

CDOT Region 4 Hydraulics Unit  
Non-Project Specific Contract Scope of Work

**Overview and Intent**

CDOT Region 4 operates within the following counties in the State of Colorado: Boulder, Broomfield, Cheyenne, Elbert, Kit Carson, Larimer, Lincoln, Logan, Morgan, Phillips, Sedgwick, Washington, Weld and Yuma. The following NPS scope of work shall apply to services within these Counties, and may also include activities in other parts of the state under the coordination of Region 4 staff. For the purposes of this contract, the main contact for CDOT Region 4 shall be the Hydraulics Unit Team Lead.

The Region 4 Hydraulics Unit staff provide services to internal CDOT customers. These customers include, but are not limited to: the Region Transportation Director; project engineers, resident engineers, and program engineers; CDOT maintenance patrols and supervisors; other specialty units (i.e. Right-Of-Way; Traffic; Environmental); the Local Agency program; and Permits. The Hydraulics Unit also services external customers and stakeholders, including other Federal, State, and local agencies; private citizens; and policy makers.

This NPS contract will provide Drainage, Hydraulics, and other adjacent services under the guidance of the Hydraulics Unit Team Lead. The firm(s) operating under this contract shall be considered an extension of CDOT's Region 4 Hydraulics Unit to supplement the unit's limited staffing and availability. The consultant firm(s) shall identify a primary point of contact ("POC") who will work closely with the Hydraulics Unit Team Lead to distribute labor of ongoing and upcoming task orders and to help coordinate Quick Response requests.

**Scope of Services**

A. Project Management. The POC shall communicate project needs with the Hydraulics Unit through the planning, execution, and closure process on all task orders and Quick Response requests. Consultant responsibilities will include the following:

- i. Contract Management
- ii. Task Order Processing (initiation; invoices; progress reporting; closeout)
- iii. Schedule Maintenance
- iv. Coordination with internal CDOT customers, external customers, and other consultants
- v. Assessment of permit needs and other regulatory needs (i.e. SUE) for projects
- vi. Field visits for Scoping activities or Validation activities (i.e. Hydrologic studies)

B. Fluvial Geomorphologic Assessments. The Consultant Team will provide written field assessments of the fluvial geomorphology of sites of interest within Region 4. These assessments will inform design, revetment options, maintenance retrofits, bridge pier and abutment locations, scour analyses, and other associates tasks in support of CDOT's mission. Consultant responsibilities will include:

- i. Application of geomorphic assessment tools found in FHWA HEC manuals, current peer-reviewed scientific papers, textbooks, TRB and NCHRP publications, and other up-to-date industry standard resources. Findings shall be documented in a report or memorandum
- ii. Development of low-cost or no-cost field fixes to geomorphic issues within Region 4 for implementation by CDOT maintenance patrols
- iii. Capture of aerial video and photography utilizing a drone pilot certified under FAA Part 107
- iv. Integration of geomorphic findings and recommendations with environmental considerations; i.e. aquatic organism passage (AOP), threatened and endangered species (T&E)
- v. Provide design details and reporting to the project team for inclusion into plan set, quantities, and grading plan

C. Hydrologic Analysis. The Consultant Team will provide hydrologic analyses for design, maintenance, and other CDOT mission-oriented functions. These analyses may be steady or unsteady. Consultant responsibilities will include:

- i. Application of CDOT Region 4 methods of hydrologic analysis, using approved methodologies and modeling software (i.e. WMS, HEC-HMS, Rational Method)
- ii. Field investigations of basin characteristics to verify flow paths, detention, overtopping of roads and other hydrologically significant variables. This may include capture of aerial video and photography utilizing a drone pilot certified under FAA Part 107. This may include soil samples provided to CDOT for testing, or tested in-situ by the Consultant Team, to calibrate the hydrologic model
- iii. Research of the best available topographic data for use in the hydrologic analysis (i.e. LiDAR; ground survey for previous CDOT projects or local agency projects)
- iv. Research of available stream gage data and precipitation gage data, and possible application of a Bulletin 17C analysis (or any updates to Bulletin 17C that may emerge in the life of this Contract)
- v. Research of previously conducted hydrologic studies in the basin or tributary basins which may inform the hydrologic analysis. CWCB, FEMA Data Library, local agencies, and the Colorado Publications Library are some possible sources for these studies.
- vi. Determination of the appropriate peak flow discharge for design as mandated in the current version of the CDOT Drainage Design Manual.
- vii. Development of peak discharges and/or full hydrographs for the purposes of design, maintenance activities, research, and other purposes applicable to the CDOT mission
- viii. Hydrologic analyses will be quality checked internal to the Consultant Team by utilizing the current version of the CDOT Region 4 Hydrologic QC Spreadsheet. The Consultant will also submit this to CDOT Region 4 Hydraulics for review, and will respond to and address comments provided during the QC process
- ix. A Hydrology Report or Memorandum as a deliverable, which shall be specified on a project-by-project basis.

