

**TASK ORDER SCOPE OF WORK  
EASTERN PLAINS TIMBER BRIDGE REPLACEMENT  
ENGINEERING SUPPORT SERVICES**

CONTRACT TYPE  
 Specific Rate of Pay   
 Cost Plus Fixed Fee   
 Other

CONTRACT DATE: April 11, 2019

PROJECT NUMBER: FBR R 400-371

PROJECT LOCATION: Eastern Plains Timber Bridge Replacement BE

PROJECT CODE: 23010

***Background and Purpose***

Region 4 (Sterling Residency) requires design services for the replacement of six (6) timber structures in eastern Colorado. Based on discussions with Region 4 staff, CDOT is requesting engineering design services to compile the complete set of plans including the storm water management sheets, specifications, and estimate costs that are required for advertisement by CDOT. The project delivery method will be CMGC. The table below indicates the structure, location, and services required:

Bridge Location						Services Required						
STR	HWY	Town	MP	Region	BE/Non BE	Roadway Design	Bridge Detail	Hyd Engeer.	Traffic Design	Survey Lidar	Utilities/SUE	ROW
C-22-K	6	Brush	372.8	4	BE	x	x	x	x	x	x	x
D-24-O	34	Akron	198.8	4	BE	x	x	x	x	x	x	x
D-25-E	61	Otis	3.3	4	BE	x	x	x	x	x	x	x
*	34	Akron	206.05	4	Non BE							
D-28-D	34	Laird	257.9	4	BE	x	x	x	x	x	x	x
D-28-C	34	Laird	258.9	4	Non BE							
F-19-E	36	Byers	98	1	BE	x	x		x		x	x
F-20-L	70A	Byers	321.3	1	BE	x	x		x		x	x
F-20-J	40	Deer trail	349.7	1	BE	x	x		x		x	x
G-21-A	40	Agate	361.5	1	Non BE							

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## **SCOPE OF SERVICES**

### **Meetings**

#### **1. Task Order Meetings**

- CDOT and the consultant project managers (PMs) will meet at least monthly, to assess and monitor overall task order progress and budget, and make any needed decisions. Progress meetings can be held in-person or via teleconference.

#### **2. Project Meetings**

- A project kick-off meeting will be scheduled and conducted with appropriate stakeholders and specialty units. It is anticipated that the kick-off meeting will be held soon after the notice to proceed has been issued.
- An FIR meeting will be conducted in November 2019, with appropriate stakeholders and specialty units.
- An FOR meeting will be conducted in June 2020, with appropriate stakeholders and specialty units.
- Up to four (4) additional meetings, as needed, with CDOT project staff, stakeholders and specialty units. There will be a conference call meeting to be held once per month between CDOT and their specialties and the design consultants. It is anticipated that up to 5 more conference calls may be required as needed.

As directed and appropriate, the consultant will provide agendas and prepare exhibits, handouts, or other material for each meeting. The consultant will compile and distribute meeting minutes, and identify action items.

## ***COMPILATION OF PS&E PACKAGE***

### ***ROADWAY DESIGN***

In general, elements of roadway design are expected to include geometric design changes to accommodate any hydraulic and structural considerations. The bridges will be constructed using the Slide-In Method. On-site and Off-Site detours may be required. Roadway design will be provided by the consultant.

Design criteria for the effected corridor's will be developed based on the design speed and CDOT design criteria. It is anticipated that the horizontal alignment's will generally be maintained, but vertical geometry may be modified as necessary to accommodate hydraulic and structural conditions. Typical section elements such as shoulder widths and turning will be evaluated and incorporated into the design. Guardrail design will be developed based on the associated clear zone requirements.

The roadway designer shall attend all project meetings, both internal and external, where the roadway geometry will be a discussion topic. For the purposes of this scope of work, four (4) meetings and the Scoping, FIR, and FOR meeting are assumed.

Specific elements of roadway design are expected to include:

- a. Mainline Alignments
  - a. Geometric design changes to approximately 1000 LF of mainline
  - b. Develop horizontal and vertical geometry changes for mainline
  - c. Develop Roadway Cross sections and Typical Sections for reconstruction
  - d. Generate Removal Plans for asphalt and Bridge demolition
  - e. Compute earthwork, surfacing, and removal quantities
  - f. Tabulate quantities
- b. On-Site Detour's (if required)
  - a. Geometric design changes to approximately 1000 LF
  - b. Develop horizontal and vertical geometry changes for detour's
  - c. Develop Roadway Cross sections and Typical Sections for detour's
  - d. Compute earthwork, surfacing, and removal quantities
  - e. Tabulate quantities

An FIR Submittal will be prepared for the replacement of the bridge's. The FIR package will not include specifications and tabulations. Quantities and an opinion of probable cost will be prepared at FIR. The FIR package will include the following plan sheets:

