324, 327).

More recently, optically stimulated luminescence (OSL) dating of sediments above and below a mammoth molar discovered during construction excavation provides a later date range, likely closer to the abandonment of the Broadway terrace surface. The referenced document (Young 2006) is not from a published or peer-reviewed journal. The molar was discovered in 2004 during construction excavation in an area mapped as Broadway alluvium near Littleton, Colorado (Young 2006). The molar was recovered from about 1.25 m below ground surface (bgs) from sediment composed primarily of sand (44 percent) and silt (40 percent) with very few gravels (2 percent). The author suggests that the tooth was likely transported along with the surrounding sediment, although the fine-textured sediment suggests otherwise. OSL samples were taken by USGS scientist Shannon Mahan from strata above and below the location of the tooth following the tooth's excavation (Shannon Mahan, personal communication 2018). The two OSL dates were processed by Ms. Mahan at the USGS laboratory. The

upper sample yielded a date of 19,605±1150, and the lower sample yielded a date of 18,015±2210. An average of the two overlapping ranges provides an approximate 18,000 BP date.

The dates fit into the generally accepted age range for Broadway alluvium (Lindsey et al. 2005:3–4); however, the depth (1.25 m bgs), if accurate, would suggest very gradual aggradation over roughly 6,000 years. More likely, surface sediments were removed during construction grading of the development (Aaron Young, personal communication 2018), obliterating any evidence of soil formation. Without the context of the upper sediment, the dates do not provide relative evidence for the abandonment of the Broadway terrace, but at a minimum they do not challenge the accepted range for the alluvium.

8.2 Pre-Piney Creek Alluvium

The pre–Piney Creek alluvium was defined by Scott (1963) and described as a well-stratified light brown, moderate-brown, or moderate yellowish-brown silt and sand with thin lenses of pebbles. The soil developed within the pre–Piney Creek alluvium is described as a "strongly developed Brown soil" (i.e., a mollisol) of early Holocene age that exhibits a well-developed carbonate horizon, with calcium carbonate cementing grains and filling rootlet holes, especially in the silt layers, to a depth of 9 m (30 feet). The thickness of the pre–Piney Creek alluvium may exceed 12 m (40 feet) (Scott 1963:39), and charcoal recovered from this deposit in two different locations provided ages of 5780±160 (2 sigma calibrated (cal.) age range of 6980 to 6280 BP) and 5450±160 (2 sigma cal. age range of 6630 to 5910 BP) (Scott 1963:40; Reimer et al. 2013). A date from a charcoal-enriched stratum close to the base of the alluvium under the T1 terrace of Newlin Gulch at site 5DA1957 (Gantt 2007) indicates that deposition of fine-textured alluvium had begun by 6420±160 (2 sigma cal. age range of 7420 to 7270 BP) and had ceased by 4200 BP. The surface of this alluvium was stable for a sufficient period for the formation of a well-developed soil prior to being buried by alluvium dated <4200 to 3880 BP (Gantt 2007:46). This second episode of alluvial deposition correlates with the initiation of the Piney Creek alluvium. South of the Palmer Divide along Fountain Creek at 5EP211, another strong paleosol formed in alluvium mantling the Broadway terrace returned a radiocarbon age of 6770 BP (McFaul 2004).

The distribution of the pre–Piney Creek alluvium is somewhat limited, with most exposures observed south of the Denver area in channels cut in the Pleistocene-age Louviers alluvium, while further west the alluvium is found under the first terrace above Indian Creek and Rainbow Creek, and in Willow Creek it was observed under the Piney Creek alluvium (Scott 1963:40). In streams that head in the mountains, the pre–Piney Creek alluvium had begun accumulating by this time, and in some valleys it was deposited on older alluvium on higher Pleistocene terraces while in other valleys it is found under terraces below the Broadway terrace, indicating an episode of incision and subsequent fill during the early Holocene. In lower-order intermittent streams that head on the plains (such as Newlin Gulch and its tributaries), this alluvium often underlies the Piney Creek alluvium.

8.3 Early Holocene Eolian Sand

Early Holocene–age eolian sand occurs as blankets of mostly medium-grained, well-rounded particles. In general, deposits are less than 3 m thick, but locally deposits can exceed 12 m thick (Trimble and Machette 1979). The presence of Folsom material in dune sediments at the Powers site in the Kersey area, east of Greeley, indicates that eolian deposition had begun by the beginning of the Holocene (Holliday 1987). Soils developed in deposits of eolian sand in Douglas County are mapped as primarily Bresser-Truckton sandy loam with an A-Bt-C profile or Renohill and Buick series with an A-Btk-Bk-C profile.

8.4 Piney Creek Alluvium

The Piney Creek alluvium (Hunt 1954; Scott 1963) is found under the second terrace above most streams, although in some drainages there are two terraces in the post–Piney Creek alluvium, so caution must be taken when assigning terrace age based on the number of terraces observed. Piney Creek

alluvium is described as brownish-gray humic silt, sand, and clay, which forms a flat-topped fill in almost every valley in the area. This alluvium ranges from 1 to 7.5 m thick. The lithology of the Piney Creek alluvium varies, but the diagnostic features are dark gray color, abundance of humus, silty texture, and steep walls in arroyos (Scott 1963). Scott (1963) assigned a late Holocene age to the soil developed on the Piney Creek alluvium. This soil has a characteristic A-Bt-Ck profile below an altitude of 1,830 m, above which this soil is typically azonal. Van Horn (1976) reports that the Piney Creek alluvium in the Golden area has a weakly developed azonal soil, and Holliday (1987) reports a weakly developed azonal soil for the Kuner alluvium west of Greeley. Although terraces of Kuner alluvium cannot be directly traced to the Piney Creek terrace, they are similar, and Hunt (1954) correlates the two alluvia. The strongest soil developed on the Kuner alluvium is similar to the strongest soil developed on the Piney Creek, and these data, as well as the relative position of the Piney Creek and Kuner terraces with respect to the Broadway terrace, indicate these two surfaces likely are related (Holliday 1987).

Piney Creek alluvium is classified as loamy or sandy alluvial land (Larson 1974) with a characteristic A-Ck profile. This soil likely can be classified as an Ustochrept, although except for the presence of Stage I calcium carbonate development, apparent horizonation may be due entirely to parent material layering (Soil Conservation Service 1977). In many reaches of Cherry Creek and its tributaries, a relatively thick (30 to 40 cm) cumulic A horizon is observed at the top of the Piney Creek alluvium, buried by 30 to 40 cm of fine-textured overbank deposits. Cumulic A horizons represent periods of stability or rates of deposition slow enough to allow for the accumulation of organic material (Daniels 2003). The Piney Creek alluvium beneath the buried cumulic A horizon contains one or more relatively thin buried A horizons. In the absence of other pedogenic features, relatively thin buried A horizons indicate a moderate rate of sediment deposition, characterized by episodes of surface stability of varying lengths (Daniels 2003), with stable periods likely representing wetter conditions between episodes of deposition, which represents drier conditions.

Dating the Piney Creek alluvium has relied almost exclusively on radiocarbon ages from archaeological sites buried in the alluvium of low-order intermittent tributaries, and no published dates are available for the alluvium of Cherry Creek. Hunt (1954) identified a site "representing the Woodland Culture" on the surface of the type section of the Piney Creek alluvium, and a date of 1150±150 BP was returned from a hearth 45 cm bgs. However, Hunt (1954) questioned the accuracy of this assay and suggested that the termination of alluvial deposition occurred prior to AD 800. During investigations at the Parker Jordan Centennial Open Space, Gilmore and Gibson (2010) hypothesized that the top 35 cm of fine-textured alluvium deposited on the surface of the Piney Creek terrace above a relatively thick buried A horizon represented overbank deposits of post–Piney Creek alluvium age, possibly deposited after initial incision of the Piney Creek terrace had begun. Scott (1963) correlated the Piney Creek alluvium to the lower member of the Gold Basin formation in the La Sal Mountains in Utah, which has an associated age of 2800 BP. Buckles (1980) revised the range of this alluvium to 3500 to 1850 BP in southeast Colorado, and these dates are reflected in other dated alluvia in the Denver area. At Dutch Creek (Gilmore 1989; Jepson and Hand 1994), a lower alluvium dating between 4200 and 1980 BP overlain by an alluvium deposited after 1430 BP may represent the Piney Creek and post–Piney Creek alluvia separated by a depositional hiatus or period of erosion. At site 5AH741 in Arapahoe County, the dates from features contained within the Piney Creek alluvium in an ephemeral tributary of Piney Creek range from 4300 to 1740 BP (Graham 1998).

In contrast to these dates, radiocarbon ages from buried components at the Senac site (5AH380) in southern Arapahoe County date the upper alluvium under the second terrace above intermittent Senac Creek from 1700 to 1000 BP. This terrace was identified as Piney Creek alluvium (Albanese 1988). In northeastern Colorado, Madole and Rubin (1984) assigned the Piney Creek alluvium an Altithermal age of 7500 to 5500 BP, based on dates from the post–Piney Creek alluvium from the northern Colorado Piedmont. McFaul et al. (1994) dated the abandonment of the Kuner terrace (correlated by many

investigators to the Piney Creek alluvium) by a downcutting South Platte River after 6380 BP and prior to 1900 BP.

