1. **PROJECT INFORMATION AND APPROACH**

**Statement of Qualifications**

CEI is an award winning civil engineering and environmental services firm with offices in Marlborough, MA, Merrimack, NH and New Britain, Connecticut. Founded in 1987, CEI is a women-owned small business that has been providing premier engineering and environmental services to federal, state, municipal and private clients for over 28 years throughout the Northeast. CEI is employee-owned with a technical staff of approximately 30 including professional engineers (civil, environmental, geotechnical and chemical), biologists/limnologists, environmental scientists, Certified Floodplain Managers (CFM), Professional Geologists (PGs), drinking water facility operators, hydrologists and various other technical staff including those expert in CADD, MicroStation, GIS, and SPECSINTACT.

**Personnel**

Based upon staff experience, delineation of primary staff responsibilities for the work outlined herein is indicated below including contract rate labor level/category.

**Matthew Lundsted, P.E., CFM – Project Manager, Professional Level 4**

Matt will serve as the Project Manager, main client contact and be responsible for all final deliverables.

**Mr. Scott Salvucci, P.E. – Project Engineer, Professional Level 3**

Scott will serve as CEI’s Project Engineer and work closely with the Project Manager on all engineering related tasks.

**Mr. David Nyman, P.E. – QA/QC, Technical Review, Professional Level 4**

Dave will provide QA/QC and technical review services to the project team where needed.

**Ms. Stephanie Hanson, CE – Principal Scientist/Certified Ecologist, Professional Level 3**

Stephanie will work with the project team to provide permitting support and resource area delineation services.

**Project Purpose**

The goal of this project is to assess and understand existing conditions at two road-stream crossing culvert locations. The first is in Spencer, MA where Clark Road crosses a tributary to Stiles Reservoir and the second being in Ashfield, MA where Baptist Corner Road crosses a tributary to the Bear River. DER will use the collected information from the two sites to conduct onsite training for municipal staff and stakeholders. The tasks noted in below will serve as the initial site assessment and first phase of what will ultimately be the design of replacement culverts which meet the River and Stream Crossing Standards.

**II. SCOPE OF WORK**

The scope for each culvert location will include performing borings and soil analysis, delineation of resource area(s), identification of key stream features including bankfull width and riverbed substrate, topographic survey of each site including the resource areas and stream characteristics previously identified, a hydrologic and hydraulic (H&H) analysis, a recommendation of structure type, preliminary opinion of probable costs and technical summary report. In addition CEI will attend project kickoff meeting(s), coordinate and oversee sub-consultant work (survey and borings), participate in project conference calls and attend training sessions at each site to provide technical assistance.

**A. TASKS**

The following tasks and subtasks will be completed by CEI.

***Task 1.0 –Geotechnical Evaluation***

1.1 **Borings**- The local DPW will DigSafe mark the site and notify CEI of the results and clearance date. CEI will employ a drilling sub-consultant to perform borings in Spencer, one each side of the existing culvert. It is anticipated that borings no deeper than 40’ will be needed on each side of the culvert to obtain the necessary soil information for preliminary design of foundations. Borings will be logged along with blow counts. Split spoon samples will be taken every 10’ or change in soil material type to a maximum of 6 samples. CEI staff will observe the drilling operation. We have assumed that it will take a maximum of one day per boring. If both borings can be completed within one day, field observation services will be adjusted accordingly.

1.1 Deliverables

* Boring log sketch showing the location of the borings in relation to the culvert (pdf).
* Boring logs noting soil types, groundwater observations and blow counts (pdf).

1.2 **Soil Samples**- Soil samples will be analyzed by a certified laboratory for sieve and Atterberg limits. Laboratory analysis must be completed by a firm which meets the standards outlined in DER’s RFR`DER 2015-04 under Category 2. Additionally, DER must provide prior approval of selected Laboratory prior to CEI sub-contracting for chemical analysis services.

1.2 Deliverables

* Soil sieve analysis and lab results (pdf).

1.3 **Geotechnical Memo**- CEI geotechnical engineers will prepare a summary memo of the drilling operation in Spencer noting the results of the borings, soils types and sampling results. Basic parameters needed for final foundation type design such as likely soil bearing capacity, suitability of soils, impact of water table, likelihood of need for soil amendments, etc. will be covered in the geotechnical memo.