- Title Sheet (the consultant)
- Standard Plans List (the consultant)
- General Notes (the consultant)
- Typical Sections (the consultant)
- Removal Plans (the consultant)
- Roadway Plan and Profile Sheets (the consultant)
- Detour Plan and Profile Sheets (the consultant)
- Roadway Cross Sections (the consultant)
- Detour Cross Sections (the consultant)
- Bridge Plan Sheets (see Bridge Design section of this scope)
- Hydraulics Sheets (see Hydrology and Hydraulics section of this scope)
- Floodplain Info Sheet (preliminary)
- Storm Water Management Plan Sheets (see Environmental section of this scope)
- Wetland Plan Sheets (if applicable)
- Utility Sheets
- Signing and Striping Sheets (see Traffic Design section of this scope) (the consultant)
- Standard Detail Sheets
- Preliminary Drainage and Hydraulic Design Reports (80% of Final)
- Digital media supporting calculation and design, including hydrologic and hydraulic models, CAD and GIS files, calculation spreadsheets and other software

An FOR Submittal will be prepared for the replacement of the bridge's. The FOR package to include plans, specifications, and estimate of probable construction costs. The following plan sheets will be included:

- Title Sheet (the consultant)
- Standard Plans List (the consultant)
- General Notes (the consultant)
- Summary of Approximate Quantities (the consultant)
- Tabulation Summaries (the consultant)
- Typical Sections (the consultant)
- Removal Plans (the consultant)
- Roadway Plan and Profile Sheets (the consultant)
- Detour Plan and Profile Sheets (the consultant)
- Roadway Cross Sections (the consultant)
- Bridge Plan Sheets (see Bridge Design section of this scope)
- Hydraulics Sheets (see Hydrology and Hydraulics section of this scope)
- Floodplain Info Sheet (final)
- Storm Water Management Plan Sheets (see Environmental section of this scope)
- Wetland Impact Plan Sheets (if applicable)
- Utility Sheets
- Signing and Striping Sheets (see Traffic Design section of this scope) (the consultant)
- Construction Traffic Control Tabulation (see Traffic Design section of this scope) (the consultant)
- Standard Detail Sheets
- Final Drainage and Hydraulic Design Reports (100%)
- Digital media supporting calculation and design, including hydrologic and hydraulic models, CAD and GIS files, calculation spreadsheets and other software used for design

Roadway specifications will also be prepared and provided to the consultant for inclusion into the overall specification package.

Comments from the FIR and FOR review meetings will be incorporated into the plan set to produce a For-Advertisement (PS&E) package to be advertised by CDOT. The PS&E package shall include: plans, project special provisions, any applicable reports, and bid schedule.

Assumptions:

- Specifications:
  - CDOT Roadway Design Guide (2018)
  - CDOT CADD Manual (2011)
  - CDOT Standard Specifications for Road and Bridge Construction (2017). Project special provisions will be developed for any items not included in the CDOT Standard Specifications or Standard Special Provisions.
  - American Association of State Highway and Transportation Officials Roadside Design Guide
  - American Association of State Highway and Transportation Officials, A Policy on the Geometric Design of Highways and Streets

- All plan sheets and design to be completed in Microstation/InRoads, Version SS4 and in accordance with the CDOT CADD Manual (2011).
- Summary of Approximate Quantities will be provided to CDOT at the FOR and Final Advertisement level for an estimate of approximate cost for construction.
- Design criteria for the corridors to be provided by CDOT (design speed, max super-elevation, ADT, DHV, % Trucks, etc.)
- Only one round of comments from the FOR meeting will be accepted and incorporated into For-Advertisement package, or until all Environmental comments have been addressed. The consultant will provide a comment tracking sheet for the FOR meeting.
- Comments from any entity except CDOT shall not be considered during any phase of this project, unless authorized CDOT.
- Tabulation summaries to include: earthwork, surfacing, removals/resets/adjustments, delineators, traffic items (see Traffic Design section of this scope), survey, and bridge items.
- ROW Ownership map (if required) shall be prepared by CDOT.
- No utility relocation design is included in this scope.
- Any environmental clearances or permits required for the bridge replacement shall be completed by CDOT.
- Lighting design is not part of this project.
- Any floodplain permits required for work in FEMA-regulatory floodplains or floodways, acquired by the consultant.

### ***BRIDGE DESIGN AND DETAILING***

Bridge design will be provided by CDOT Staff Bridge. the consultant will assist Staff Bridge by providing detailing of the bridge sheets based on the design criteria.

The bridge engineer shall attend all project meetings, both internal and external, where the bridge's will be a discussion topic. For the purposes of this scope of work, eight (8) meetings are assumed. The primary detailer assigned to the project shall have a minimum of 3 years of bridge detailing experience.

Specific elements of the Bridge design details are expected to include:

- General Information (by CDOT Staff Bridge)
- Summary of Quantities (by CDOT Staff Bridge)
- General Layout (by CDOT Staff Bridge)
- Typical Section and Profile Grade (by CDOT Staff Bridge)
- Engineering Geology
- Bridge Hydraulic Information
- Construction Layout
- Foundation Layout Details
- Abutment Plan and Elevation sheets
- Wingwall Details

- Pier Plan and Elevation
- Pier Details
- Girder Details Prestressed Concrete Slab (by CDOT Staff Bridge)
- Deck reinforcing Plan
- Deck Reinforcing Details
- Bridge Rail Type 10M Details
- Approach Slab Details
- Excavation and Backfill
- Mechanically Stabilized Backfill
- Bridge Deck Elevations (by CDOT Staff Bridge)

The consultant will develop a full set of quantity calculations for the bridge plans, in order to complete the quantity check for the bridge plans. It is anticipated that one round of comments will be incorporated into the quantity check calculations to resolve differences between the quantity and quantity check set.