8.5 Post–Piney Creek Alluvium

The post–Piney Creek alluvium ranges among coarse sand and gravel to cobble-sized clasts representing channel deposits to fine-textured material similar to descriptions of the Piney Creek alluvium. In the larger perennial streams such as Plum Creek and Cherry Creek, the alluvium under the first terrace is often coarse, and it is unlikely that these deposits could contain intact buried cultural components due to the relatively high-energy depositional environment they represent, although the valleys of higher-order streams in the region contain fine-textured deposits of post–Piney Creek alluvium containing intact stratified cultural components dating to the Late Prehistoric period (1850 to 150 BP). Along reaches of Cherry Creek, a 30 to 40 cm thick deposit of silty alluvium superimposed on the Piney Creek terrace is correlated with the post–Piney Creek alluvium and contains Early Ceramic period cultural material (Gilmore 2011).

The post–Piney Creek alluvium was described by Scott (1963) as correlating with the Protohistoric and Historic alluvium of Hunt (1954) and the post–Piney Creek alluvium of Malde (1955). Dates for the post–Piney Creek alluvium are provided by archaeological sites with buried Early Ceramic components, and Scott (1963) describes a section of post–Piney Creek alluvium with an archaeological site containing pottery and an associated radiocarbon age of 1490±160 BP. This date correlates well with the upper alluvium at Dutch Creek, which was deposited after 1430 BP. Charcoal samples from cultural occupations in the post–Piney Creek alluvium returned ages of 1050±200 BP from 22 to 35 cm bgs and 2140±145 BP from 50 to 90 cm bgs of a 1.8 m high terrace adjacent to Van Bibber Creek in the Golden area (Nelson 1969). These ages are in agreement with those recovered from the upper unit of silty sand within the post–Piney Creek alluvium by Madole and Rubin (1984), who also determined that a lower sand and gravel unit of the post–Piney Creek was deposited between 5000 and 1960 BP in the northern Colorado Piedmont. McFaul et al. (1994) date the initiation of deposition of the Harden alluvium (correlated by many investigators to the post–Piney Creek alluvium) by the South Platte River after 1900 BP and ending by 200 to 150 BP.

8.6 Late Holocene Eolian Sand and Loess

Thin, laterally discontinuous, and unmappable deposits of eolian sand and loess deposits are also common in Douglas County, with more recent deposits of eolian sand most common east of Plum Creek and Cherry Creek and south of the South Platte River (Trimble and Machette 1979). These deposits are relevant to the discussion of the preservation of archaeological materials dating to the Late Prehistoric period. Archaeological sites located in upland areas would be much more likely to be buried and preserved (but possibly much more difficult to find because of burial) during periods of increased eolian activity. The same conditions of aridity that would result in increased eolian activity could also contribute to the sort of surface instability that would lead to increased movement of colluvium, which could also result in the increased likelihood of burial and preservation of upland archaeological sites. Scott (1963) documents thin deposits of late Holocene eolian sand and loess that rest unconformably on bedrock or early Pleistocene alluvium in upland situations that contain buried archaeological sites. A date from the Rainbow Creek site (5DA124) indicates that deposition of the eolian sand commenced prior to 1370±200 BP (Larmore and Gilmore 2003; Scott 1963), and at the Jarre Creek site (5DA541), the pooled mean of two radiocarbon dates from the same occupation indicated that deposition of the loess commenced prior to 1085±42 BP (Gilmore 2004). At the Bayou Gulch site (5DA265), three episodes of eolian deposition were documented: >5000 BP, >3450 to ca. 1660 BP, and ca. 1000 to 640 BP (Gilmore 1991). Upland deposits of eolian sand and loess resting on the wide, flat interfluves between drainages eroded into the Castle Rock Conglomerate, such as those observed at Prairie Canyon Ranch, likely correlate to this late Holocene episode of eolian deposition. These relatively thin deposits have a wide

distribution through Douglas County and are likely associated with previously identified century-scale episodes of aridity at a regional or continental spatial scale that may have contributed to the burial and preservation of upland Late Prehistoric period sites in Douglas County. Regional episodes of aridity identified as the Early Ceramic Drought by Gilmore (2008) and as the Medieval Climate Anomaly (a climate episode of increased aridity and increased climate variability recognized throughout the northern hemisphere; Bradley 2000; Broecker 2001; Cook et al. 2004; Mann and Jones 2003) have likely contributed to the burial and preservation of upland sites dating to the Late Prehistoric period in the study area. An extended period of drought during the early Holocene is associated with extensive eolian deposits on the plains, as are several shorter periods of drought during the Middle and Late Archaic periods that are not as well expressed in the geological record of Colorado. Evidence for widespread and significant increases in eolian activity are associated with two periods of aridity dated to the Late Prehistoric period, the Early Ceramic drought (1550 to 1350 BP) and the Medieval Climate Anomaly (950 to 550 BP; Gilmore 2012).

9.0 Assessment Results

The land use study identified six areas of undisturbed or minimally disturbed land outside the existing I-270 right-of-way but within project limits (Appendix A; Google Earth 2019; NETR 2020). These areas are in fact disturbed, however, based on mechanical scars visible on historical aerial photographs and confirmed through field assessment (Google Earth 2019; NETR 2020). Most of these areas are heavily disturbed from gravel pit extraction, I-270 and I-76 construction, sewer/water and electric utility construction, and stormwater management infrastructure, including roadside ditches and water retention/detention ponds. The location of potential historical buildings and structures are depicted on the Appendix A figures but have no potential for intact archaeological deposits, based on field verification. However, the following areas were subject to exploratory testing (Figure 3–Figure 7, below).

9.1 Area 1 and Area 2

Areas 1 and 2 are mapped as Piney Creek alluvium and are part of what was a broad Holocene-age terrace (Lindvall 1980). The lots were cultivated in the past, but exploratory shovel testing is needed to determine the depth of the potential plowzone and whether intact buried cultural resources are present below. Field assessment determined that these areas have been disturbed by I-270 development.

9.2 Area 3

Area 3 is located along Clear Creek below I-270. Portions of the area may be intact but are mapped as Louviers alluvium (Qlo) and active channel (Lindvall 1980) and, therefore, are unlikely to contain any potential for intact buried cultural deposits. Field assessment determined that this area has been disturbed by I-270 development.

9.3 Area 4

Area 4 is a broad terrace north of the South Platte River and Sand Creek confluence. The terrace is located on Metro Wastewater Reclamation Property (MWRP) and mapped as Post–Piney Creek alluvium (Qpp). Prior to I-270 and MWRP development, the terrace was cultivated and the outlines of the former agricultural fields are still visible in modern aerial imagery (NETR 2020). The landform is likely to have been inundated by a large flood in 1965, but it is unclear whether the flood created the deposit or merely added sediments (Matthai 1969:Plate 4). ERO tested the landform to determine whether sediments that predate the 1965 flood are intact below recent flood deposits.

ERO excavated 12 shovel tests (ST1 through ST10, ST21, and ST22). ST1 through ST10 begin at the northern MWRP property boundary and end where a series of buried utilities crosses the property northeast to the southwest (Figure 3). The STs follow the eastern margin of a berm that may be associated with past agricultural use. ERO also excavated ST21 and ST22 on a nearby MWRP parcel to

the northwest. (Permission to access the private parcels between the two MWRP parcels was not granted.) Auger probes were attempted in ST1, ST3, ST4, ST5, ST8, ST10, and ST21, and most did not reach 1.4 m bgs due to sand and gravels that could not be removed from the auger bucket.

Figure 3. Overview of ST locations west of the South Platte River. I-270 at photo left and the vegetation in the background mark the location of the South Platte River.

9.3.1 Results

Only one ST yielded buried cultural material. ST2 yielded a copper tag and a fragment of sun-altered amethyst glass from between 10 and 40 cm bgs. ST4 and ST5 were excavated 10 m away on either side and were negative for cultural material, indicating the cultural material is limited to the location and immediate vicinity of ST2. Both artifacts were recovered from a plowzone and are therefore not in primary context and are not considered an isolated find.

The STs exposed a consistent plowzone about 30 to 50 cm thick across the terrace surface. The plowzone likely rearranged an A horizon that formed across the terrace surface and that thickened from east to west. The horizon consists of a gray brown sandy loam that becomes more fine textured with distance from the South Platte River. Sediments below the A horizon are alternating bands of sand, gravel, silt, clay, gravel, and cobbles. None of the lower sediments exhibit soil development, but redoximorphic features are present beginning around 80 cm bgs. All of the STs and auger probes terminated in coarse, poorly sorted gravels and sand.

The ST results indicate that the effects of the 1965 flood are not detectable on the tested portion of the terrace. The upper sediments do not exhibit course gravels expected from scouring (Waters 1992:149), and the addition of fine-textured low-energy deposits on the flood margins would have been tilled into existing sediments after plowing resumed post flood (NETR 2020). The ST results do indicate the presence of intact sediments that have not been disturbed historically. Exposed sediments are typical of migrating channel deposits that become coarser in proximity to the South Platte River.

No buried A horizons are present in the testing area, but intact buried A horizons below the plowzone may be present elsewhere in the terrace outside the APE.