1.3 Deliverables

* Geotechnical summary memo (pdf).

1.4 **Borings**- The local DPW will DigSafe mark the site and notify CEI of the results and clearance date. CEI will employ a drilling sub-consultant to perform borings in Ashfield, one each side of the existing culvert. It is anticipated that borings no deeper than 40’ will be needed on each side of the culvert to obtain the necessary soil information for preliminary design of foundations. Borings will be logged along with blow counts. Split spoon samples will be taken every 10’ or change in soil material type to a maximum of 6 samples. CEI staff will observe the drilling operation. We have assumed that it will take a maximum of one day per boring. If both borings can be completed within one day, field observation services will be adjusted accordingly.

1.4 Deliverables

* Boring log sketch showing the location of the borings in relation to the culvert (pdf).
* Boring logs noting soil types, groundwater observations and blow counts (pdf).

1.5 **Soil Samples**- Soil samples will be analyzed by a certified laboratory for sieve and Atterberg limits. . Laboratory analysis must be completed by a firm which meets the standards outlined in DER’s RFR`DER 2015-04 under Category 2. Additionally, DER must provide prior approval of selected Laboratory prior to CEI sub-contracting for chemical analysis services.

1.5 Deliverables

* Soil sieve analysis and lab results (pdf).

1.6 **Geotechnical Memo**- CEI geotechnical engineers will prepare a summary memo of the drilling operation in Ashfield noting the results of the borings, soils types and sampling results. Basic parameters needed for final foundation type design such as likely soil bearing capacity, suitability of soils, impact of water table, likelihood of need for soil amendments, etc. will be covered in the geotechnical memo.

1.6 Deliverables

* Geotechnical summary memo (pdf).

***Task 2.0 – Site Recon and Resource Delineation***

2.1 **Wetland Delineation**- CEI wetland scientists will visit the Spencer site to delineate resource areas such as ordinary high water, inland bank and associated wetlands. During the delineation CEI will photograph the resource areas and take field notes for completion of USACE determination forms.

2.1 Deliverables

* Wetland photographs (pdf).

Completed USACE forms (pdf).

2.2 **Pebble Counts**- CEI stream experts will visit the Spencer site during the resource delineation to study the existing stream bed and will perform pebble counts and collect field data to aid in the design of stream bed materials. Tim Chorey will be consulting and coordinating this effort with our field team.

2.2 Deliverables

* Pebble counts (pdf).

2.3 **Observe Stream Characteristics**- During the above noted field work CEI staff will observe the existing condition of the tributary to identify the type and integrity of stream grade controls and prepare field sketches so these locations can be surveyed during Task 3.0.

2.3 Deliverables

* Field sketches (pdf).

2.4 **Bankfull Width**- During the above noted field work CEI staff, in conjunction with DER if feasible, will identify and flag six bankfull width measurement locations and representative cross-sections (three upstream and three downstream of culvert) so these locations can be surveyed during Task 3.0.

2.4 Deliverables

* Included in sketch from Subtask 2.3.

2.5 **Reference Reach Identification**- During the field work noted above CEI staff will identify appropriate reference reaches for the stream crossing.

2.5 Deliverables

* Included in sketch from Subtask 2.3.

2.6 **Wetland Delineation**- CEI wetland scientists will visit the Ashfield site to delineate resource areas such as ordinary high water, inland bank and associated wetlands. During the delineation CEI will photograph the resource areas and take field notes for completion of USACE determination forms.

2.6 Deliverables

* Wetland photographs (pdf).
* Completed USACE forms (pdf).

2.7 **Pebble Counts**- CEI stream experts will visit the Ashfield site during the resource delineation to study the existing stream bed and will perform pebble counts and collect field data to aid in the design of stream bed materials. Tim Chorey will be consulting and coordinating this effort with our field team.

2.7 Deliverables

* Pebble counts (pdf).

2.8 **Observe Stream Characteristics**- During the above noted field work CEI staff will observe the existing condition of the tributary to identify the type and integrity of stream grade controls and prepare field sketches so these locations can be surveyed during Task 3.0.