### ***GEOTECHNICAL ENGINEERING SERVICES AND PAVEMENT DESIGN***

Geotechnical and pavement design services will be provided by CDOT.

### ***HYDROLOGY AND HYDRAULIC ENGINEERING AND FLOODPLAIN MANAGEMENT***

Hydrology and Hydraulics data will be collected, analyzed, and reported by the consultant for the six structures located in Region 4. This includes analysis and design of effected drainage locations.

Specific elements of Hydrology/Hydraulic Engineering are expected to include:

a) Floodplains Assessment

- Assessment of Potential Floodplain Impacts of the Project  
The team will identify the types and nature and extent of potential impacts of bridge and roadway improvements on baseline (existing) flood risks and provide qualitative recommendations for the design team in order to mitigate those impacts to allowable thresholds established by local and state criteria. The consultant will summarize the potential impacts and mitigations in a memorandum.
- Initial Floodplain Orientation and Permit Requirements  
The consultant will gather all the relevant information regarding the FEMA NFIP floodplains and floodways in the project area, to include available FIRM maps, FIS reports, GIS files, hydraulic model files and other available, useful information. The team will contact the jurisdictional floodplain administrator for the associated Counties to discuss the governing floodplain ordinances, and the process, submittal requirements, fees and timelines for Floodplain Development Permits.
- Floodplain Information Sheet  
The consultant will prepare a Floodplain Information Sheet for the plan set. The team will:

- Show and clearly label the current effective 100-yr floodplain and floodway boundaries, the 500-year floodplain (as applicable), the existing 100-yr and 500-yr floodplain boundaries, and the proposed 100-yr and 500-yr floodplain boundaries.
  - Show and clearly label all cross sections and BFE lines published on the current effective FIRM (note; all elevations must be reported in the same vertical datum identified on the current effective FIRM)
  - Show and clearly label any existing fluvial hazards, buffer zones or erosion management zones
  - Show the limits of disturbance for all permanent and temporary activities, and label as such.
  - Show all ground survey point elevations in the same vertical datum identified on the current effective FIRM
  - Add notes to indicate the waterway name, jurisdiction and community number, panel number, date of current effective information, a sentence describing which local code requires permits, a sentence for permitting and no-rise compliance, and a note recognizing that flooding may occur outside the mapped Special Flood Hazard Area (SFHA)
- b) Topographic Survey for Floodplain/Hydraulic Modeling and Mapping:
- Aerial LiDAR mapping must be acquired for hydraulic analyses and merged with ground topography
  - Ground truthing of the LiDAR will be performed by the consultant.
  - Ground survey and structure survey will be collected and submitted in TMOSS format.
  - Ground survey will be performed for control of the aerial mapping as needed.
  - The LiDAR and ground survey data will be assumed to be collected in NAD83 State Plane Colorado North survey feet and in the CDOT Project Control for the horizontal projection and in NAVD88 for the vertical projection.
  - The consultant will coordinate with CDOT survey and the consultant to use the same horizontal and vertical systems.
  - Permissions to enter private property shall be performed by the Consultant.
  - Establish survey control in conformance with the CDOT Survey Manual for Class A Survey for the following structures:
    - C-22-K
    - D-24-O
    - D-25-E
    - D-28-D
- c) Survey Memorandum:
- The consultant will develop a memorandum summarizing the methods and results of the collection effort for the ground survey, and control data that is collected and set as part of this project.
- d) Hydrology/Hydraulic Engineering:

- *Hydrology Verification*
  - The consultant will verify flood hydrology that was used for the current effective floodplain mapping for the project area (as represented in the Flood Insurance Study) with CWCB or the flood hydrology that was completed as part of the 20865 US34 Wray project.
  - The team will compile the flood history that was collected as part of the 20865 project. The team will perform desktop reconnaissance, identifying relevant hydrologic/hydraulic information from CDOT's databases, from FEMA and CWCB resources and from public domain websites.
  - The data sought will include:
    - Accounts of past floods and associated damage, road overtopping, bridge debris collection, etc.
    - Historical bridge inspection reports and photos
    - Records of streambank protection and scour countermeasures installed throughout the study reach
    - Historical maps and aerial photographs showing the channel alignment and floodplain activities through time
    - Channel profile elevations and lateral alignments through time
  
- *Engineering Field Reconnaissance*
  - the consultant (2 people) will complete a project site visit over a half day to evaluate channel/overbank roughness coefficients, channel stability, vegetation, condition/adequacy of existing structures, Ordinary High Water Marks, allowable high water, etc.
  - If engineered riprap is present along the channel banks or at bridge abutments, the team will perform Wolman counts to characterize the gradation of the existing riprap to later determine suitability for re-use on the final project. If other revetments are present, the team shall categorize the type, size, configuration and existing effectiveness of non-riprap treatments.
  - The team will obtain stream bed samples for scour calculations.
  
- *Geomorphic Assessment of Stream Stability*
  - A qualitative evaluation of the morphology of the affected waterway at the bridge sites will start with a desktop analysis as part of a Level 1 qualitative geomorphic analysis defined in HEC-20. The desktop analysis will include an evaluation of historic and contemporary maps, ground and aerial photos, survey data from all sources, bridge plans and inspection records, utility plans for stream crossings, existing watershed plans and reports, geologic and geotechnical data, and hydrologic and hydraulic data and information. This data and information will be used to assess long term historical changes in river planform and channel geometry and help inform potential future changes in channel morphology and sediment transport capacity.



