

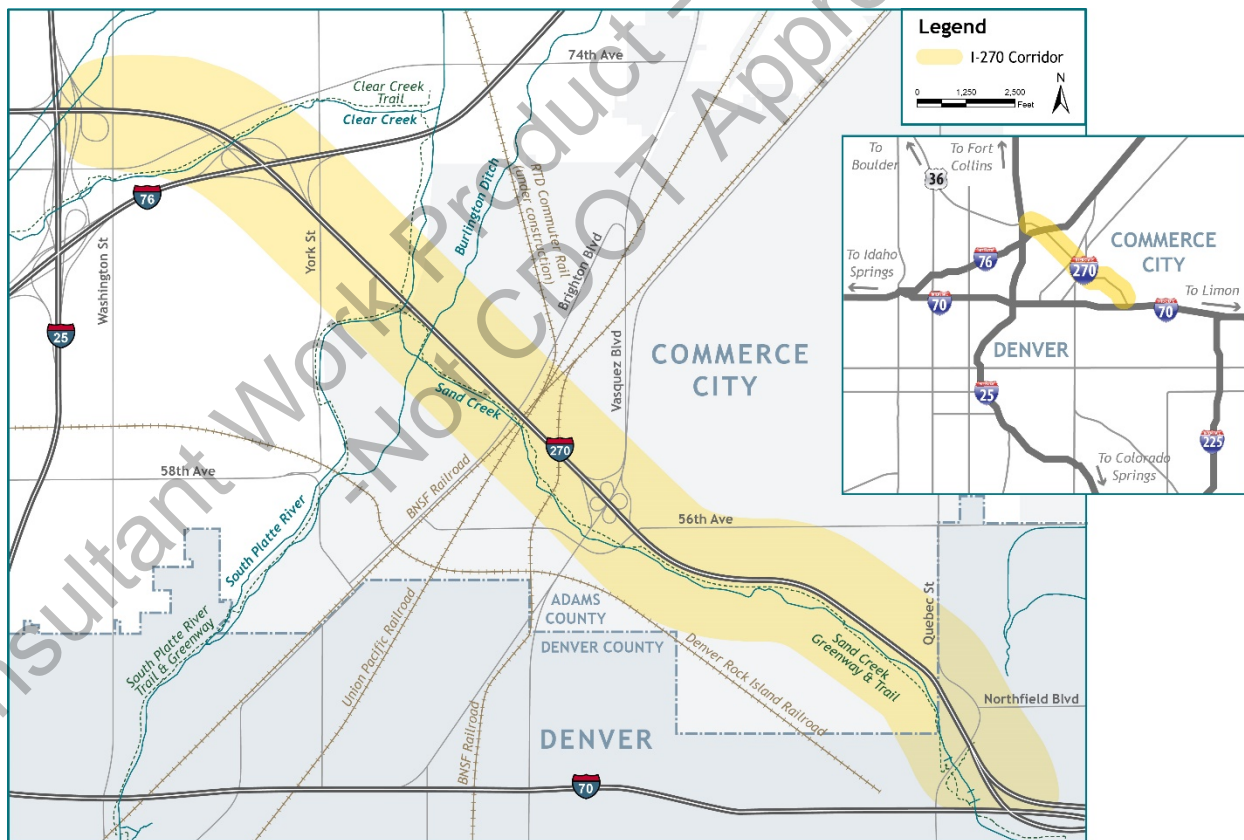


# Paleontological Technical Memorandum

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## 1.0 Introduction

The Colorado Department of Transportation (CDOT) and the Federal Highway Administration (FHWA), 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, primarily between Interstate 25 (I-25) and Interstate 70 (I-70) (Figure 1). CDOT and FHWA are preparing an Environmental Assessment (EA) for the project, referred to as the I-270 Corridor Improvements project. Sections 1 and 2 of the EA, and EA Appendix A, contain the project setting and a detailed description of alternatives. This technical memorandum presents the technical analysis, findings, and any applicable mitigation measures related to paleontological resources.



