GEOLOGIC RESOURCES AND SOIL TECHNICAL REPORT

FOR THE

6TH AVENUE PARKWAY EXTENSION ENVIRONMENTAL ASSESSMENT

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E-470 ..... E-470 Tollway
SH 30..... State Highway 30

1. INTRODUCTION

This technical report has been prepared in support of the 6th Avenue Parkway Extension Environmental Assessment (EA) extending 6th Avenue from State Highway 30 (SH 30) to the E-470 Tollway (E-470). This technical report evaluates the effects of the Proposed Action and the No Action Alternative with respect to geologic resources.

1.1 Proposed Action

The Proposed Action would extend the 6th Avenue Parkway for approximately 2 miles along a new alignment, connecting existing 6th Avenue/SH 30 to the west with the existing 6th Avenue Parkway at E-470 to the east. This would close a gap in the existing major arterial street system, reducing out of direction travel and improving the efficiency and reliability of the transportation system. The Proposed Action would be a six-lane arterial roadway with a raised median and sidewalks.

Six initial alternatives were developed and screened through three screening levels to identify the Proposed Action. The alternatives screening is summarized in **Appendix A1** *Alternatives Technical Report* of the EA. Details of the Proposed Action are presented in **Appendix A2** *Conceptual Design Plans* of the EA.

The Proposed Action is shown on **Figure 1**. Major elements of the Proposed Action are identified by number from west to east on **Figure 1**, and include the following:

Element 1. Tie into existing 6th Avenue/SH 30: 6th Avenue/SH 30 is an existing two-lane arterial. At the western end of the Proposed Action, a signalized "thru-tee" type intersection would be constructed connecting the Proposed Action roadway to existing 6th Avenue/ SH 30. This new signalized intersection would include bypass lanes for the eastbound SH 30 through movement or a thru-tee signalized intersection with bypass lanes for both the eastbound SH 30 through movement. The tie-in would be an urban curb and gutter section with three 12-foot travel lanes in each direction to connect to future 6-lane section to the west. A 10-foot sidewalk would be located on both the north and south sides of the roadway.

Element 2. Triple Creek Trail realignment and connections: A portion of the existing Triple Creek Trail would be realigned and would pass beneath the Proposed Action roadway which would be on a bridge at this location (see Element 3 in **Figure 1**). The Triple Creek Trail would be connected to 6th Avenue via a spur trail to the sidewalk constructed along the south side of the new roadway. The Triple Creek Trail is a 10–foot wide soft surface trail that serves equestrians, bicyclists and pedestrians. The realigned portion would match the existing width and surface. A 10-foot sidewalk on both sides of the bridge (Element 3) would provide connections to the trail. The southern terminus of the trail is currently at the Coal Creek Arena, and further extension to the south is planned by the City of Aurora.

Element 3. Roadway bridge over Sand Creek: Immediately east of the new intersection with existing 6th Avenue/SH 30 (Element 1 in **Figure 1**), the roadway would be elevated onto a six-lane bridge crossing over Sand Creek and its associated floodplain/floodway, and over the Triple Creek Trail. The bridge length and profile would be set to minimize impacts to Sand Creek, while still providing a minimum 10-foot vertical clearance over the Triple Creek Trail. The bridge would have a median and sidewalks. The bridge would be approximately 680 feet in length with 5 variable length spans supported on four piers. The bridge would be

designed to be compatible with the surrounding environment and to allow wildlife connectivity along Sand Creek and the Triple Creek Trail.