- The desktop analysis will also be used to help focus the detailed site reconnaissance on particular aspects or morphological characteristics that may be impacting the stability of the channel reaches associated with the bridges.
- In addition, historic as well as current or recent survey data and bridge inspection records will be used to evaluate vertical and lateral changes as well as changes in channel geometry and capacity.
- The team's geomorphologist will conduct a detailed site reconnaissance to document and map the existing morphology of the project reaches at, upstream, and downstream of the bridge.
- The site reconnaissance will be conducted based on the guidance provided in HEC-20 and the Stream Reconnaissance Handbook by Lagasse, Zevenbergen, Spitz and Arneson (2012). The site reconnaissance work will include documenting the general sediment caliber and character of the channel bed and banks where visible, delineating existing bank protection, delineating any structures in the channel, exposed utility crossings, sand and gravel bars, inset berms/benches, outfalls, railroad embankments and crossings, and documenting any other man made feature in or along the channels that could impact or are influencing the channel morphology.
- Stream Reconnaissance Record Sheets (HEC-20) that include detailed field notes and georeferenced ground photos using GeoJot+ will be used to document existing conditions. Once the site visit has been conducted, the completed Record Sheets and georeferenced photos will be compiled, formatted, and imported into the project database.
- Using the data and information obtained in the desktop and field reconnaissance a Level 1 qualitative geomorphic analysis of the project reaches will be conducted per the guidelines defined in HEC-20.
- Following completion of the desktop analysis, field reconnaissance, and geomorphic analysis, a memo summarizing the findings of the Level 1 Qualitative Geomorphic Analysis for the reach will be developed. The memo will document all findings of the geomorphic analysis and will include recommendations for improved sediment transport and flood flow conveyance, if necessary, as well as channel and stream bank maintenance and stabilization within the vicinity of the bridge.

e) Hydraulic Modeling:

- *Hydraulic Analysis of Existing Conditions*
  - the consultant will develop hydraulic model simulations of the floodplains existing conditions through the project areas.
  - Two-dimensional hydraulic modeling will be performed using SMS 13 for the 10-year, 50-year, 100-year and 500-year flood recurrence intervals, and for the incipient overtopping and/or pressure flow conditions. The modeling will incorporate the updated survey and topographic data and will encompass the full floodplain through the full model limits.

- *Hydraulic Analysis of Proposed Design Alternatives*
  - The consultant will develop two-dimensional hydraulic model simulations using SMS 13 to account for the multidirectional flow of the waterway at all crossings. These two-dimensional models will inform any existing regulatory one-dimensional models, if they exist. Existing one-dimensional models may require updates to proposed conditions.
  - All hydraulic modeling will allow hydraulic assessments of these key features for infrastructure constructed in the natural environment:
    - Changes in flood elevations, compared to existing conditions, for various flood recurrence intervals, not just along a single profile but throughout the affected floodplain area (not to exceed 0.50 ft of rise in 100-year storm events)
    - Changes in channel velocity and shear stress, compared to existing conditions
    - The freeboard provided above the design flood event, compared to other design alternatives
    - Overall motorist safety, traffic serviceability, and emergency ingress and egress during flooding compared to other design alternatives
    - Scour and stream instability risk factors, compared to existing conditions and other design alternatives
    - Overall hydraulic efficiency and effectiveness of existing and proposed structures and roadway features
  
- *Hydraulic Analysis of Temporary Conditions*
  - Additional hydraulic modeling will be performed as needed to assess the hydraulic and floodplain impacts of worst-case temporary conditions during construction. It is assumed that two additional models will be developed for temporary conditions, for the 10-, and 100-year floods.
  
- f) Hydraulic Design of Replacement Crossings:
  - The consultant will use the results of the hydraulic analysis described above, along with the geomorphic evaluation, to develop the hydraulic design of the replacement crossing including:
    - Bridge length and span lengths
    - Freeboard requirements and low chord profiles
    - Scour evaluation and countermeasure design
  
- g) Support of Plan Set Development:
  - the consultant will support this effort by providing:
    - Bridge Hydraulic Information Sheets in Microstation/InRoads SS4 format Scour elevations and scour profile sketches
    - Plan view and sectional sketches as needed to convey the design intent of scour countermeasures
    - Special provisions as needed for scour countermeasures