D. Hydraulic and Drainage Analysis. The Consultant Team will provide hydraulic analyses for design, maintenance, and other CDOT mission-oriented functions. These analyses may be steady or unsteady. Consultant responsibilities will include:

- i. Application of CDOT Region 4 methods of hydraulic analysis, using approved methodologies and modeling software (i.e. SRH-2D, HEC-RAS, FHWA Hydraulic Toolbox, HY-8)
- ii. Field investigations of existing drainage infrastructure or proposed sites of new infrastructure. These may involve coordination and traffic control as provided by CDOT Maintenance, and may involve confined space entry (i.e. storm sewer access points; water quality (PWQ) vaults) performed by CDOT Maintenance in accordance with confined entry



requirements. These investigations may involve safe entry into live waterways for flow and velocity measurements, stage measurements, scour hole dimensions, and other associated functions. These investigations may include capture of aerial video and photography utilizing a drone pilot certified under FAA Part 107, and a UAS/drone provided by the Consultant Team. Streambed and overbank sediment samples may be collected by the Consultant Team for testing by CDOT to establish the sediment gradation.

- iii. Research of the best available topographic data for use in the hydraulic analysis (i.e. LiDAR; ground survey for previous CDOT projects or local agency projects)
- iv. Research of previously conducted hydraulic studies and models in the study area. CWCB, FEMA Data Library, local agencies, and the Colorado Publications Library are some possible sources for these studies. This data may be used for calibration of hydraulic variables (i.e. Manning roughness) and comparison of results/tie-in locations.
- v. Determination of the appropriate peak flow discharges of interest as mandated in the current version of the CDOT Drainage Design Manual and guidance from the Region 4 Hydraulic Team Lead. These may include low flows such as the channel-forming discharge and fish passage flows of interest; the incipient overtopping elevation for bridges and river banks; the 0.2% recurrence flood for scour analysis for bridges; and other flows as appropriate.
- vi. An existing conditions baseline analysis will be performed for most culvert, bridge, and river restoration/revetment designs. Proposed conditions analysis will be performed for recommended culvert, bridge, river restoration/revetment, storm sewer, and other hydraulic designs, and performance compared against the existing. A summary of all applicable CDOT, Federal, and local criteria (i.e. spread widths; HW/D ratio) shall be provided in the hydraulic/drainage reporting.
- vii. Coordination with the local agency/agencies, particularly as part of projects located in urbanized areas where the hydraulic design will tie into the LA infrastructure or where LA or private assets have the potential to be affected (i.e. storm sewer and inlets).
- viii. Hydraulic analyses will be quality checked internal to the Consultant Team. The Team may use their own internal QC comment and response forms, though 2D hydraulic analyses shall also utilize the current version of the CDOT Region 4 Two-Dimensional QC Spreadsheet. The Consultant will submit QC materials to CDOT Region 4 Hydraulics for review, and will respond to and address comments provided during the QC process.
- ix. A Hydraulics Report or Memorandum as a deliverable, which shall be specified on a project-by-project basis.

E. Permanent Water Quality. The Consultant Team may be tasked with design and construction support of permanent water quality features on projects located within Region 4. Consultant responsibilities will include:

- i. Determination of criteria to be met by the facility, using CDOT as well as Local Agency criteria and in consultation with CDOT Region 4 Environmental.
- ii. Selection and design of an appropriate PWQ feature, selecting from those detailed by the Mile High Flood District and other industry standard publications and research
- iii. Drafting of plan sheets, quantities, and project special specifications which will support construction of the PWQ feature(s)
- iv. Construction observation, project inspection/walkthrough, and PWQ certification if needed on CDOT and local agency projects within Region 4

F. Floodplain Permitting. The Consultant Team shall prepare and submit floodplain development permits as well as FEMA submittals were required on projects within Region 4. Consultant responsibilities will include:

- i. Attendance at meetings with the local floodplain administrator and/or FEMA



- ii. Research of applicable local, CWCB, and FEMA requirements for floodplain permitting and permitting closeout
- iii. Preparation of floodplain development permits in anticipation of work to be performed by CDOT, including work to be performed by CDOT Maintenance
- iv. Preparation of floodplain information plan sheets, project special specifications relating to floodplain permit compliance, and floodplain closeout activities
- v. Preparation, certification, and submittal of Conditional Letters of Map Revision and Letters of Map Revision to FEMA as required. This shall include coordination with the floodplain administrator, CWCB, and preparation of required public notifications.

G. Plan Sheet Production and Quantities. The Consultant Team may be asked to produce plan sheets, associated quantities, and project special specifications for projects within Region 4. These deliverables shall be related in some way to the drainage/hydraulic design, i.e. Hydraulic Information Sheets, pipe plan and profiles, grading sheets. These shall not include: Stormwater Management Plan sheets, SUE investigation, traffic control, removal plans, or other non-related discipline activities.