9.4 Area 5

This area includes the north and south banks of Sand Creek. The landform is mapped as primarily Post–Piney Creek alluvium (Qpp; Lindvall 1980). This area was likely heavily affected by the 1965 flood and, given its narrow corridor, is unlikely to contain sediments other than post-1965 flood deposits (Matthai 1969:Plate 4); however, ERO recommends limited exploratory testing to confirm this. Field assessment determined that this area has been disturbed by I-270 development.

9.5 Area 6

This area is mapped as Piney Creek alluvium (Qp) and appears to have been unaffected by the 1965 flood (Lindvall 1980; Matthai 1969:Plate 4). Based on historical aerial imagery, the land was cultivated as recently as 1964 (NETR 2020). ERO tested the landform to determine the depth of the potential plowzone and whether intact buried cultural resources are present.

ERO excavated 10 STs (ST11 through ST20) on the northeast side of I-270 and southeast of the Oneida Street and East 52nd Place intersection (Figure 4). Auger probes were placed in half of the STs (ST11, ST13, ST17, ST18, and ST19).

9.5.1 Results

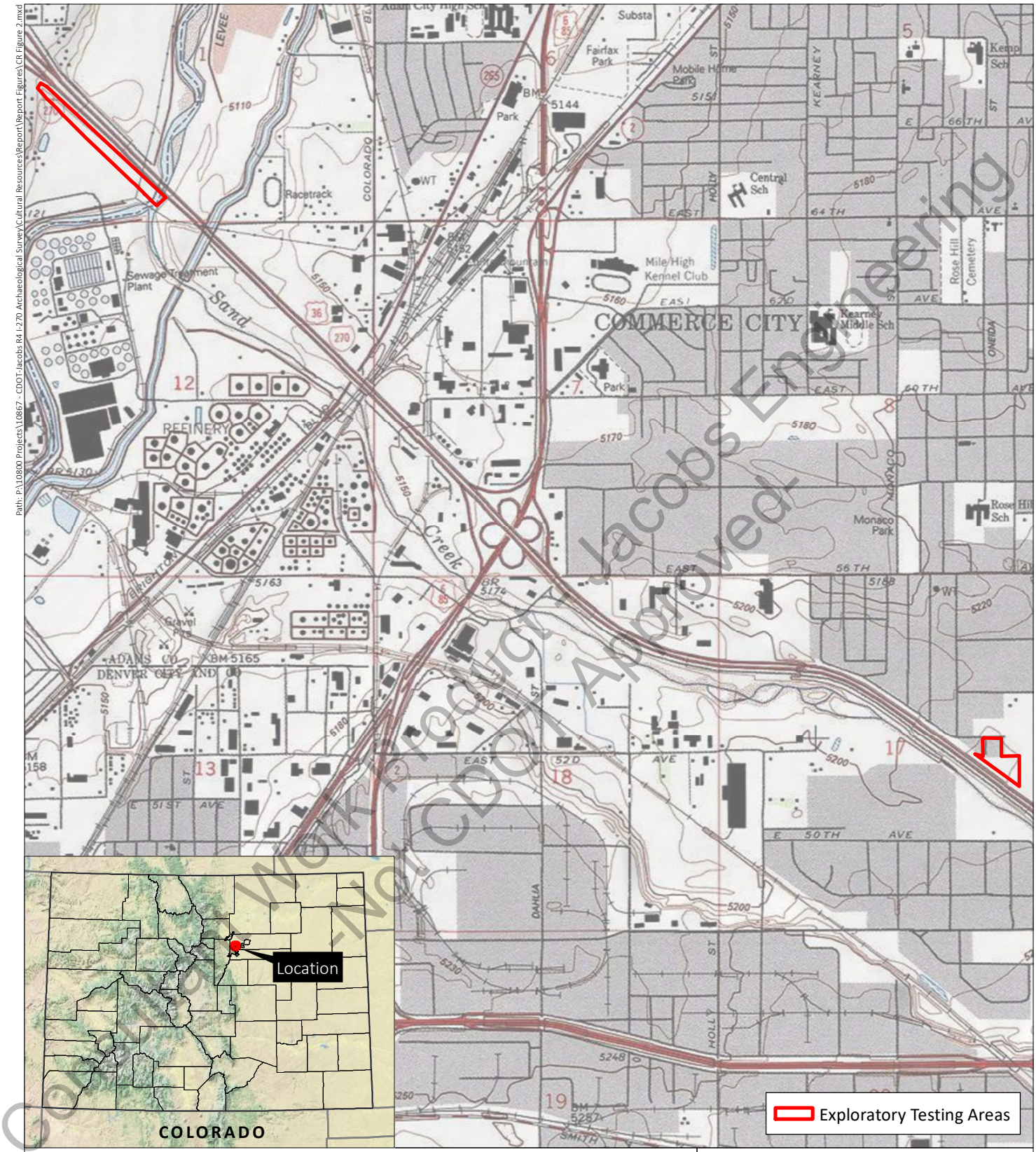
Two STs (ST14 and ST16) yielded modern trash in the upper 60 cm, including colorless and green vessel glass fragments (n=5). Most artifacts were recovered from a plowzone between 0 to 30 cm bgs and are therefore not in primary context.

The STs exposed a consistent plowzone about 40 cm thick across the terrace surface. Below the plowzone is a well-sorted gray brown loam with angular blocky structure (approximately 10 to 45 cm thick) followed by alternating fine to medium-grained sand deposits. In general, the sand deposits are finer textured as the STs move northeast away from Sand Creek; this is typical, as the energy of the lateral flood deposits and overbank deposits decrease further from the source.

A few tests indicate the presence of older, stable horizons. An auger probe in ST13 revealed gray brown silty loam from 130 to 175 cm bgs, a buried A horizon that was washed away across the remainder of the terrace. ST19, the furthest ST from Sand Creek, revealed various well-structured and fine-textured strata in the upper meter of deposits. However, the upper sediments were affected by the plowzone, and any potential A horizon was disturbed. The lower deposits in ST19 consisted of fine to coarse-grained sand and sandy clay that contained decomposing sandstone nodules.

The ST results reconstruct a terrace landform restructured by a meandering stream channel and covered by low-energy alluvia. Deposits become coarser in proximity to Sand Creek, which indicates that those portions of the terrace that overlap the study area are less likely to have preserved archaeological sites. While portions of the terrace further from Sand Creek have better potential for Holocene-age deposits similar to Piney Creek alluvium, the plowzone has heavily affected the upper 40 cm, and ERO did not encounter any archaeological deposits.

Figure 4. Overview of Area 6, ST11 in foreground and I-270 at photo right; view to the southeast.



Archaeological Assessment
Interstate 270 Environmental Assessment and Conceptual Design
Adams and Denver Counties, Colorado

Sections 35 and 35, T2S, R68W; 6th PM
Sections 7, 16, 17, 18, 21, and 22, T3S, R67W; 6th PM
Sections 1, 2, 3, and 12, T3S, R68W; 6th PM
USGS Commerce City, CO Quadrangle (1:24,000; 1980)
Adams and Denver Counties, Colorado

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0 1,000 2,000 Feet

1:24,000

Figure 5
Exploratory Testing Areas

Prepared for:
Jacobs Engineering Group, Inc.
File: CR Figure 2.mxd (ME)
September 29, 2020

ERO Resources Corp.

Archaeological Assessment
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Sections 35 and 35, T2S, R68W; 6th PM
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Sections 1, 2, 3, and 12, T3S, R68W; 6th PM
USGS Commerce City, CO Quadrangle (1:24,000; 1980)
Adams and Denver Counties, Colorado