- The consultant PE stamp on drawings predominantly featuring the consultant recommendations
  - Digital copies of CAD and GIS files, and terrain model surfaces used in two-dimensional hydraulic analyses
- h) Preliminary Hydraulic Design Report (80% of Final):
- the consultant will prepare a Preliminary Hydraulic Design Report in accordance with CDOT Drainage Design Manual:
    - Introduction, Hydrology, Hydraulic Analysis Existing Structures and Design Discussion sections should be close to final at this level. Design Discussion should include CDOT and local criteria the project intends to meet.
    - The narrative should include a description of the development and validation of the two-dimensional model simulations and results for existing conditions, the design alternatives examined, and the selected design
    - The narrative should describe the approach taken to scour calculations and summarize the results of the 50-, 100- and 500-year recurrence intervals, and for worst-case scour conditions possibly encountered at incipient overtopping and/or pressure flow conditions.
    - Recommended design should be preliminary at this level and progress through final design.
    - All design assumptions and related design decisions shall be documented.
    - The Appendix shall contain:
      - Drainage basin map
      - Geomorphic assessment memorandum
      - Data used in the hydrology verification
      - Relevant output graphics and tables from two-dimensional modeling in SMS
      - Scour calculation worksheets
      - Countermeasure design calculation worksheets
      - Digital media supporting calculation and design, including hydrologic and hydraulic models, CAD and GIS files, terrain models, calculation spreadsheets and other software
- i) Floodplain Modeling Memorandum:
- To support the pursuit of floodplain development permits and/or FEMA map change requests, and to provide thorough documentation of the floodplain analysis and results in accordance with the Urban Drainage Flood Control District (UDFCD) Guidelines and Checklist, the consultant will prepare a Floodplain Modeling Memorandum to include the following efforts:
    - Provide narrative of the floodplain modeling effort and results including the comparison of duplicate effective, existing conditions and post-project flood profiles
    - Include the Floodplain Information Sheet in 11x17, and all other hydraulic mapping information relevant to requisite permits and certifications
    - List and identify all applicable ordinance or code, and describe how those specific standards were addressed and resolved

- Discuss all alternatives analyzed, analysis results, recommendations, and final design direction
  - Record all relevant current effective floodplain information, like community number, panel number(s), effective date(s), waterway names, cross sections, BFEs, and contact name and information for local floodplain administrators contacted for the project.
  - Provide a copy of approved floodplain development permits and floodway no-rise certifications
  - Identify all construction and as-built stipulations required from approved permits and certifications
  - Provide all background survey information on 11x17 or smaller certified by a P.L.S. licensed in Colorado
  - Identify future actions required prior to CDOT project close-out
  - Provide floodplain work maps of existing conditions and post-project conditions including topographic contours, inundated area, cross section locations, base flood elevations, floodway encroachment limits and standard notes
- j) Floodplain Development Permit Applications:
- The consultant will prepare and submit application for a Floodplain Development Permit for the crossing replacement work. Application will be made to the County Floodplain Administrator.
- k) Field Inspection Review (FIR):
- The consultant PM and/or a designated project engineer will attend the FIR meeting.
- l) Final Design (FOR):
- The consultant PM and/or a designated project engineer will attend the FOR meeting.
  - Based on the FIR decisions, the consultant will review and update as necessary the data and information developed under the preliminary hydraulic investigation.
  - The consultant will finalize the hydraulic analyses as may be needed to reflect changes to the replacement crossing designs as a result of FIR decisions. It is assumed that the modeling changes will be limited in scope and will involve final model runs of only the selected design condition (e.g. not existing conditions or alternative analyses).
  - The consultant will update and finalize the hydraulic design information developed under the preliminary design phase. Including:
    - Finalize hydraulic analysis elevations, flow lines, water surface profiles and hydraulic information.
    - Finalize configuration, size and skew of major structures and channels.
    - Coordinate final water surface profiles and final low chord elevation for selected structures.
    - Finalize scour calculations and provide scour profiles for 50-, 100- and 500-year scour for the bridge, and worst-case scour generated by incipient overtopping and/or pressure flow conditions.

- Finalize channel erosion protection limits and scour countermeasures for selected structures and provide appropriate details.
- The consultant will finalize the data, sketches, and special provisions developed in the preliminary design phase as needed to reflect changes resulting from FIR decisions.
  - The consultant will review and finalize all sections of the Final Drainage and Hydraulic Design Reports and include the Bridge Hydraulic Information Sheets and Floodplain Info Sheet from the plan set.
  - The final report will be submitted to the consultant for distribution with all digital media supporting calculation and design, including hydrologic and hydraulic models, CAD and GIS files, terrain models, calculation spreadsheets and other software
- If the post-project floodplain analysis changes as a result of FOR decisions, the consultant will update and finalize the Floodplain Modeling Memorandum and will submit the updated report and updated work maps to the consultant and jurisdictional County Floodplain Administrator.

m) Internal Quality Control and Quality Assurance

- the consultant will implement a quality assurance plan and perform quality control review prior to submitting final products to the consultant.

Refer to the hydraulic attachment #1 provided for more details.

***ENVIRONMENTAL ENGINEERING***

CDOT will provide the environmental portion of this project. The CDOT Region Environmental Manager will complete technical analyses for resources listed on the front page of Form 128. The necessary documentation will be provided for each environmental resource. CDOT will also provide Storm-water Management Plans and any special provisions regarding environmental issues.

***TRAFFIC DESIGN***

The signing and striping, traffic control, together with a peer review of the PS&E package will be completed by the consultant.

Traffic design services will include:

- Signing and striping
- Construction phasing
- Tabulations

***Signing and Striping***

Signing and pavement markings for the roadways and temporary detours will be completed by the consultant and Associates based on the 2009 MUTCD and latest CDOT S-Standards. the consultant will evaluate the existing signing and striping and make recommendations for

improvements, if needed. Placement of delineators will also be considered and tabulated. Signing and striping modifications will be reviewed with Region 4 Traffic for concurrence.