2.8 Deliverables

* Field sketches (pdf).

2.9 **Bankfull Width**- During the above noted field work CEI staff, in conjunction with DER if feasible, will identify and flag six bankfull width measurement locations in Ashfield as well as representative cross-sections (three upstream and three downstream of culvert) so these locations can be surveyed during Task 3.0.

2.9 Deliverables

* Included in sketch from Subtask 2.8.

2.10 **Reference Reach Identification**- During the field work noted above CEI staff will identify appropriate reference reaches for the stream crossing.

2.10 Deliverables

* Included in sketch from Subtask 2.8.

***Task 3.0 –Topographic Survey***

3.1 **Topographic Survey**- CEI will employ a survey sub-consultant to perform survey in Spencer. Survey will include the resource areas identified in Subtask 2.1, centerline elevation of the road at the culvert and edge of pavement/road features for a minimum of 50’ in either direction, adjacent areas for the potential use of stormwater features, headwall/wingwall locations and elevations, geotechnical boring locations and visible or DigSafed utilities.

3.1 Deliverables

* See Subtask 3.5.

3.2 **Stream Survey**- CEI survey sub-consultant in conjunction with CEI stream team and DER will survey the stream profile for a minimum of 500’ (if feasible) upstream and downstream of the culvert crossing along with the bankfull width cross-sections (three upstream and three downstream) for inclusion in the existing conditions base plan.

3.2 Deliverables

* See Subtask 3.5.

3.3 **Stream Features**- CEI survey sub-consultant in conjunction with CEI stream team and DER will survey the stream characteristics identified in Subtask 2.3 for inclusion in the existing conditions base plan.

3.3 Deliverables

* See Subtask 3.5

3.4 **Property Line and ROW Research**- CEI’s survey subconsultant will perform the necessary and obtain data for showing property lines and right-of-way lines on the base plan.

3.4 Deliverables

* See Subtask 3.5.

3.5 **CAD/D Plan**- Based on the field survey data collected in Subtasks 3.1 through 3.4 CEI survey sub-consultant will prepare an existing condition base plan for use in ultimately designing and preparing construction plans for a new stream guideline compliant crossing.

3.5 Deliverables

* CAD/D base plan (24X36 hard copy) and electronic file (pdf and .dwg file).

3.6 **Topographic Survey**- CEI will employ a survey sub-consultant to perform survey in Ashfield. Survey will include the resource areas identified in Subtask 2.6, centerline elevation of the road at the culvert and edge of pavement/road features for a minimum of 50’ in either direction, adjacent areas for the potential use of stormwater features, headwall/wingwall locations and elevations, geotechnical boring locations and visible or DigSafed utilities.

3.6 Deliverables

* See Subtask 3.10.

3.7 **Stream Survey**- CEI survey sub-consultant in conjunction with CEI stream team and DER will survey the stream profile for a minimum of 500’ (if feasible) upstream and downstream of the culvert crossing along with the bankfull width cross-sections (three upstream and three downstream) for inclusion in the existing conditions base plan.

3.7 Deliverables

* See Subtask 3.10.

3.8 **Stream Features**- CEI survey sub-consultant in conjunction with CEI stream team and DER will survey the stream characteristics identified in Subtask 2.8 for inclusion in the existing conditions base plan.

3.8 Deliverables

* See Subtask 3.10.

3.9 **Property Line and ROW Research**- CEI’s survey subconsultant will perform the necessary and obtain data for showing property lines and right-of-way lines on the base plan.

3.9 Deliverables

* See Subtask 3.10.

3.10 **CAD/D Plan**- Based on the field survey data collected in Subtasks 3.6 through 3.9 CEI survey sub-consultant will prepare an existing condition base plan for use in ultimately designing and preparing construction plans for a new stream guideline compliant crossing.

3.10 Deliverables

* CAD/D base plan (24X36 hard copy) and electronic file (pdf and .dwg file).