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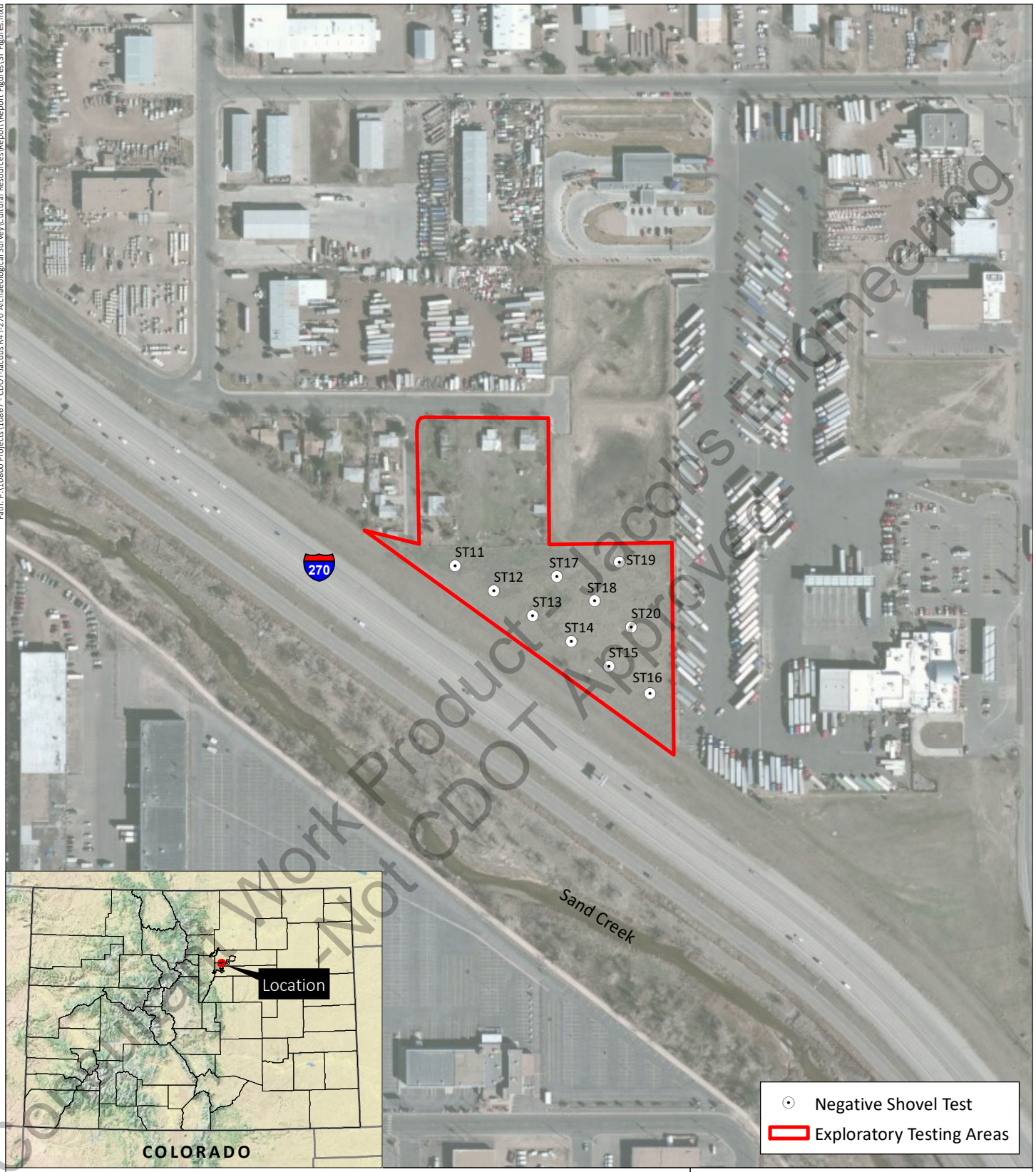
0 150 300 Feet
1:3,500

Figure 6
Exploratory Testing Areas

Prepared for:
Jacobs Engineering Group, Inc.
File: ST Figures.mxd (ME)
September 29, 2020

ERO Resources Corp.



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Sections 35 and 35, T2S, R68W; 6th PM
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Sections 1, 2, 3, and 12, T3S, R68W; 6th PM
USGS Commerce City, CO Quadrangle (1:24,000; 1980)
Adams and Denver Counties, Colorado

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0 150 300 Feet
1:3,500

Figure 7
Exploratory Testing Areas

Prepared for:
Jacobs Engineering Group, Inc.
File: ST Figures.mxd (ME)
September 29, 2020

ERO Resources Corp.

10.0 Summary

ERO identified six areas conducive to containing intact sediments with the potential for subsurface cultural deposits unaffected by development of the I-270 corridor. ERO's field assessment (i.e., surface inspection) indicated that four of the six areas were too disturbed by development to warrant subsurface testing. ERO's exploratory testing results in the remaining areas (Areas 4 and 6) were negative, despite confirmation that intact sediments exist in those areas. Given the extensive development and terraforming that has taken place along the I-270 corridor, no systematic pedestrian survey took place; rather, areas identified in the land use history as potentially undisturbed from transportation development were examined for surface cultural manifestations. Although two areas of potential surface historical archaeology were identified, these areas are currently outside of the project limits/APE and were not documented.

11.0 References Cited

Adams County Tax Assessor

2020 Residential Property Profile. Online database, https://gisapp.adcogov.org/Html5Viewer/index.html?viewer=BasicMobile.BasicMobile, accessed April 17, 2020.

Albanese, John

1988 Geologic Investigations of Site 5AH380, Arapahoe County, Colorado. Appendix C, in *Data Recovery Program at Site 5AH380 for the City of Aurora Proposed Senac Dam and Reservoir, Arapahoe County, Colorado*, pp. 239–264. Manuscript on file at the Colorado Historical Society, Office of Archaeology and Historic Preservation, Denver.

Birkeland, Peter W.

1999 *Soils and Geomorphology.* Oxford University Press, New York.

Bradley, Ray

2000 1000 Years of Climate Change. *Science* 288(5470).

Broecker, Wallace S.

2001 Was the Medieval Warm Period Global? *Science* 291(5508).

Buckles, William

1980 Radiocarbon Dates of Deposits of Piney Creek Alluvium in Southeastern Colorado. *Southwestern Lore* 46(3).

Cook, Edward R., Connie A. Woodhouse, C. Mark Eakin, David M. Meko, David W. Stahle

2004 Long-Term Aridity Changes in the Western United States. *Science* 306 (5698):1015–1018.
Daniels, J. Michael

2003 Floodplain aggradation and pedogenesis in a semiarid environment. *Geomorphology* 56 (2003) 225–242.Fraser, Clayton B., and Jennifer H. Strand

1997 *Railroads in Colorado, 1858–1948, Multiple Properties Listing*. National Register of Historic Places Multiple Property Documentation Form. Fraser Design, Loveland, Colorado.

Gantt, Erik M.

2007 *Mitigative Excavations at the Hess (5DA1951), Oeskeso (5DA1957), and 5DA1936 Archaeological Sites at the Rueter-Hess Reservoir, Douglas County, Colorado.* Prepared for States West Water Resources Corporation, Cheyenne, Wyoming, and Parker Water and Sanitation District, Parker, Colorado, by Centennial Archaeology, Fort Collins, Colorado.

General Land Office (GLO)

1862a *Township 2 South-Range 68 West* [plat]. 1:40. Denver.

1862b *Township 3 South-Range 68 West* [plat]. 1:40. Denver.

1865 *Township 3 South-Range 67 West* [plat]. 1:40. Denver.

Gilmore, Kevin P.

1989 Archaeology and Holocene Stratigraphy at the Foot of the Front Range. *Southwestern Lore* 55(3):12–28.

1991 *Bayou Gulch: Geoarchaeology of a Multicomponent Site in Central Colorado*. Unpublished Master's Thesis, Department of Anthropology, University of Colorado, Boulder.

2004 Analysis of the Artifact Collection from the Jarre Creek Site (5DA541), a Terminal Early Ceramic Period Occupation on the Palmer Divide, Colorado. In *Southwestern Lore* 70(2):1–32.

2008 Ritual Landscapes, Population and Changing Sense of Place During the Late Prehistoric Transition in Eastern Colorado. *Archaeological Landscapes on the High Plains,* pp. 71–114. L. L. Scheiber and B. Clark (eds.). The University Press of Colorado, Boulder.

2011 Geomorphology and Paleoenvironment at Two Late Archaic Period Sites in Arapahoe County, Colorado. *Newsletter of the Colorado Council of Professional Archaeologists* 33(1):5–9.

2012 Footprints in the Mud: A Holocene Drought Record from a Pocket Fen and the Implications for Middle Archaic Cultural Ecology on the Great Plains. In *Colorado Archaeology* 78(1):1–13.

Gilmore, Kevin P., and Bonnie Gibson

2010 *Cultural Resource Survey and Results of Evaluative Testing at Sites 5AH3216 and 5AH3217, Parker Jordan Open Space Project, Arapahoe County, Colorado.* Prepared for the U.S. Army Corps of Engineers, J3 Engineering Consultants, and the Parker Jordan Metropolitan District, Centennial, Colorado, by ERO Resources Corporation, Denver. Ms. on file at the Colorado Office of Archaeology and Historic Preservation Office, Denver.

Google Earth

1993 Aerial image [13S: 494402m E, 4377171m N]. 29 June. www.google.com/earth, accessed February 17, 2020.

Graham, Carol L.

1998 *Archaeological Investigations at 5AH741, a Buried Multicomponent Site in Arapahoe County, Colorado*. Prepared for Centennial Engineering by Metcalf Archaeological Consultants, Inc., Arvada, Colorado.

Hedlund, Jonathan

2019 New Radiocarbon Dates and Quaternary Geology in the South Platte Drainage. Paper presented at the 41st Annual Meeting of the Colorado Council of Professional Archaeologists, Durango, Colorado.

Hedlund, Jonathan, and Katherine Mayo

2019 *Technical Memorandum Newlin Gulch and Tributaries Upstream of Rueter-Hess Reservoir Channel Improvement Project, Douglas County Colorado*. Prepared for Urban Drainage and Flood Control District. Submitted to the U.S. Army Corps of Engineers, Denver Regulatory Office. On file at the Colorado Office of Archaeology and Historic Preservation, Denver.

Holliday, Vance T.

1987 Geoarchaeology and Late Quaternary Geomorphology of the Middle South Platte River, Northeastern Colorado. *Geoarchaeology* 2:317–329.

Hunt, Charles B.

1954 *Pleistocene and Recent Deposits in the Denver Area, Colorado*. U.S. Geological Survey Bulletin 996-C. U.S. Government Printing Office, Washington, D.C.