### ***Traffic Control***

The consultant will evaluate construction phasing for the construction at each site. A schedule of traffic control devices and traffic control specifications will be prepared at final design for bidding purposes. Construction phasing plans and device plans are included in this scope of work. Work zone and construction staging needs, traffic volumes, and the Region 4 Lane Closure Strategy will be evaluated to develop an approach to construction phasing that can be used to develop traffic control quantities.

### ***Project Management and Coordination***

The consultant will attend the following meetings in support of the consultant team:

- Formal Review Meetings – Scoping, FIR and FOR
- Design team meetings with the consultant (4 in person meetings)

### ***Prepare FIR/FOR and PS&E Package***

The following plan sheets are anticipated for traffic related items:

- Signing and Striping Plans - the consultant
- Signing and Striping Tabulations - the consultant
- Traffic Control Tabulation - the consultant
- Quantities will be calculated and provided in spreadsheet format. Tabulations signing and striping (provided by the consultant) will be provided.
- Traffic specifications will be prepared at FOR and PS&E including Traffic Control Plan General.

### ***SURVEYING***

The consultant will attend meetings with the appropriate agencies. One meeting is anticipated. As part of this task the consultant will develop work plans, obtain necessary Permission to Enter, mobilize staff and keep the Consultant Manager and CDOT Project Manager updated relative to the survey and aerial mapping teams' progress or any concerns.

### **UTILITIES – Subsurface Utility Engineering (SUE) Investigation**

#### **Services to Be Provided By the State of Colorado:**

A. Subject to availability, the services to be provided or performed by the State of Colorado (State)

will include, but not be limited to, the following items:

- a. Schematic designs
- b. Provide existing data file, when available, to include but not limited to:
  - i. Existing topographic and physical feature data, graphic files, roadway design/geometry, survey control

- ii. Roadway construction plans, documents for current and/or past projects;
- iii. Right-of-Way mapping;
- iv. Available interface data for any projects adjacent to, crossing, and/or within the immediate area of the defined project limits;
- v. If available, Subsurface Utility Engineering (SUE) data and utility ownership/facility data from past projects within the project area;
- vi. Planimetric layouts and/or related information; and
- vii. Issuance of State Utility Permit
- c. Applicable general notes, special specifications, and special provisions.
- d. Approved State design standard drawings, standard summary and border sheets (i.e., blank summary tables, blank plans, and profile sheets with title blocks, etc.).
- e. In situations beyond the control of the SUE Consultant, provide assistance in obtaining required data/information from other local, regional, State and federal agencies.
- f. Provide timely review, comment or direction, as required, to aid the SUE Consultant in completing an assigned task or maintaining the established project schedule.
- g. Electronic Files: If not readily available online, the State may, at the discretion of the State's Project Manager or Region Utility Engineer, provide graphic file data, standards, font libraries, and Micro Station cell libraries, etc. as required to provide confirmation to the State's graphic standards.

**Services to Be Provided By the Engineer:**

- B. A Professional Engineer licensed in the State of Colorado (Consultant) shall conduct, document, stamp and seal a Subsurface Utility Engineering (SUE) investigation of the project area to determine existing utility conditions within the project limits. As part of the SUE investigation the Consultant will:
- a. contact all utility providers and collect available utility records within the project area;
  - b. Provide guidance as to what Utility Quality Level to attempt for any utilities that the Engineer believes do not need to be depicted at QLB
  - c. Attempt to identify all known and unknown utilities except as noted above within the project area at QLB, and depict those utilities at their actual achieved Utility Quality Level,
  - d. From a synthesis of all information, depict the following attributes on the plans or within the SUE report: ownership, type, size, encasement, material.
- C. Should utility relocation be required after designers make prudent attempts to avoid relocations, Engineer shall research, request, and furnish copies of utility easements (public and private) and utility franchise agreements to determine conditions under which the utility was established in its present location (e.g. by revocable permit or by a privately owned easement).
- D. The utility investigation requirements are to meet Quality Levels A and/or B, as required under CI/ASCE 38, and to the horizontal designation precision defined herein.
- E. The Consultant shall perform engineering services consisting of Subsurface Utility Engineering on the following project:

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- a. The work will include a Subsurface Utility Engineering (SUE) Investigation to determine attributes and horizontal and vertical location of utilities:
  - i. The Consultant shall prepare a sealed PDF plan set, plus a working MicroStation (DGN) file(s) covering the specific work location, meeting the State’s standards and specifications.
  - ii. The Consultant shall complete a Quality Level B SUE investigation as directed by CDOT, as shown in the attached .dgn or .pdf files. *Note that the investigation area provided within the .dgn files is different than the area shown on Exhibit A Location Map. Use Exhibit A Location Map for SUE investigation area estimating.*
  - iii. The Consultant shall complete up to xxx (xx) Quality Level A Test Holes, at locations specified by CDOT after recommendations from Engineer and task designers following the examination of QL-B data on utility crossings, for verification of utilities in conflict with the proposed design.
  - iv. The Consultant shall complete overhead inventory within the area defined on the Location Map (Exhibit 1)
  - v. A sealed Subsurface Utility Engineering Report shall accompany the sealed plan set(s)
  - vi. A list of known utility providers is also attached.