***Task 4.0 –Hydrologic and Hydraulic Study***

4.1 **Hydrologic Study- Spencer**- CEI will perform hydrologic modeling for the subwatershed contributing to the tributary to the Stiles Reservoir and the crossing utilizing GIS and average curve numbers to determine discharges for the 1, 5, 10, 25, 50 and 100 year events. In addition we will review any available existing FEMA mapping and available FIS profile and associated data for comparison purposes. GIS will be utilized to define contributing areas, land use and soils inputs and estimating Time of Concentration. We propose using the NRCS (“Cornell Study”) precipitation data using the supplemental methodology from NRCS to adjust the rainfall distributions in running the hydrologic calculations and inputs developed in GIC through the AutoCAD add-on “Storm and Sanitary Analysis” (SSA). If possible and in cooperation with DER in defining a candidate gauge stream, we will run a stream gauge transfer method for comparison purposes to validate output.

4.1 Deliverables

* 1, 5, 10, 25, 50 and 100 year subwatershed discharges combined with Subtask 4.2.

4.2 **Hydraulic Study- Spencer**- CEI will perform basic hydraulic analysis to determine likely water depths, the water surface profile as well as velocities based on the hydrologic output for each design storm utilizing HEC-RAS with detailed cross-sections from the survey data. In addition we will compare these values through the FHWA method for comparison purposes and coordinate with DER on the results. In addition we will assess implications on downstream flood elevations due to change in culvert size, and identify potential mitigation strategies if this is an issue.

4.2 Deliverables

* Hydraulic summary (brief PDF memo).
* All data in native format
* HEC-RAS Model

4.3 **Hydrologic Study- Ashfield**- CEI will perform hydrologic modeling for the subwatershed contributing to the tributary to the Bear River and the crossing utilizing GIS and average curve numbers to determine discharges for the 1, 5, 10, 25, 50 and 100 year events. In addition we will review any available existing FEMA mapping and available FIS profile and associated data for comparison purposes. GIS will be utilized to define contributing areas, land use and soils inputs and estimating Time of Concentration. We propose using the NRCS (“Cornell Study”) precipitation data using the supplemental methodology from NRCS to adjust the rainfall distributions in running the hydrologic calculations and inputs developed in GIC through the AutoCAD add-on “Storm and Sanitary Analysis” (SSA). If possible and in cooperation with DER in defining a candidate gauge stream, we will run a stream gauge transfer method for comparison purposes to validate output.

4.3 Deliverables

* 1, 5, 10, 25, 50 and 100 year subwatershed discharges combined with Subtask 4.4.

4.4 **Hydraulic Study- Ashfield**- CEI will perform basic hydraulic analysis to determine likely water depths, the water surface profile as well as velocities based on the hydrologic output for each design storm utilizing HEC-RAS with detailed cross-sections from the survey data. In addition we will compare these values through the FHWA method for comparison purposes and coordinate with DER on the results..In addition we will assess implications on downstream flood elevations due to change in culvert size, and identify potential mitigation strategies if this is an issue.

4.4 Deliverables

* Hydraulic summary (brief PDF memo).
* All data in native format
* HEC-RAS Model

***Task 5.0 –Traffic Analysis***

The local RPA’s will perform traffic counts as needed.

***Task 6.0 –Structure Type Selection***

6.1 **Type Study**- Based on previous experience and utilizing data collected in Tasks 1 through 5, CEI engineers will develop a plan to determine the most feasible crossing solution for the Clark Road crossing. We will compare various crossing types including but not limited to three sided culverts, precast or metal arches, embedded box culverts and large diameter pipes to name a few. The alternatives will be analyzed based on relative construction cost, ease of construction (phasing, construction duration, lead time, water handling, utility impacts, traffic control needs, etc.) and the level which each alternative meets the desired outcome of most compatible crossing. CEI will provide work product flow procedures for the selection methodology to aid in development of training materials.

6.1 Deliverables

* Draft alternative recommendations for discussion with DER (conference call).

6.2 **Structure Characteristics**- For the recommended structure type CEI’s engineers will determine likely selected characteristics such as foundation type and depth, estimated scour, hydraulic capacity, openness ratio, etc. based on engineering judgement and not detailed modeling.

6.2 Deliverables

* See Subtask 6.4.

6.3 **Opinion of Probable Cost**- Based on the information developed in Subtasks 6.1 and 6.2 CEI will develop a cost estimate range for the recommended structure after concurrence with the Project Team.