Jepson, Daniel A., and O. D. Hand

1994 *Archaeological Investigations at a Portion of the Dutch Creek Site (5JF463), A Multicomponent Camp in Jefferson County, Colorado*. Colorado Department of Transportation Archaeological Research Series No. 4.

Keeley, Gail

2012 *Historic Context - Denver's Brick Sewers, Denver, Colorado*. Hermsen Consultants.

Larmore, Sean, and Kevin P. Gilmore

2003 Rainbow Creek Site (5DA124). In *Palmer Divide Archaeology Project: Documentation of Artifact Collections from the Tenth Fairway (5DA123), Rainbow Creek (5DA124), and Jarre Creek (5DA541) Sites, Douglas County, Colorado*, pp. 22–35. *S*ubmitted to the Colorado Historical Society, Denver, by the University of Denver, Archaeological Research Institute.

Larson, Lynn S.

1974 *Soil Survey of the Castle Rock Area, Colorado*. U.S. Department of Agriculture Soil Conservation Service.

Lindsey, David A., William H. Langer, and Daniel H. Knepper, Jr.

2005 *Stratigraphy, Lithology, and Sedimentary Features of Quaternary Alluvial Deposits of the South Platte River and Some of its Tributaries East of the Front Range, Colorado.* Professional Paper 1705. U.S. Department of the Interior, U.S. Geological Survey.

Lindvall, Robert M.

1980 Geologic Map of the Commerce City Quadrangle, Adams and Denver Counties. U.S. Geological Survey, Denver.

Maberry, John O., and Robert M. Lindvall

1972 Geologic Map of the Parker Quadrangle, Arapahoe and Douglas Counties, Colorado. Map. 1:24,000. Department of the Interior, U.S. Geological Survey.

Machette, Michael N.
1977 Geologic Map of the Lafayette Quadrangle, Adams, Boulder, and Jefferson Counties, Colorado. Map. 1:24,000. Department of the Interior, U.S. Geological Survey.

Madole, Richard F., and Meyer Rubin
1984 Reinterpretation of Holocene Alluvial Chronology in Major Valleys of the Northern Colorado Piedmont. In *American Quaternary Association: Program and Abstracts of the Eighth Biennial Meeting,* p. 76. University of Colorado, Boulder.

Madole, Richard F.
1991 Colorado Piedmont Section. In *Quaternary geology of the Northern Great Plains*. Wayne, William J. James S. Aber, Sherry S. Agard, Robert N. Bergantino, John P. Bluemle, Donald A. Coates, Maurice E. Cooley, Richard F. Madole, James E. Martin, Brainerd Mears, Jr. Robert B. Morrison, Wayne M. Sutherland. *The Geology of North America* Vol. K-2 Quaternary Nonglacial Geology: Conterminous U.S. The Geological Society of America.

Malde, Harold E.
1955 Surficial Geology of the Louisville Quadrangle, Colorado. A contribution to General Geology. U.S. Geological Survey. *Bulletin 996* (E).

Mann, Michael E., and Phillip D. Jones
2003 Global Surface Temperatures over the Past Two Millennia. *Geophysical Research Letters* 30(15).

Marin, Michelle
2019 *Preliminary Modified Environmental Assessment - Interstate 270 Corridor*. Interstate 270 Between Interstate 70 and U.S. 36, Denver and Commerce City, Colorado. Pinyon Environmental, Inc., Lakewood, Colorado.

Matthai, Howard
1969 Floods of June 1965 in South Platte River Basin, Colorado. *Geological Survey-Water Supply Paper* 1850(B). United States Government Printing Office, Washington, D.C.

McFaul, Michael
2004 *Paleosol Investigation, Jimmy Camp Creek and Williams Creek Study Areas, Phase I Literature Review and Field Study*. Letter Report Submitted to Western Cultural Resource Management, Inc. by Laramie Soils Service, Inc., Laramie, Wyoming.

McFaul, Michael, Karen Lynn Traugh, and Grant D. Smith
1994 Chapter Five: Geomorphic Investigations. In *Archaeological and Geomorphic Investigations Along U.S. Highway 34 Between Kersey and Hardin, Weld County, Colorado*. Centennial Archaeology, Inc. Prepared for the Colorado Department of Transportation, Denver.

Mead & Hunt
2019 *Selective Historic Resources Inventory Report - I-270 Corridor, Adams County*. Prepared for the Colorado Department of Transportation, Denver, and Jacobs Engineering.

Nationwide Environmental Title Research (NETR)
2020 Historic Aerials. *National Environmental Title Research LLC*. Electronic document, https://www.historicaerials.com, accessed February 25, 2020.

Nelson, Charles E.
1969 Salvage Archaeology on Van Bibber Creek, Site 5JF10. *Southwestern Lore* 34(4):84–106.

Reimer, Paula J., Edouard Bard, Alex Bayliss, J. Warren Beck, Paul G Blackwell, Christopher Bronk Ramsey, Caitlin E Buck, Hai Cheng, R. Lawrence Edwards, Michael Friedrich, Pieter M. Grootes, Thomas P. Guilderson, Haflidi Haflidason, Irka Hajdas, Christine Hatté, Timothy J. Heaton, Dirk L. Hoffmann, Alan G. Hogg, Konrad A. Hughen, K. Felix Kaiser, Bernd Kromer, Sturt W. Manning, Mu Niu, Ron W. Reimer, David A. Richards, E. Marian Scott, John R. Southon, Richard A. Staff, Christian S. M. Turney, and Johannes van der Plicht
2013 IntCal13 and MARINE13 radiocarbon age calibration curves 0-50000 years cal BP *Radiocarbon* 55(4). DOI: 10.2458/azu_js_rc.55.16947.

Sanocki, Abigail, Jonathan Hedlund, and Sean Larmore
2020 *Preliminary Archaeological Review, Interstate 270 Environmental Assessment and Conceptual Design, Adams and Denver Counties, Colorado*. Prepared by ERO Resources Corporation, Denver, on behalf of Jacobs Engineering Group, and submitted to the Colorado Department of Transportation, Region 1.

Scott, Glenn R.
1960 Subdivision of the Quaternary Alluvium East of the Front Range Near Denver, Colorado. In *Bulletin of the Geological Society of America* 71:1541–1544.
1963 *Quaternary Geology and Geomorphic History of the Kassler Quadrangle, Colorado*. United States Geological Survey Professional Paper N421-A. Washington, D.C.

Soil Conservation Service
1977 *Soil Taxonomy: Key to Orders, Suborders and Great Groups*. USDA Soil Conservation Service, West Technical Service Center, Portland, Oregon.

Szabo, Barney J.
1980 Results and Assessment of Uranium-Series Dating of Vertebrate Fossils from Quaternary Alluviums in Colorado. *Arctic and Alpine Research* 12(1):95–100.

Thorson, Jon P.
2005 *Geologic Map of the Castle Rock North Quadrangle, Douglas County, Colorado*. Colorado Geological Survey, Department of Natural Resources, Denver. Open-File Report Number 05-02.

Trimble, Donald E., and Michael N. Machete
1979 Geology Map of the Greater Denver Area, Front Range Urban Corridor Colorado, U.S. Geological Survey Miscellaneous Investigations Series Map I-856-H.

U.S. Federal Census
1940 Adams County, Colorado Enumeration Districts [map]. Electronic document, http://1940census.archives.gov/search/?search.result_type=map&search.state=CO&search.county=Adams+County&search.city, accessed September 9, 2016.

U.S. Geological Survey (USGS)
1890 *East Denver, Colorado* [topographic map]. 1:125,000. Denver.
1938 *Derby, Colorado* [topographic map]. 1:24,000. Denver.
1965 *Commerce City, Colorado* [topographic map]. 1:24,000. Denver.
1981 *Denver East, Colorado* [topographic map]. 1:24,000. Denver.

Van Horn, Richard

1976 *Geology of the Golden Quadrangle, Colorado*. U. S. Geologic Survey Professional Paper 872. U.S. Government Printing Office, Washington, D.C.

Varnes, David J., and Glenn R. Scott

1967 General and Engineering Geology of the United States Air Force Academy Site, Colorado. In *Geological Survey Professional Paper 551*. United States Department of the Interior, Geological Survey.