### **Project Goals**

For the purposes of this proposal, a utility is defined as: A privately, publicly, or cooperatively owned above or underground line, facility, or system for producing, transmitting, or distributing communications, cable television, power, electricity, light, heat, gas, oil, crude products, water, storm water, irrigation, steam, waste, or any other similar commodity, including any fire or police signal system, street lighting system, or directional / instructional transportation related system or sign.

**A. Quality Level B (QL-B)** involves the use of Quality Level D and C methods of utility investigation

plus the use of surface geophysical techniques under the direction of a Professional Engineer licensed in the State of Colorado to determine the existence and horizontal position of underground utilities with a precision of *three inches* from the exterior sides of the line, facility, or system. This activity is called “designating.” The information obtained in this manner is surveyed to project control. Two-dimensional mapping information is obtained. This information is usually sufficient to accomplish preliminary engineering goals.

**B. Quality Level A (QL-A)** involves the use of Quality Level D, C and B methods of investigation plus

the use of minimally intrusive excavation methods at critical points to determine the precise horizontal and vertical position of underground utilities, as well as the type, size, condition, material, and other characteristics. The excavation and data documentation activity is called "test holing" (sometimes called Locating). It is the highest level of utility certainty presently available. When surveyed and mapped, precise plan and profile information is available for making final design decisions.



C. **3D Modeling** involves the use of CADD to depict the precise horizontal and vertical profile of each utility in areas of high conflict. This tool is only utilized in areas where precision locating and design of utilities is essential for project success.

### **Subsurface Utility Engineering Investigation Methodology**

#### **A. Project Scoping**

- a. This work is included in the Project Scoping Plan Set for the Project Scoping meeting
- b. Quality Level B SUE Investigation, as defined above
- c. Use existing survey project control data, GIS data, plans and electronic data from utility providers, and field survey to prepare utility design plans that meet ASCE 38 Quality Level B standards.

#### **B. FIR (Field Inspection Review)**

- a. This work is performed at 30% design, prior to FOR Plan development
- b. First iteration of Quality Level A SUE Investigation

#### **C. FOR (Final Office Review)**

- a. Second iteration of Quality Level A SUE Investigation
- b. 3D Modeling – when required, this work is performed at 60% design, during FOR Plan development. 3D modeling may require additional utility investigations including MCGPR and non-excavation depth determinations.

#### **D. PS&E (Plans, Specifications & Estimate)**

- a. Ready for Utility Clearance
- b. Ready for Advertisement

### **Deliverables**

#### **A. Project Scoping:**

- a. The end product (the CADD file or project plans and SUE Report) contains the results of the SUE investigation for utilities, ownership, type, and size of the line including any special conditions of the line.
- b. The CADD file or project plans should depict the lines following CDOT utility line type standards and colors, include all utility easements, and CDOT power source locations and the status of any easements.
- c. Easements shown on plans
- d. Through outreach to the utility providers, the consultant will produce a utility contact list: Including utility provider, contact name, email address, mailing address, work & cell phone numbers. These are to be shown in the utility general notes and specifications.
- e. The utility plans sheets will include the utility line work with proper designation colors.
- f. The consultant will include services for water, sewer, electrical, communications and natural gas.
- g. The consultant will differentiate transmission main lines and secondary feed lines with labels when possible.
- h. The consultant will distinguish lines between CDOT owned facilities, local agency facilities and utility provider facilities.
- i. The consultant will produce utility plan sheets for review with utility providers including an oversize plan sheet for coordination and meetings.
- j. The consultant will include known easements for the utility providers located inside, and adjacent to, CDOT ROW on the utility plans.

- k. The consultant to provide a table for each utility provider that includes size and type of the providers' facilities.
  - l. Include manhole rim labels and inverts in and out labels that match CDOT project datum elevations.
- B. FIR (Field Inspection Review)**
- a. The consultant will provide a matrix of potential utility conflicts
  - b. The consultant will provide test hole services
  - c. The consultant will provide a test hole map for survey.
  - d. The consultant will provide a test hole chart and incorporate test hole location into the FIR Utility Plans
  - e. The consultant will update utility plan sheets for review with utility providers including an oversize plan sheet for coordination and meetings
  - f. The consultant will update the utility plans through coordination with utility providers to verify storm and sanitary sewer rim elevations, inverts in and inverts out, include pipe size and pipe material. Include labels for other sewer appurtenances, lift stations, drop manholes, vents and force mains, elevations for water valve boxes including size, water line pipe size and water line pipe material. Include labels for other water appurtenances, air vacuums, PRV vaults, vents and curb stops. Verify dry utility lines and show labels for vaults, pull boxes, manholes, drop down transformers and other providers attached to all overhead utility line poles.
- C. FOR (Final Office Review)**
- a. Produce Utility notification letters for Region Utility Engineer.
  - b. The consultant will calculate quantities and produce a tabulation of utility pay items.
  - c. The consultant will incorporate on the utility plan sheets all relocation work.
  - d. The consultant will provide Utility 3-D modeling in high conflict areas where precision placement of utilities during the design phase is essential.
  - e. The utility plans sheets will include the utility line work with proper designation colors.
  - f. The consultant will include utility notes and specifications.
  - g. The consultant will complete FOR design for utility plans.
  - h. The consultant will finalize the identification of existing utilities (both wet and dry) that will be impacted by design and finalize the existing utility plans with call-outs indicating which existing utilities are impacted by the project.
  - i. The consultant will work with utility providers to get estimates for utility work.
  - j. Cross section sections will include utility crossings and ROW lines.
  - k. The Consultant will provide MicroStation compatible electronic files of utilities for inclusion in other plan sheets.