**Figure 1. Project Setting**  
 Source: Jacobs

## 2.0 Regulatory Context

### 2.1 Federal Regulations

While not specifically called out in the National Environmental Policy Act, fossils, which are formed from the remains or traces of extinct organisms, are considered a non-renewable resource and are therefore broadly protected under general federal environmental protection rules. In addition, the Paleontological Resource Preservation Act of 2009 protects fossils, particularly of vertebrate animals, on federally owned and administered lands. Stricter rules may apply in the National Park System and some other federally administered lands.

### 2.2 State and Local Regulations

Colorado protects fossils on land owned by the state or by subdivisions of state government. The Historical, Prehistorical, and Archaeological Resources Act (Colorado Revised Statute 24-80-401 [State Antiquities Act]) reserves ownership of fossils on state land, as well as land administered by counties, cities, and other subdivisions, to the State of Colorado. Permits issued by the State Historical Preservation Office are required to collect, destroy, or otherwise remove fossil localities covered by this law, and a requirement to avoid damage to fossil localities without such a permit is implied.

## 3.0 Methods

Standard pre-project paleontological evaluation methods used in this review are as follows:

- Review geologic maps of the project area to determine the paleontological sensitivity of the underlying rock units. High-sensitivity units may require additional mitigation even if no fossils are known from the immediate project area.
- Review scientific literature and museum records for known fossil localities in the project area. Historical fossil localities may require additional mitigation efforts if the project will damage or destroy the location.
- Perform remote or on-the-ground surveys to identify exposures of bedrock. If exposures exist, additional survey(s) to search for previously unidentified fossil localities will be conducted.

## 4.0 Existing Conditions

### 4.1 Underlying Geology

The entire project lies within the U.S. Geological Survey Commerce City map quadrangle, and the corresponding 7.5 minute geologic map was used to review the geological context of the project.

The project is underlain by the following units (Sections 4.1.1 through 4.1.7).

#### 4.1.1 Artificial Fill

Artificial fill is a human-made unit consisting of displaced sediment and is considered to be non-sensitive for paleontological resources.

#### 4.1.2 Holocene Piney Creek and Post-Piney Creek Alluvium

Holocene units, including the Piney Creek and Post-Piney Creek alluviums, can produce prehistoric bone, shell, or plant material. However, these units are less than about 11,000 years old, placing any such finds in an archaeological rather than a paleontological context. Entirely Holocene units are not typically considered sensitive for paleontological resources but should be evaluated by a qualified archaeologist.

#### **4.1.3 Holocene and Pleistocene Unnamed Eolian Sand Unit**

The unnamed eolian sand unit in the Denver Basin has produced camel, pronghorn antelope, black-tailed prairie dog, Richardson's ground squirrel, and extinct peccary remains in Denver and Aurora (Hunt 1954; Lewis 1970).

#### **4.1.4 Pleistocene Broadway Alluvium**

The Pleistocene Broadway Alluvium has produced mammoth, bison, horse, camel, jackrabbit, and white-tailed prairie dog specimens in the Denver and Greeley areas (Hunt 1954; unpublished University of Colorado Museum and CDOT fossil locality data).

#### **4.1.5 Pleistocene Louviers Alluvium**

The Pleistocene Louviers Alluvium has produced mammoth, horse, camel, llama, deer, bison, bighorn sheep, ground squirrel, black-tailed prairie dog, and pocket gopher remains in the Denver area (Scott 1962; Wang and Neas 1987; unpublished University of Colorado Museum and CDOT fossil locality data).

#### **4.1.6 Pleistocene Slocum Alluvium**

The Pleistocene Slocum Alluvium has produced mammoth, camel, horse, bison, prairie dog, Richardson's ground squirrel, pocket gopher, field mouse, and rabbit specimens, especially south of Littleton and east of Byers (Scott 1963; unpublished University of Colorado Museum and CDOT fossil locality data).