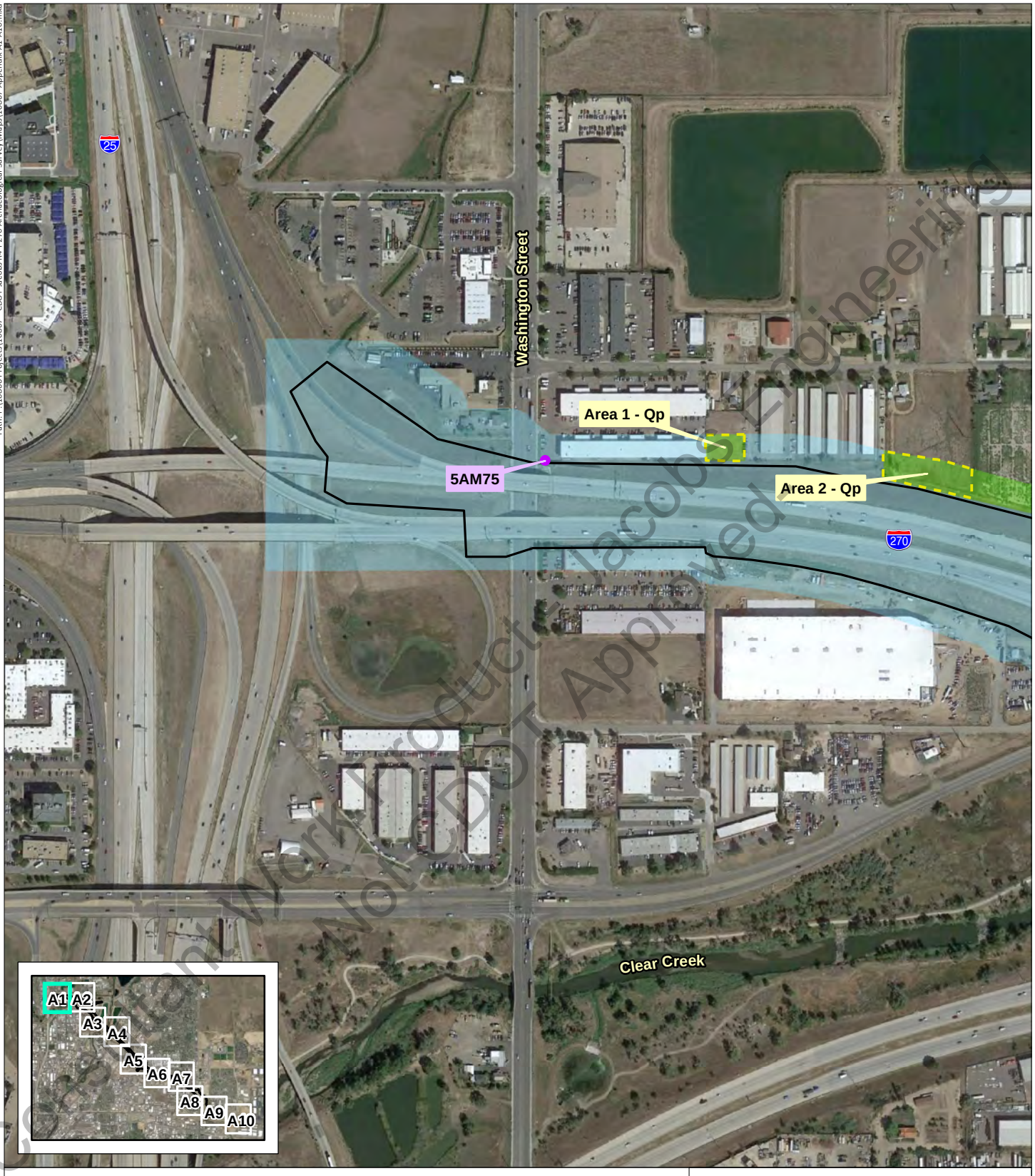
Young, Aaron

2006 Luminescence Dating of a Mammoth Molar from the Denver Colorado Area. University of Platteville, Wisconsin. Electronic document, https://www.uwplatt.edu/files/web/new_ventures/young06.pdf, accessed September 2018.

Zier, Christian J. Daniel A. Jepson, Michael McFaul, and William Doering

1993 Archaeology and Geomorphology of the Clovis-Age Klein Site Near Kersey, Colorado. *Plains Anthropologist* 38(143):203–210.

Appendix A
Figures A1–A10: Preliminary Archaeological Assessment



Preliminary Archaeological Review, Interstate 270 Environmental Assessment and Conceptual Design, Adams and Denver Counties, Colorado

Study Area
Area
Previously Documented Site
Potential Historical Period Site
Needs Assessment
Disturbed

0 250 500 Feet
1:6,000

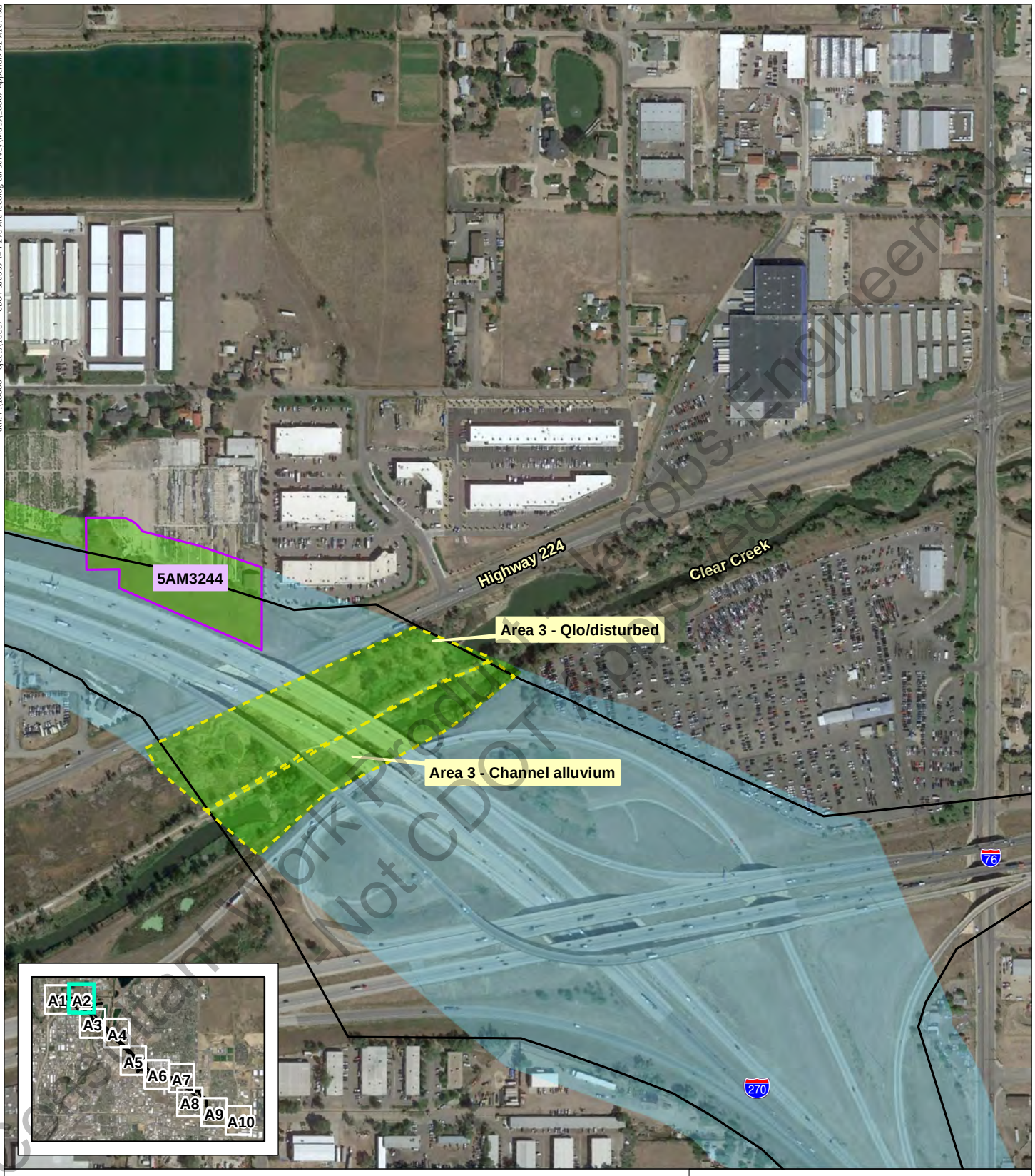
N

Appendix A1
Areas of Disturbance

Image Source: Google Earth©, September 2019

Prepared for: Jacobs Engineering Group Inc.
File: 10867 Appendix A1-A10.mxd (GS)
September 29, 2020

ERO Resources Corp.



Preliminary Archaeological Review, Interstate 270 Environmental Assessment and Conceptual Design, Adams and Denver Counties, Colorado

Study Area
Area
Previously Documented Site
Potential Historical Period Site
Needs Assessment
Disturbed