## **Utility Coordination**

### **A. Scoping**

- a. The Consultant will be responsible for obtaining all permits for work within CDOT ROW related to SUE investigations.
- b. Coordination of scoping meetings with all utility providers and meeting minutes.
- c. Request and receipt of utility maps and easements from utility companies will be coordinated with CDOT project manager and with CDOT region utility engineer.
- d. The consultant will conduct a review of utility information, obtain existing utility

mapping from the utility providers.

e. Request franchise agreements from the local agencies.

f. Request any secondary utility provider attachments to the main utility provider's facility.

g. Consultant to work with surveyor to adjust datum to match CDOT project

**B. FIR (Field Inspection Review)**

a. Coordination of FIR meetings with all utility providers and meeting minutes. (Office and Field)

b. Review utility matrix conflicts with CDOT RUE and work on plan of action.

c. Review test hole map with CDOT.

d. The consultant will coordinate with CDOT, test hole company and survey company on test hole schedule.

e. The consultant will coordinate with the CDOT region utility engineer on utility notes and specifications.

f. The Consultant will be responsible for obtaining all permits for work within CDOT ROW related to SUE investigations.

g. The consultant will coordinate with project manager and CDOT RUE and affected utility companies on the FIR utility plans for distribution.

**C. FOR (Final Office Review)**

a. Coordination of FOR meetings with all utility providers and meeting minutes. (Office and Field)

b. Coordination with the wet and dry utility providers on the potential relocation areas

c. The consultant will coordinate with project manager and CDOT region utility engineer and affected utility companies on the FOR design.

### ***RIGHT-OF-WAY***

The consultant will acquire the appropriate CDOT Special Use Permit (CDOT 1233) to survey within the CDOT's Rights-of-Way. If ROW is needed for any of these sites, CDOT will determine if additional services are necessary and a new task order will be developed.

### ***TMOSS SURVEY (GROUND)***

The consultant will obtain, by field methods, existing visible planimetric features and topography at a one-foot (1') contour interval for the above-mentioned six structures. The TMOSS survey will include edge of pavement, striping, structures, guardrail, fences, signs, and terrain features. The length of the survey will be fifteen-hundred feet (1,500') from each side of the bridge at all four (4) locations. The width of the survey will be Right-of-Way to Right-of Way. As part of this task, the consultant will take remote shots at the opening of the affected railroad bridges. All shots must be obtained from inside CDOT Right-of-Way. All survey information shall be seamlessly integrated into LiDAR aerial mapping to create terrain models for hydraulic analyses, structural designs and roadway designs. Terrain mapping shall be completed to a design-level accuracy determined by Region 4 Survey staff.

### ***BRIDGE/STRUCTURE SURVEY(GROUND)***

The consultant will obtain, by field methods, detailed survey of the above referenced six structures. The survey will include the length of bridge, upstream and downstream location of

piers and abutments (front face of abutments), piers (including notes for distances from center to center of piers, dimensions, shape, and type), low chord, profile of handrail/guardrail, profile of road centerline, and bridge deck. As part of this task, the consultant will include photos and or sketches for each bridge/structure location.

### ***LIDAR ACQUISITION AND GROUND TRUTHING SURVEY***

The consultant will survey the location of the required NVA Photo Identifiable Points (PID) for aerial LiDAR data acquisition and ground truthing purposes. Bare earth LiDAR data shall be provided as point clouds for archiving and digital elevation models (DEMs) to be converted to terrain models prior to design. GIS shapefiles, layer packages or map package will be provided. The consultant will provide a point file and photographs of each point in the ground truthing inventory.

### ***PEER REVIEW AND QA/QC***

The consultant will provide one QA/QC review of the consultant documents at each plan submission, FIR, FOR and PS&E. The consultant will also provide technical support throughout the project in an advisory capacity. In addition, the consultant will provide peer review of the overall construction documents in support of the consultant. The consultant's review efforts will confirm appropriateness of methodologies used, accuracy of documents, reasonableness of conclusions, document completeness, and overall clarity.

### ***BASIS OF DESIGN***

AASHTO methodologies, CDOT standards, the 2009 MUTCD, PROWAG, CDOT Access Code, FHWA HEC-series and HDS-series manuals, and AASHTO's Roadside Design Guide will serve as the basis of design.

### ***ITEMS SPECIFICALLY NOT INCLUDED***

The following items are not included in this scope of work. They are either anticipated to be provided by others or not needed for the project at this time.

- Lighting design
- Public Outreach Support and Participation
- Construction management
- Post Design Services
- ROW plans and acquisition
- Environmental, Stormwater Management Plan, clearances and permits

### ***PROJECT MANAGEMENT AND ADMINISTRATION***

The consultant will submit monthly invoices, in CDOT's format. Invoices will include a summary of work performed for the period, and progress status. the consultant will also perform

other paperwork and reporting, required by CDOT or otherwise necessary, to administer and manage the task order.

***SCHEDULE AND BUDGET***

The consultant will perform the work for a not-to-exceed amount of \$ XXX,XXX. The completion date for all services under this task order is XX/XX/XXXX.