6.3 Deliverables

* See Subtask 6.4.

6.4 **Spencer Structure Recommendation**- Based on Project Team input and utilizing the data developed in Subtasks 6.1 through 6.3 we will prepare a memo summarizing our findings and detailing the preferred structure type.

6.4 Deliverables

* Structure Recommendation Memo (pdf).

6.5 **Type Study**- Based on previous experience and utilizing data collected in Tasks 1 through 5, CEI engineers will develop a plan to determine the most feasible crossing solution for the Baptist Corner Road crossing. We will compare various crossing types including but not limited to three sided culverts, precast or metal arches, embedded box culverts and large diameter pipes to name a few. The alternatives will be analyzed based on relative construction cost, ease of construction (phasing, construction duration, lead time, water handling, utility impacts, traffic control needs, etc.) and the level which each alternative meets the desired outcome of most compatible crossing. CEI will provide work product flow procedures for the selection methodology to aid in development of training materials.

6.5 Deliverables

* Draft alternative recommendation for discussion with DER (conference call).

6.6 **Structure Characteristics**- For the recommended structure type CEI’s engineers will determine likely selected characteristics such as foundation type and depth, estimated scour, hydraulic capacity, openness ratio, etc. based on engineering judgement and not detailed modeling.

6.6 Deliverables

* See Subtask 6.8.

6.7 **Opinion of Probable Cost**- Based on the information developed in Subtasks 6.5 and 6.6 CEI will develop a cost estimate range for the recommended structure after concurrence with the Project Team.

6.7 Deliverables

* See Subtask 6.8.

6.8 **Spencer Structure Recommendation**- Based on Project Team input and utilizing the data developed in Subtasks 6.5 through 6.7 we will prepare a memo summarizing our findings and detailing the preferred structure type.

6.8 Deliverables

* Structure Recommendation Memo (pdf).

***Task 7.0 –Technical Reports***

7.1 **Draft Technical Report- Spencer**- CEI will develop a draft report summarizing our findings from Tasks 1 through 6 and detailing at a minimum the following:

* Existing site conditions summary, including features of the existing crossing and stream, bankfull width, stream gradient, habitat features, natural resource areas, etc.;
* A summary description of the stream longitudinal profile, including type and integrity of grade controls, cross-sections, riverine features (thalweg location, riffles, pools, etc.) and riverbed substrate;
* Conceptual design of stream bed (materials and bedforms) within the limits of the crossing and as applicable, for restoration of approaching and departing channels;
* Presentation of H&H analysis highlighting design points;
* Assessment of stream bed material stability under bankfull, design flow, and 100-yr event (FHWA HEC-26 methodology, or equivalent) for approaching, departing, and in-structure bed conditions;
* A description of the critical infrastructure at each site and potential site and construction constraints for replacing the crossing;
* A summary of the geotechnical analysis allowing completion of design and construction recommendations for foundations compliant with the MassDOT LRFD Bridge Manual;
* The traffic analysis;
* The recommended structure type and opinion of probable cost range;
* Summary of design basis;
* Recommendations for next steps detailing requirements needed for final design of a compliant crossing.

7.1 Deliverables

* Draft Technical Report (word.doc for review editing).
* Full size site plans.
* Three color copies.
* All native data

7.2 **Final Technical Report**- Based on review comments received CEI will finalize the Technical Report for the replacement of the Clark Road crossing in Spencer.

7.2 Deliverables

* Final Technical Report (pdf).
* Full size site plans.
* Three color copies of the Final Technical Report.

7.3 **Draft Technical Report- Ashfield**- CEI will develop a draft report summarizing our finding from Tasks 1 through 6 and detailing at a minimum the following:

* Existing site conditions summary, including features of the existing crossing and stream, bankfull width, stream gradient, habitat features, natural resource areas, etc.;
* A summary description of the stream longitudinal profile, including type and integrity of grade controls, cross-sections, riverine features (thalweg location, riffles, pools, etc.) and riverbed substrate;
* Conceptual design of stream bed (materials and bedforms) within the limits of the crossing and as applicable, for restoration of approaching and departing channels;
* Presentation of H&H analysis highlighting design points;
* Assessment of stream bed material stability under bankfull, design flow, and 100-yr event (FHWA HEC-26 methodology, or equivalent) for approaching, departing, and in-structure bed conditions;
* A description of the critical infrastructure at each site and potential site and construction constraints for replacing the crossing;
* A summary of the geotechnical analysis allowing completion of design and construction recommendations for foundations compliant with the MassDOT LRFD Bridge Manual;
* The traffic analysis;
* The recommended structure type and opinion of probable cost range;
* Summary of design basis;
* Recommendations for next steps detailing requirements needed for final design of a compliant crossing.