H. Survey. The Consultant Team shall have the ability to obtain survey data to support CDOT's mission. Consultant responsibilities will include:

- i. Capture of ground survey which may be required to be certified by a PLS registered in Colorado and may be tied to CDOT control, or other requested coordinate system. This may include bathymetric survey of rivers and other bodies of water within Region 4
- ii. Establishment of new control for CDOT's use
- iii. Verification of parcel boundaries and CDOT ownership
- iv. Ability to secure LiDAR for topography, and to secure georeferenced aerial photography and video

I. Scour and Sediment Transport. The Consultant Team shall produce designs, provide assessments in the field or remotely, and participate in policy discussions relating to scour and sediment transport relating to CDOT's mission. Consultant responsibilities will include:

- i. Calculation of proposed scour depths and scour risk assessment at bridge abutments, piers, river revetment, culverts, and other hydraulic structures. This shall include estimated embedment depths of existing structures. These analyses shall follow guidance in the FHWA HEC manuals, CDOT Drainage Design Manual, TRB and NCHRP publications, peer-reviewed articles, textbooks, and other industry standard resources.
- ii. Preparation, assistance in preparation, and/or QC of studies, designs, and implementation of scour critical Plan of Actions relating to CDOT assets. This may include hydrologic and hydraulic design as described in this Scope; creation of plan sheets, quantities, and specifications; and construction observation.
- iii. Construction observation and support of projects which include a scour or sediment transport component. This may include Wolman counts of riprap or similar revetment to verify compliance with CDOT standards and project documents.
- iv. Providing site recommendations for minimal cost erosion and sedimentation solutions in support of CDOT Region 4 maintenance
- v. Analysis of potential morphodynamic conditions, as directed, utilizing SRH-2D, HEC-RAS 2D, and other hydraulic modeling technologies with morphodynamic modeling abilities.

J. Geotechnical Engineering. The Consultant Team shall have the ability to obtain and analyze borings, soil samples, and other pertinent geotechnical information in support of CDOT's mission. Drilling services may be required.



K. Research, Training, and Conference Presentations. The Consultant Team may be asked to leverage their expertise by participating in CDOT mission-oriented research, and to present the findings through published reports, peer-reviewed articles, conference presentations, seminars, and other means of output. This may involve in-state or out-of-state travel, which shall be negotiated on a task order by task order basis. This may also involve development of training materials appropriate for a wide variety of audiences, including other CDOT Region Hydraulic Engineers; other CDOT staff; members of the local, State, Federal agency communities; and members of the consultant community. Current topics of interest for research and training (among others) are:

- i. Morphodynamic Modeling using 2D and 3D technologies
- ii. Fish passage/AOP on CDOT projects
- iii. Post-wildfire recovery design and calibration of hydrologic/hydraulic modeling
- iv. UAS (drone) technology for hydrologic and hydraulic design, geomorphology, and survey
- v. Culvert design for roadway engineers and non-hydraulic engineers

L. Quick Response. The Consultant Team shall have the ability to agree to a Quick Response task order which shall include issues requiring immediate attention in support of CDOT Region 4. Some functions of this Quick Response task may be:

- i. Owners Representative functions at CDOT milestone meetings (Scoping, FIR, FOR, field support), public meetings, and meetings with local, State, or Federal agencies
- ii. Maintenance activity support, including field visits and possible design work. Some of these requests may require same-day response and shall be coordinated between the CDOT R4 Hydraulics Team Lead and the Consultant POC.
- iii. Local Agency Project and Developer Reviews on behalf of CDOT Region 4 Hydraulics
- iv. Independent review of other consultant work, which has been submitted to CDOT Region 4 Hydraulics in support of a project or other CDOT mission
- v. QC of in-house CDOT work produced by CDOT Region 4 Hydraulics
- vi. Provide training for CDOT R4 Hydraulics staff, CAD assistance, and collaborate with CDOT R4 Hydraulics on ideas, resources, and strategies for best practices

M. Disaster Response. CDOT Region 4 has responded to numerous disaster incidents, including the High Park Fire (2012), flooding of six major watersheds (2013), and the Cameron Peak Fire (2020). To assist with these types of unanticipated incidents, the Consultant Team shall have a demonstrated familiarity and record of success with:

- i. FHWA reimbursement procedures for damaged infrastructure
- ii. FEMA reimbursement procedures for damaged infrastructure
- iii. The Emergency Watershed Protection (EWP) program
- iv. Coordination with the USFS, NRCS, USGS, and watershed coalitions

### **Cost Basis for Work**

Individual efforts will be evaluated for cost per task order initiated. Cost basis may be either "Cost plus fixed fee" or "Specific rate of pay".