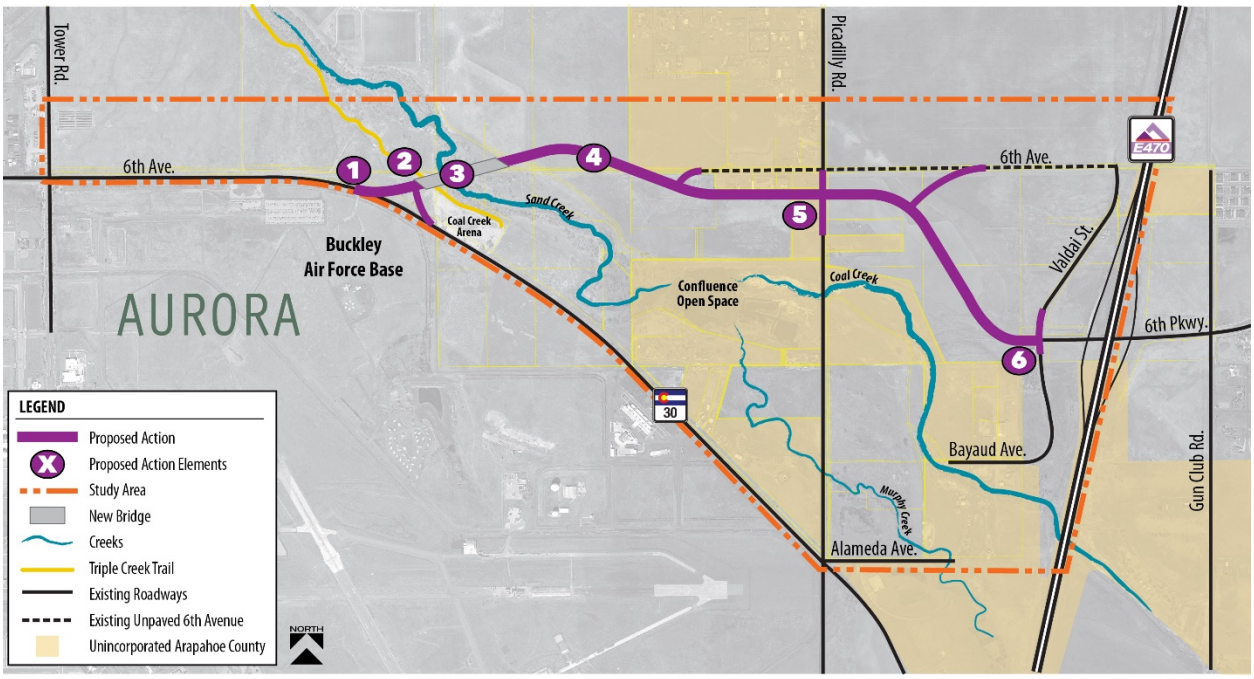
Element 4. 6th Avenue Parkway arterial roadway: The 6th Avenue Parkway extension would consist of a 144-foot wide, six-lane arterial roadway (three lanes in each direction) with a raised vegetated median. There would be curb and gutter and 10-foot wide sidewalks on the north and south sides of the roadway. The Proposed Action would provide two new access connections from the Proposed Action to two existing portions of 6th Avenue. One of these connections would provide access to the existing residences along unpaved 6th Avenue, west of Picadilly Road. The second connection would extend northeast from the Proposed Action to unpaved 6th Avenue to areas planned for development east of Picadilly Road.

Element 5. Intersection with Picadilly Road: The Proposed Action roadway would cross Picadilly Road, which is an existing north-south road. A signalized intersection would be constructed at this location. Picadilly Road is currently two lanes, but the City of Aurora anticipates that expansion to six lanes would occur in the future as a different project. Therefore, the intersection would be configured such that future expansion of Picadilly Road to six lanes can be accommodated and is not precluded.

Element 6. Tie into existing 6th Avenue Parkway at E-470: On its eastern end, the Proposed Action roadway would tie into the existing E-470 interchange, which currently truncates at this location, forming a connection with the existing 6th Parkway to the east of the interchange. The intersection tie-in at Valdai Street and 6th Avenue Parkway would be signalized. This connection would allow access from the west via the Proposed Action to the E-470 interchange and to the existing 6th Avenue Parkway extending to the east of E-470.

In addition to these transportation elements, the Proposed Action would include permanent roadway stormwater drainage with water quality features for roadway runoff and accommodate offsite stormwater flows. Details of drainage and water quality features are presented in **Appendix A6** *Floodplains and Drainage Assessment Technical Report* of the EA.

Figure 1 Proposed Action and Study Area



Note: Numbers in graphic correspond with text above.

1.2 No Action Alternative

If the Proposed Action is not selected for implementation, there would be no improvements made to 6th Avenue beyond the existing and committed transportation system. The No Action Alternative was carried forward as a baseline comparison for environmental analysis purposes.

2. GEOLOGIC RESOURCES ASSESSMENT METHODOLOGY

This report summarizes existing study area conditions, soils and geology in the Study Area, and describes the consequences of the No-Action Alternative and the Proposed Action. Possible geology-related impacts that are important to consider include:

- Topographic changes which lead to other potential adverse impacts such as slope stability, excessive settlement, changes in the groundwater conditions, and visual impacts (e.g., permanent cut and fill slopes).
- Substantial settlement and/or subsidence due to past underground mining activities
- Prevention of the recovery of significant mineral resources
- Significant erosion or siltation
- Exposure of people or structures to major geologic hazards

The study was performed, in part, by a review of the existing literature and maps including the Fitzsimons Quadrangle, Colorado, 7.5 minute series (topographic); Coal Creek Quadrangle, Colorado, 7.5 minute series (topographic); Soil Survey, Arapahoe County, Colorado Surficial Geologic Map of the Denver 1^{o} x 2^{o} Quadrangle, Colorado, 2001 (Moore, Straub, Berry, Baker and Brandt); Geologic Map of the Denver 1^{o} x 2^{o} Quadrangle, North-Central Colorado, 1981 (Bryant, McGrew, and Wobus); Earthquake Potential in Colorado, C.G.S., 1981 (Kirkham and Rogers); Preliminary Quaternary Fault and Fold Map and Database of Colorado, C.G.S., 1998 (Widmann, Kirkham, and Rogers); Schwochow, Shroba, Wicklein Atlas of Sand, Gravel, and Quarry Aggregate Resources Colorado Front Range Counties (Schwochow, Shroba, and Wicklein). Information from these resources was augmented with our experience in the area.

