

## Appendix H

### Project Scope

## SUPPLEMENTAL AGREEMENT NO. 1 SCOPE OF SERVICES

### BACKGROUND:

Lake Delhi Dam is located southwest of the city of Delhi, Iowa and forms an impoundment of the Maquoketa River. The dam is owned and maintained by the Lake Delhi Recreation Association. During the flood event of July 23-24, 2010 a portion of the southern earthen embankment was breached and eroded by the flood and the concrete spillway's gates were damaged. Flood waters also infiltrated and seeped through a section of the northern embankment.

The Lake Delhi Combined Recreation and Water Quality Tax District (CLIENT) have retained Stanley Consultants, Inc. (CONSULTANT) to provide consulting services for:

- Analysis of conditions for reconstruction of Lake Delhi Dam.
- Preparation of regulatory documentation for the reconstruction of Lake Delhi Dam.
- Preparation of construction documents for the reconstruction of Lake Delhi Dam.
- Bidding services
- Engineering services during construction.

The primary objectives of this project are:

- Reconstruct eroded, damaged, or inadequate portions of the dam's embankment.
- Repair damages to the gated concrete spillway structure.
- Bring the structure (embankments, spillway(s) and powerhouse) into compliance with current dam safety standards.
- Restore Lake Delhi to its normal pool elevation.

### 1.0 BASIC SERVICES

The following Tasks will comprise the Scope of Services for the Lake Delhi Dam Reconstruction Project:

- Task 1.1 - Geotechnical Evaluation and Report
- Task 1.2 – Spillway/Powerhouse Structure Evaluation and Report
- Task 1.3 – Archaeological Survey
- Task 1.4 – Hydrologic/Hydraulic Studies
- Task 1.5 – Reconstruction Design Alternatives
- Task 1.7 – Permitting and Agency Coordination

### 1.1 TASK 1 – GEOTECHNICAL EVALUATION AND REPORT

Geotechnical data will be collected by Braun Intertec, a regional geotechnical consultant. CONSULTANT will review geotechnical data, perform analysis and provide recommendations related to reconstruction design and allow evaluation of the stability of the concrete structures. The geotechnical data, analysis, and recommendations will be summarized in a report submitted to the CLIENT.

1.1.1 *Geotechnical Investigations* – A soil boring plan will be developed for a 240' by 210' area south of the existing concrete spillway structure and a 120' by 120' area north of the spillway structure and a potential borrow area identified by the CLIENT. The program will consist of the following:

- A total of 64 borings (36 in the area south of the structure, 20 north of the structure, 3 through the spillway and powerhouse structures and 5 in a potential borrow area).
  - Dam reconstruction area borings
    - Depth will extend to auger refusal to determine the top of bedrock.
    - 5' deep rock corings will also be taken at 20 of the boring locations.
    - More borings may be cored if rock elevations are found to be erratic.
  - Existing Spillway and Powerhouse borings

- Depth will extend 20 feet below base of concrete structures
    - Continuous cores of concrete and foundation bedrock will be taken
  - Borrow area borings
    - Depth will extend to +/- 20 feet.
    - Soil samples will be taken at 2½- to 5-ft. intervals above the bedrock.
- Braun Intertec will mobilize a drill rig and field crew to perform the boring program.
- CONSULTANT will mobilize a geotechnical engineer to the site to kick-off and coordinate the boring program.
- Once the boring program has begun collecting initial field data, CONSULTANT will organize a teleconference between the CONSULTANT's Project Manager, Braun Intertec Crew Chief, and CLIENT's Project Manager to determine if adjustments of the boring program are required due to site conditions.
- If boring program adjustments are needed, CONSULTANT will revise the Scope of Services and Compensation of the boring program and submit to the CLIENT for approval.
- A laboratory testing program will be developed to provide design input parameters.
- Data will be summarized in boring logs which will characterize subsurface soil, rock and groundwater conditions.
- Braun Intertec will summarize findings in a geotechnical report certified by an Iowa Professional Engineer.
- The report will include:
  - Field notes and observations
  - Boring logs
  - Laboratory test results
  - Soil/Bedrock profiles
  - Recommended engineering parameters (shear strength, unit weight and permeability) of site soils, bedrock, and proposed borrow materials
- CONSULTANT's geotechnical engineers will review a draft version of the report prior to its final issue.

1.1.2 *Geotechnical Analyses/Evaluations* - CONSULTANT will complete global stability, seepage and settlement analyses of the proposed reconstruction alternatives in accordance with current dam safety criteria and IDNR Technical Bulletin 16.