0 250 500 Feet
1:6,000

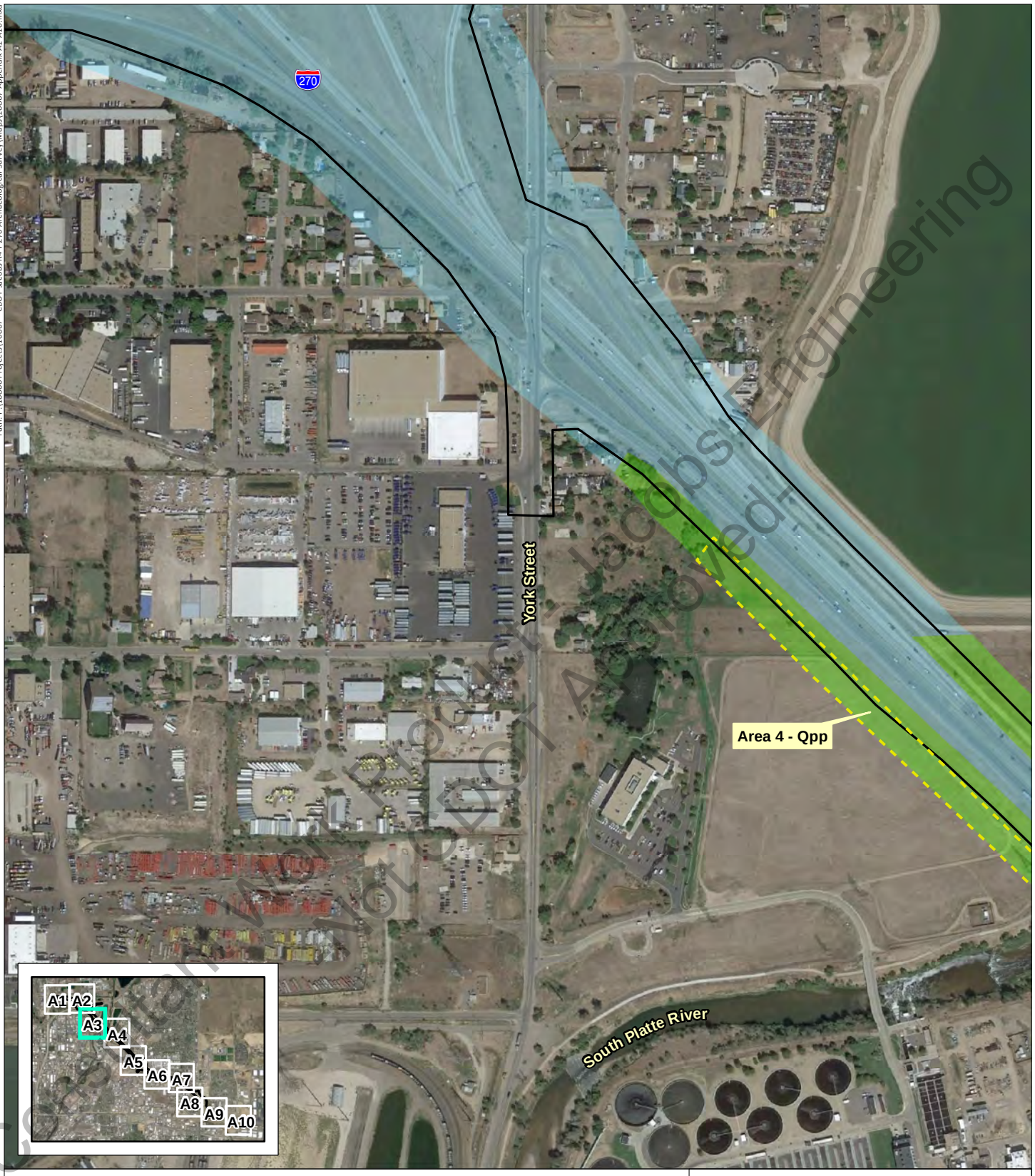
N

Appendix A2
Areas of Disturbance

Image Source: Google Earth©, September 2019

Prepared for: Jacobs Engineering Group Inc.
File: 10867 Appendix A1-A10.mxd (GS)
September 29, 2020

ERO Resources Corp.



Preliminary Archaeological Review, Interstate 270 Environmental Assessment and Conceptual Design, Adams and Denver Counties, Colorado

Study Area
Area
Previously Documented Site
Potential Historical Period Site
Needs Assessment
Disturbed

0 250 500 Feet
1:6,000

N

Appendix A3
Areas of Disturbance

Image Source: Google Earth©, September 2019

Prepared for: Jacobs Engineering Group Inc.
File: 10867 Appendix A1-A10.mxd (GS)
September 29, 2020

ERO Resources Corp.

Preliminary Archaeological Review, Interstate 270 Environmental Assessment and Conceptual Design, Adams and Denver Counties, Colorado

Appendix A4
Areas of Disturbance

Image Source: Google Earth©, September 2019

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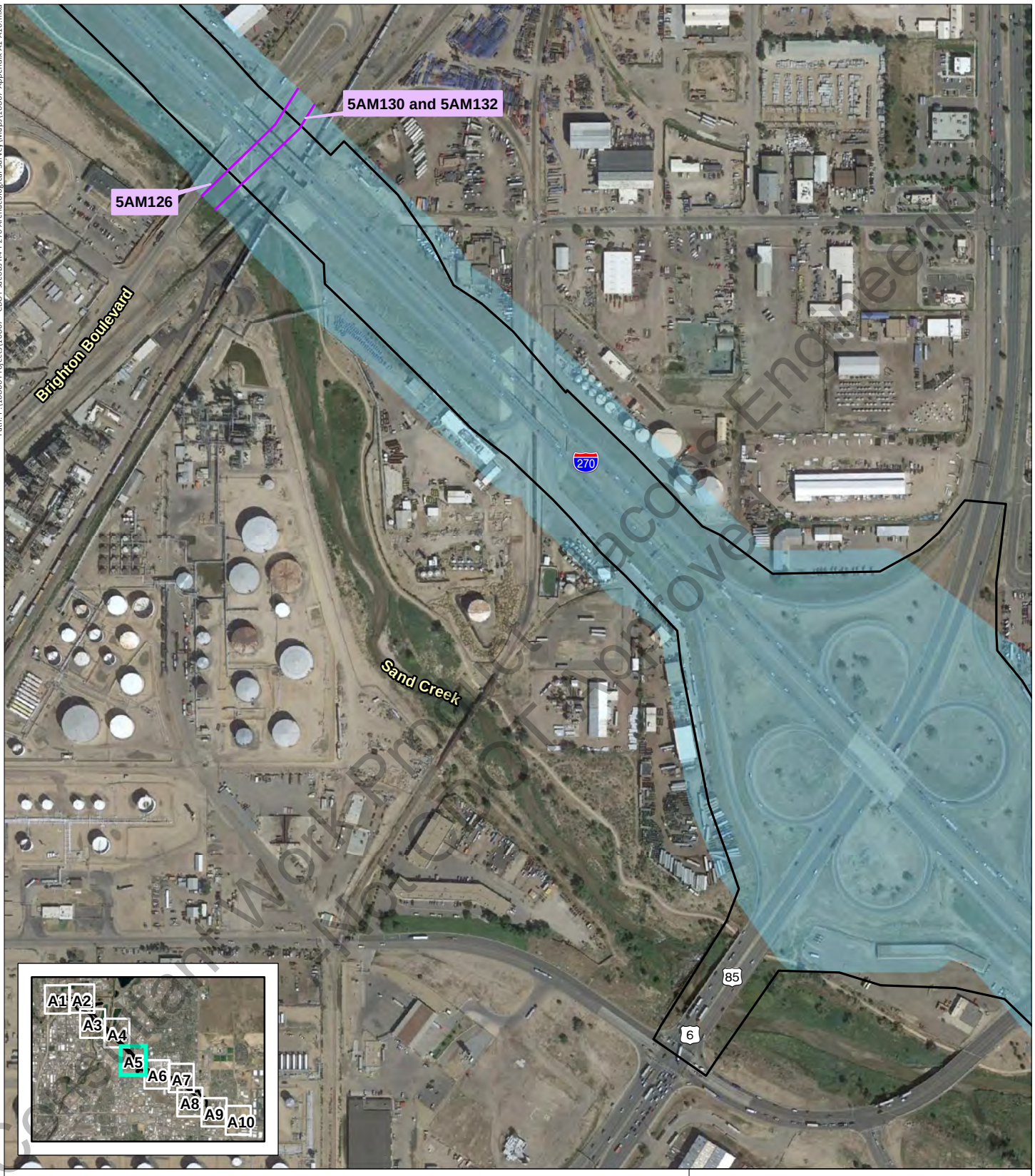
September 29, 2020

ERO Resources Corp.



Preliminary Archaeological Review, Interstate 270 Environmental Assessment and Conceptual Design, Adams and Denver Counties, Colorado

Study Area
Area
Previously Documented Site
Potential Historical Period Site
Needs Assessment
Disturbed

0 250 500 Feet
1:6,000

N

Appendix A5
Areas of Disturbance

Image Source: Google Earth©, September 2019

Prepared for: Jacobs Engineering Group Inc.
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ERO Resources Corp.