Following the collection of the data, a drive-through tour of the study area was conducted by Kumar & Associates staff to observe the current study area conditions. No additional data collection or field investigations were performed.

3. AFFECTED ENVIRONMENT

This section summarizes the initial evaluation and investigation of the study area usage, soils, geology, and potential mineral resources for the natural and human-made setting at the Study Area.

3.1 Study Area Usage/Existing Conditions

The study area is located in portions of Section 1, 2, 3, 10, 11, and 12 Township 4 South, Range 66 West of the 6th Principal Meridian. The study area can generally be considered a rural area where study area usage is variable consisting of agricultural and pastureland, as well as various residential properties with out-buildings. The southern limits of the study area is bounded by SH 30, the Tower Road easement to the west, vacant parcels and residential development to the north, and the E-470 Toll Road to the east. North Picadilly Road bisects the study area in a south-north alignment with the alignment located 2 miles east of the Tower Road easement. A ½-mile of asphalt paved alignment for 6th Avenue currently exists west of North Picadilly Road. The 6th Avenue easement continues to the west and generally exists as a dirt surfaced trail.

The topography of the study area is generally gently to moderately rolling with the overall slope down towards the major drainage that cross the study area, with the drainages flowing to the west-northwest. Coal Creek and Murphy Creek enter the study area from the east with the confluence occurring approximately ¼-mile west of North Picadilly Road. Coal Creek and Murphy Creek merge to become Sand Creek which flows to the west-northwest. Culvert crossings for both creeks occur at North Picadilly Road. In addition to the culverts, North Picadilly Road is depressed at Coal Creek in order increase the crossing capacity during high flows in the creek. Near vertical banks approximately 10 feet in height exist along portions of the creeks.

3.2 Soils

The soils in the study area provide for various uses including agricultural and pastureland. Vegetation is abundant throughout the study area including natural grasses and weeds along the drainages including medium to large deciduous trees. Erosion and near vertical banks, as well as siltation and sedimentation occur along portions of the creek alignments.

Alluvial land-Nunn Series is present in the study area and is generally confined to the flood plain and terraces of the creeks. This series generally consist of loamy and sandy soils. The Nunn-Bresser-Ascalon Series occurs near the northeastern portion of the study area and are generally loamy soils that have a clayey to loamy subsoil. The majority of the study area is comprised of the Fondis-Weld Series which are loamy soils that have a clayey layer in the subsoil and are formed mainly in silty, wind-deposited material.

3.3 Geology

The overburden soils are variable across the study area. The soils within the study area primarily consist of sand, silt and gravel which are part of the Post Piney Creek Alluvium (Holocene to Late Pleistocene) transitioning to the Louviers and Slocum Alluvium (Late to Middle Pleistocene) in the eastern portion of the study area. The eastern portion of the study area, outside the drainages, is generally comprised of eolian (wind-blown) sand of the Holocene to Late Pleistocene era.

The study area is underlain by the bedrock of the Paleocene to Upper Cretaceous Denver Formation. The Denver Formation is comprised of yellowish-brown to grayish-olive fluvial tuffaceous claystone, siltstone and sandstone. The depth to bedrock at the study area is expected to be variable depending upon the historic scouring of the bedrock and resulting siltation within the drainage area. Depth to bedrock is generally expected to range from 15 to 40 feet with the deep depths occurring at the drainage crossings.

The swell characteristics of the overburden soils are expected to be non-expansive to low expansive with moderate to highly expansive bedrock at greater depths. Depth to groundwater will be controlled by flows in the creeks with at surface levels in the creek to greater than 20 feet well outside the flood plain of the creeks.

3.4 Subsidence

No underground mining occurred in the past which would lead to subsidence potential if it had occurred. Eolian (wind-blown sand) occurs at the study area which has the tendency of a small amount of collapse due to hydro-compression.