7.3 Deliverables

* Draft Technical Report (word.doc for review editing).
* Full size site plans.
* Three color copies.
* All native data

7.4 **Final Technical Report**- Based on review comments received CEI will finalize the Technical Report for the replacement of the Baptist Corner Road crossing in Ashfield.

7.4 Deliverables

* Final Technical Report (pdf).
* Full size site plans.
* Three color copies of the Final Technical Report.

***Task 8.0 –Project Management***

8.1 **Spencer Kick-off Meeting**- CEI staff will attend an on-site kick-off meeting with the Project Team at the Clark Road crossing and at that time will discuss field reconnaissance planning and resource delineation prior to topographic survey taking place.

8.1 Deliverables

* Meeting attendance.

8.2 **Structure Type Conference Call**- CEI staff will sit in and participate in a conference call with the Project Team to discuss the results of initial site and desktop data collection/development for the Clark Road crossing and discuss the planned approach for and prior to executing the Type Study for the crossing.

8.2 Deliverables

* Conference call participation.

8.3 **Ashfield Kick-off Meeting**- CEI staff will attend an on-site kick-off meeting with the Project Team at the Baptist Corner Road crossing in Ashfield and at that time will discuss field reconnaissance planning and resource delineation prior to topographic survey taking place..

8.3 Deliverables

* Meeting attendance.

8.4 **Structure Type Conference Call**- CEI staff will sit in and participate in a conference call with the Project Team to discuss the results of initial site and desktop data collection/development for the Baptist Corner Road crossing and discuss the planned approach for and prior to executing the Type Study for the crossing.

8.4 Deliverables

* Conference call participation and notes.

8.5 **Additional Meeting**- CEI has included an allowance for an additional meeting, subject TBD.

8.5 Deliverables

* Meeting attendance and minutes.

8.6 **Training Sessions**- CEI will make their senior engineer available for a half day of the training session to be held at each site to answer any technical questions which may arise.

8.6 Deliverables

* Meeting attendance.

**Please note that CEI staff are available by email and phone as needed to discuss project issues for the duration of the project as well as after the project at the convenience of the client. This service is provided as a matter of course and is not identified as a separate distinct task.**

1. **SCHEDULE**

CEI proposes the following project schedule.



The Scope of Services will be initiated based on completion of a fully executed contract between Comprehensive Environmental Inc. (CEI) and the Department of Fish and Game, Division of Ecological Restoration and following issuance of Notice to Proceed by DER.

**All deliverables will be submitted in final form no later than June 30, 2016**

**IV. PAYMENT and BUDGET**

In keeping with established ***Ecological Restoration Technical Service Masters Agreement*** contract and per the terms of RFR DER 2015-04 for the MA Dept. of Fish and Game, Division of Ecological Restoration, reimbursement will be on a time and materials basis not to exceed **$63,751.42**, according to the budget in Table 1 below. Variance greater than 10% between tasks and subtasks will require reapproval by DER.

Invoice for services will be submitted monthly or at the completion of each Task or Subtask. The date a complete invoice and associated deliverables are received by the Commonwealth is considered the invoice date[[1]](#footnote-1). An accounting of expenses by task and subtask, including a breakdown of hours and costs of personnel, copies of receipts and applicable deliverables must be submitted with each invoice. Invoices should clearly state the start and end of the billing period.

Final invoices for this scope of work must be received by July 31, 2016.

**Work requested outside the scope of work defined above will not be completed without prior written approval from DER, including definition of the scope, schedule, and budget for additional tasks as/if required.**

1. A complete invoice includes all required documentation of expenses and receipt of associated deliverables. [↑](#footnote-ref-1)