#### **4.1.7 Paleocene and Upper Cretaceous Denver and Arapahoe Formations**

The Upper Cretaceous Denver and Arapahoe formations are part of the larger Denver/Dawson complex that occurs throughout the Denver area as well as further up and down the Front Range. The Denver Formation in particular has produced Late Cretaceous leaves, dinosaur, and other vertebrate remains including very rare mammal teeth, as well as early Paleocene leaves and mammal, reptile, and amphibian bones and teeth in the Denver Basin (Cannon 1906; Brown 1962; Middleton 1983; Carpenter and Young 2002; Johnson et al. 2003; Hutchison and Holroyd 2003; Eberle 2003; Middleton and Dewar 2004; Wilf et al. 2006; Reynolds et al. 2007). Published information on invertebrate fossil occurrences in the Denver Formation is limited, with only two occurrences widely known (Cross 1889; Cannon 1893; Brown 1943), but a third occurrence has been recorded adjacent to State Highway 86 east of Kiowa, at University of Colorado Museum fossil locality 91278.

The Denver Formation is a paleontologically sensitive geologic unit whose regular production of scientifically important leaf fossils and more sporadic production of scientifically important vertebrate fossils has resulted in the establishment of a general policy of construction monitoring wherever significant construction impacts to the unit are proposed.

Note that it can be difficult to predict the exact depth at which the Denver Formation occurs below the surface, because its contact with the overlying more recent units tends to be extremely variable. Depth can be estimated from geotechnical surveys or existing well data, but an exact depth often cannot be given until excavation reaches the unit.