3.5 Faults and Seismicity

There are no known potentially active faults that lie within the limits of the study area. Historical records of earthquakes activity in Colorado go back as far as 1870, and only a few earthquakes have exceeded an earthquake magnitude of 5.0. The study area is located in the Plains Seismotectonic Province. The estimated magnitude of maximum credible earthquakes within this province is estimated to range from 5.5 to 6.0 (Kirkham and Rogers, 1981).

3.6 Sand and Gravel Resources

According to the Sand, Gravel, and Aggregate Resources Map (Schwochow, Shroba, and Wicklein), the study area falls within multiple landforms. Following Sand Creek/Coal Creek from northwest to southeast, the study area consists of wind-deposited sand, stream terrace deposit (sand), and floodplain deposit. The map also notes an abandoned gravel pit within the study area, in the northwest ¼ of Section 12.

Although alluvial sand and gravels occur in the study area, they are likely of low value as a source of commercial grade aggregate.

4. IMPACT EVALUATION

4.1 Methodology for Impact Evaluation

Based on the information presented above, the primary soils and geologic hazards that could affect the Proposed Action are erosion, low swelling clay soils, and hydro-compression of eolian sands. The consequences of these conditions on the No-Action Alternative and the Proposed Action are summarized below.

4.2 No Action Alternative

The No-Action Alternative would not involve any new construction. Therefore, this alternative would not be affected by soils and geologic conditions in the area.

4.3 Proposed Action

The Proposed Action would require a multi-span bridge structure over Sand Creek near the western end of the alignment along with an intersection at North Picadilly Road. Structures and the roadway that would be constructed under the Proposed Action could be affected by the low expansive clays, hydro-compression of eolian sands, and could also be affected by and/or cause erosion.

5. MITIGATION MEASURES

For the Proposed Action, a project-specific geotechnical investigation will be conducted and the results will be used for preliminary and final design. The impact from low expansive clays and hydro-compression of eolian sands will be minimized and/or mitigation through proper design. The potential for erosion will also be minimized and/or minimized through proper design, and the erosion that currently exists in the channel alignments will be mitigated, where appropriate, through bank stabilization and/or revetment.

6. LIMITATIONS

This study has been prepared in accordance with generally accepted geological and geotechnical engineering practices in this area for use by the client for conceptual design and planning purposes. The preliminary conclusions and recommendations submitted in this report are based upon our observations during the study area reconnaissance and literature search. Additional investigations must be conducted for final design.

7. REFERENCES

Arapahoe County. Soil Survey.

Bryant, McGrew, and Wobus. 1981. Geologic Map of the Denver 1^{o} x 2^{o} Quadrangle, North-Central Colorado

Kirkham and Rogers. 1981. Earthquake Potential in Colorado, C.G.S.

Moore, Straub, Berry, Baker and Brandt. 2001. Colorado Surficial Geologic Map of the Denver 1^{o} x 2^{o} Quadrangle, Colorado.

Schwochow, Shroba, and Wicklein. Schwochow, Shroba, Wicklein Atlas of Sand, Gravel, and Quarry Aggregate Resources Colorado Front Range Counties.

US Geological Survey, Coal Creek Quadrangle, Colorado, 7.5 minute series (topographic).

US Geological Survey, Fitzsimons Quadrangle, Colorado, 7.5 minute series (topographic).

Widmann, Kirkham, and Rogers. 1998. Preliminary Quaternary Fault and Fold Map and Database of Colorado, C.G.S.

Appendix A Resource Impact Table

Resource	Context	No Action Alternative	Proposed Action
Geologic Resources and Soil	Geology of the study area generally consists of aeolian sands and fluvial sand and gravel deposits, underlain by Denver Formation bedrock. The depth to bedrock is expected to range from approximately 15 to 40 feet.	No impact	Would require a multi-span bridge structure over Sand Creek near the western end of the alignment along with an intersection at North Picadilly Road. The bridge structure, the roadway and associated facilities such as drainage features that would require excavation for construction be constructed under the Proposed Action could be affected by the low expansive clays, hydro-compression of eolian sands, and could also be affected by and/or cause erosion.

Appendix B Resource Mitigation Table

Mitigation Category	Proposed Action Impact	Mitigation Commitments for the 6th Avenue Extension Project	Responsible Branch	Timing/Phase that Mitigation will be Implemented
Geologic Resources and Soil	Structures and roadway could be affected by the low expansive clays, hydro-compression of eolian sands, and could also be affected by and/or cause erosion.	A project-specific geotechnical investigation will be conducted and the results will be used for preliminary and final design. The impact from low expansive clays and hydro-compression of eolian sands will be minimized and/or mitigation through proper design. The potential for erosion will also be minimized and/or minimized through proper design, and the erosion that currently exists in the channel alignments will be mitigated, where appropriate, through bank stabilization and/or revetment.	City of Aurora	Design Construction