Preliminary Archaeological Review, Interstate 270 Environmental Assessment and Conceptual Design, Adams and Denver Counties, Colorado

Study Area
Area
Previously Documented Site
Potential Historical Period Site
Needs Assessment
Disturbed

0 250 500 Feet
1:6,000

N

Appendix A6
Areas of Disturbance

Image Source: Google Earth©, September 2019

Prepared for: Jacobs Engineering Group Inc.
File: 10867 Appendix A1-A10.mxd (GS)
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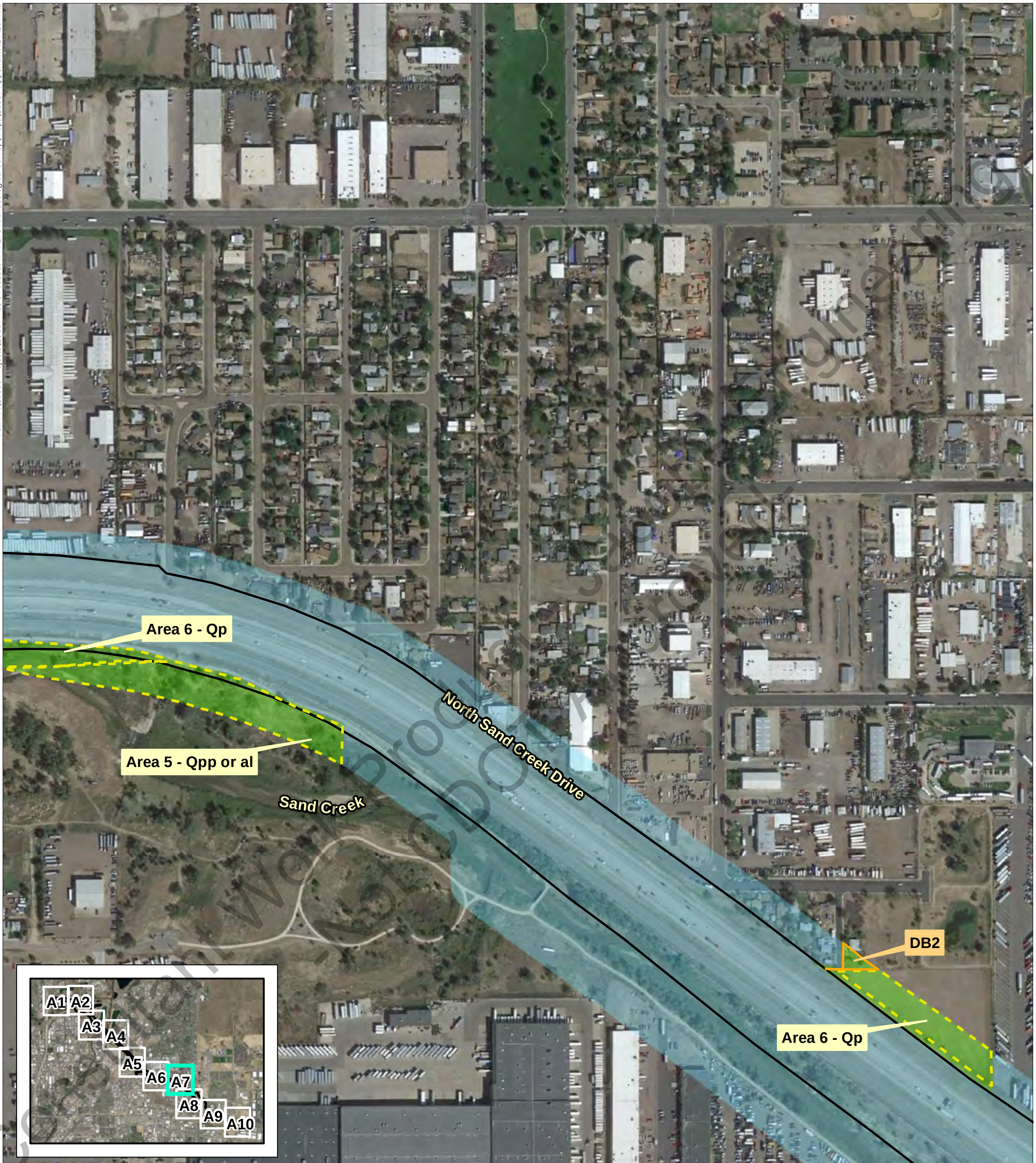


Preliminary Archaeological Review, Interstate 270 Environmental Assessment and Conceptual Design, Adams and Denver Counties, Colorado

Study Area
Area
Previously Documented Site
Potential Historical Period Site
Needs Assessment
Disturbed

0 250 500 Feet
1:6,000
N

Appendix A7
Areas of Disturbance

Image Source: Google Earth©, September 2019

Prepared for: Jacobs Engineering Group Inc.
File: 10867 Appendix A1-A10.mxd (GS)
September 29, 2020

ERO Resources Corp.

Preliminary Archaeological Review, Interstate 270 Environmental Assessment and Conceptual Design, Adams and Denver Counties, Colorado

Study Area
Area
Previously Documented Site
Potential Historical Period Site
Needs Assessment
Disturbed

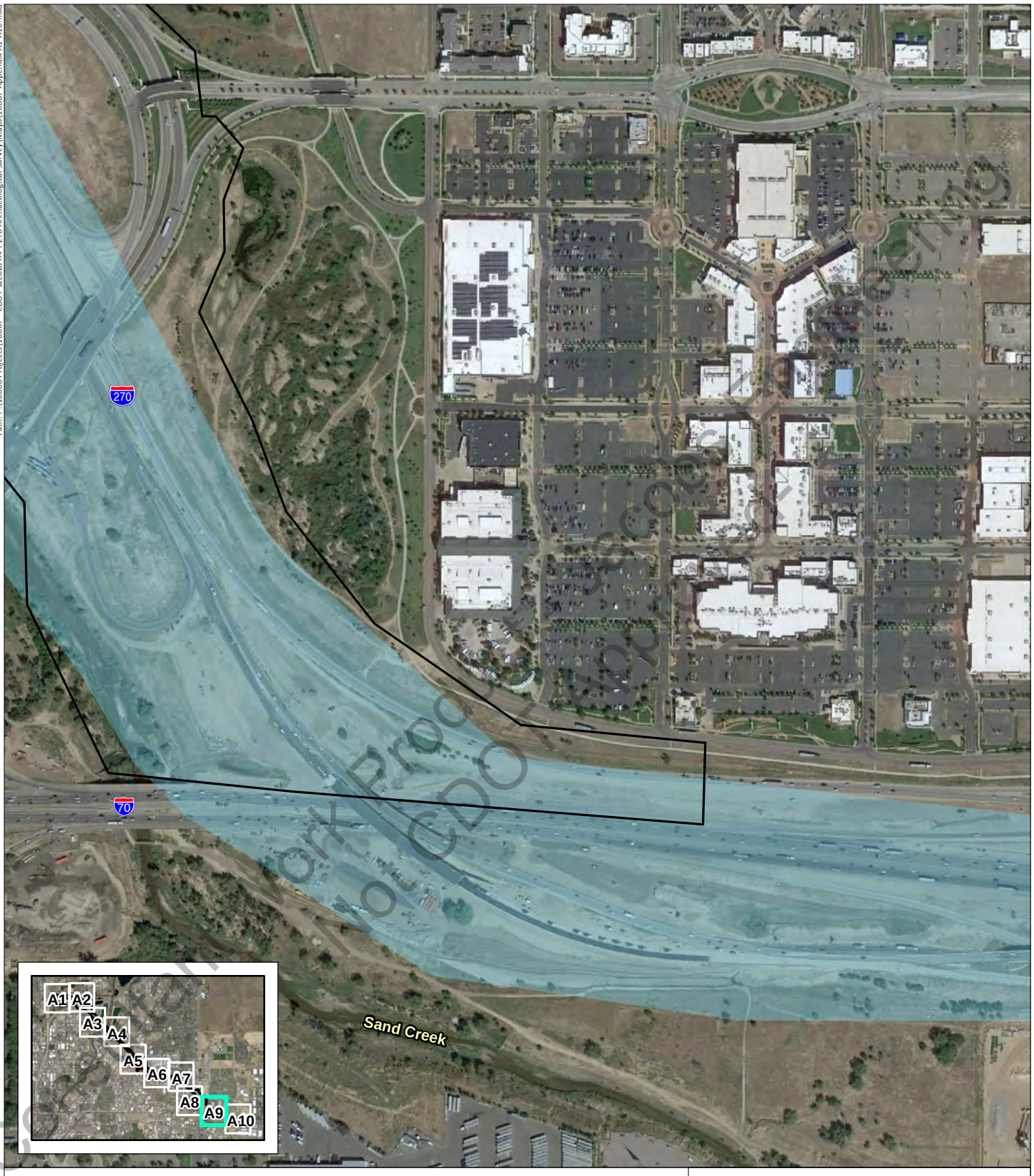
0 250 500 Feet
1:6,000
N

Appendix A8
Areas of Disturbance

Image Source: Google Earth©, September 2019

Prepared for: Jacobs Engineering Group Inc.
File: 10867 Appendix A1-A10.mxd (GS)
September 29, 2020

ERO Resources Corp.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270
70
Sand Creek
A1
A2
A3
A4
A5
A6
A7
A8
A9
A10
Work Product of Jacobs Engineering
Not CDOT Property
Preliminary Archaeological Review, Interstate 270 Environmental Assessment and Conceptual Design, Adams and Denver Counties, Colorado
Study Area
Area
Previously Documented Site
Potential Historical Period Site
Needs Assessment
Disturbed
0
250
500
Feet
1:6,000
N
Appendix A9
Areas of Disturbance
Image Source: Google Earth©, September 2019
Prepared for: Jacobs Engineering Group Inc.
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September 29, 2020
ERO
ERO Resources Corp.

Preliminary Archaeological Review, Interstate 270 Environmental Assessment and Conceptual Design, Adams and Denver Counties, Colorado

Study Area
Area
Previously Documented Site
Potential Historical Period Site
Needs Assessment
Disturbed

0 250 500 Feet
1:6,000

N

Appendix A10
Areas of Disturbance

Image Source: Google Earth©, September 2019

Prepared for: Jacobs Engineering Group Inc.
File: 10867 Appendix A1-A10.mxd (GS)
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