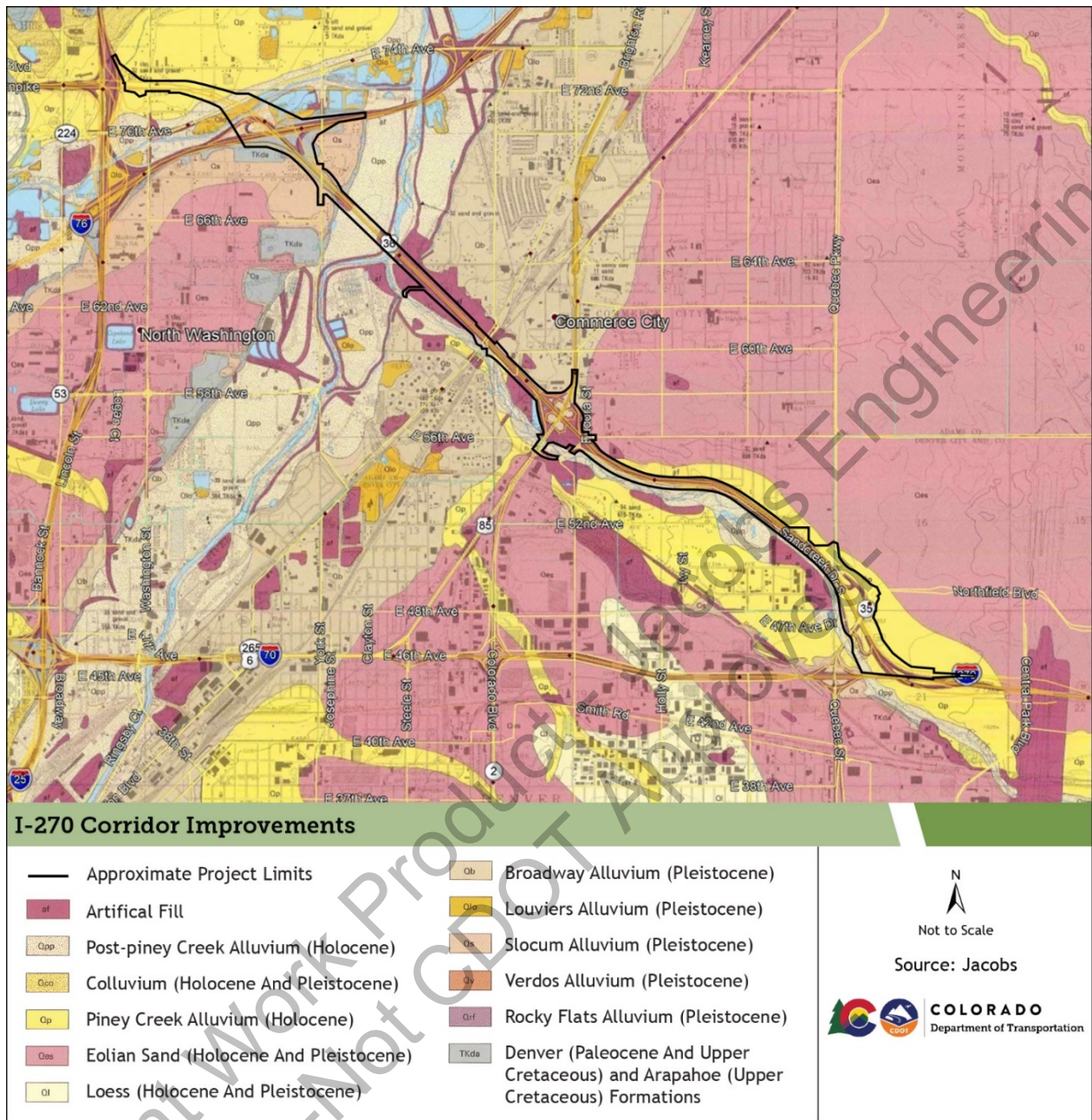


Figure 2. Local Geology

#### 4.2 Previously Recorded Localities

Two previously recorded localities are known from the immediate project area. One locality is known from the Paleocene Louviers Alluvium, and a second from the Cretaceous portion of the Denver Formation. At least seven additional localities are known from nearby portions of Adams County, including Cretaceous dinosaur fossils and Pleistocene mammal fossils.

#### 4.3 Survey Results

The project area is heavily urban and previously disturbed from prior construction efforts, with appropriate landscaping on slopes. Therefore, no exposed bedrock currently exists that would warrant a detailed on-the-ground survey prior to project construction.

## 5.0 Impacts Assessment

### 5.1 No Action Alternative

If no action is taken, no impacts are likely to occur to any known or unknown fossil localities. In addition, any currently buried localities are unlikely to be discovered.

### 5.2 Proposed Action

Ground disturbance extending below the current disturbed ground level is highly likely to impact potentially fossil-bearing units, including Pleistocene units and Cretaceous bedrock. Two known localities are likely to be impacted, and an unknown number of additional localities may be uncovered during construction. With appropriate mitigation, potential impacts to paleontological resources can be minimized. It is also possible that fossil resources may be destroyed if not recognized in time.

## 6.0 Mitigation Measures

Temporary and permanent impacts to paleontological resources could occur because of the Proposed Action. The recommended mitigation measures that will be implemented for the Proposed Action are summarized in Table 1.

## 7.0 Required Permits

Paleontological monitoring, as well as removal of any fossils identified on the project site, must be conducted by a qualified paleontologist holding a paleontological permit from the State Historical Preservation Office.

**Table 1. Paleontological Mitigation Measures**

Activity Triggering Mitigation	Location of Activity	Impact	Mitigation Commitment	Responsible Branch	Timing/Phase that Mitigation will be Implemented
Excavation into Pleistocene Alluvial Units	Intermittent; primarily north of the Vasquez Boulevard intersection.	Potential damage to Pleistocene mammal fossils	Paleontological monitoring at spot-check frequency, with timing determined by the staff paleontologist in consultation with the active monitor.	CDOT Engineering and Contractor	During construction
Excavation or Drilling into the Denver or Arapahoe Formations	Primarily north of the Vasquez Boulevard intersection, but potentially anywhere in the project at various depths ranging from 0 feet near I-76 to about 40 feet near Brighton Boulevard.	Potential damage to Cretaceous or Paleocene fossils	Paleontological monitoring at spot-check frequency until bedrock is identified, after which continuous monitoring will be required. Monitoring is not required when landfill material is being excavated.	CDOT Engineering and Contractor	During construction

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Consultant Work Product - Jacobs Engineering  
-Not CDOT Approved-