- Global stability analyses will be completed utilizing the Spencer's Method of analysis as included in the SLOPE/W slope stability analyses software.
- Seepage analyses will be completed using flow net procedures and/or finite element methods as contained in the SEEP/W seepage analysis software.
- Settlement analyses will be completed utilizing the CSETT analysis software developed by the U. S. Army Corps of Engineers.

1.1.3 *Geotechnical Evaluation Report* - The results of the geotechnical investigation will be packaged with the geotechnical analyses and included in a stand-alone geotechnical report. The results of the geotechnical investigation will be included as an appendix to the report. The geotechnical evaluation report will be certified and signed by an Iowa Professional Engineer from CONSULTANT. The report will include:

- Description of subsurface profiles and material parameters used in analyses.
- Global stability, seepage and settlement analyses computations. Discussion of the geotechnical aspects of the reconstruction alternatives.

Recommendations for reconstruction design including geotechnical design parameters, fill material and placement requirements, foundation preparation and seepage control requirements, drain design requirements and erosion and scour protection design.

The *Geotechnical Evaluation Report* and geotechnical analyses and computations completed as part of the final design will be included in the Design Documentation Report (Task 6.3).

## 1.2 TASK 3 – SPILLWAY STRUCTURE EVALUATION AND REPORT

CONSULTANT will perform a structural evaluation of the spillway structure. For the Scope of Services of this project the spillway structure is assumed to include the gated spillway portion of the dam as well as the water retaining portions of the powerhouse structure.

NOTE: The evaluation of Interior walls, floors and generating equipment are not included in BASIC SERVICES.

The evaluation, including data, analysis, and recommendations will be summarized in a report submitted to the CLIENT. This task will include the following:

- 1.2.1 *Concrete Coring and Testing* – Braun Intertec will take twenty (20) cores of the concrete spillway structure and powerhouse walls. These cores will be tested to evaluate the condition of the existing concrete. The coring program will include the following:
- Braun Intertec will mobilize a field crew to perform the coring program.
  - CONSULTANT will mobilize a structural engineer to the site to kick-off and coordinate the concrete sampling program.
  - Once the coring program has begun collecting initial field data, CONSULTANT will organize a teleconference between the CONSULTANT's Project Manager, Braun Intertec Crew Chief, and CLIENT's Project Manager to determine if adjustments of the coring program are required due to site conditions.
  - If coring program adjustments are needed, CONSULTANT will revise the Scope of Services and Compensation of the coring program and submit to the CLIENT for approval.
  - A laboratory testing program that includes compressive strength testing and petrographic analysis will be developed to evaluate material properties of the existing concrete to verify its strength and durability.
  - Braun Intertec will summarize findings in a concrete testing report certified by an Iowa Professional Engineer.
  - The report will include:
    - Field notes and observations
    - Coring locations
    - Photographs of cores
    - Laboratory test results
    - Concrete material properties
  - CONSULTANT'S structural engineers will review a draft version of the report prior to its final issue.
- 1.2.2 *Structural Analyses/Evaluation* – CONSULTANT will perform structural analysis of the spillway structure using results of the concrete coring/testing, foundation bedrock coring/testing and available reference drawings and engineering calculations of the dam and spillway. The following evaluations will be performed:
- Structure Stability (sliding, overturning, uplift)
    - Review of Ashton-Barnes stability calculations for concrete spillway and powerhouse
    - Determine if bedrock parameters utilized in the stability analyses are confirmed by the results of the geotechnical investigation.
  - Determine if additional investigations are required to support/verify assumptions contained in the stability analyses. Investigations may include additional coring through the structure to obtain samples of the concrete/bedrock interface and bedrock immediately below the base of the structure. If additional investigations are required, CONSUSLTANT will provide the CLIENT with a fee proposal for completing this work as an ADDITIONAL SERVICE.
  - Structure Strength
    - Analysis of strength of structural components of spillway structure
      - Abutment walls
      - Spillway concrete

- Spillway platform, equipment supports
- Powerhouse Exterior walls
- Gate piers
- Bridge slab
- Steel gates

- 1.2.3 *Structural Evaluation Report* – The structural evaluation will be summarized in a stand-alone structural report. The results of the concrete tests will be included as an appendix to the report. The structural evaluation report will be certified and signed by an Iowa Professional Engineer from CONSULTANT. The report will include:
- Description of results of concrete testing and impacts on reconstruction.
  - Structural stability and strength computations and summary discussion.
  - Discussion of the structural aspects of repairing the spillway structure.
  - Recommendations for reconstruction/rehabilitation design including what structural components will be repaired or replaced and any new structures or modifications needed to bring the dam into compliance with current dam safety standards

The *Structural Evaluation Report* and subsequent structural computations completed as part of the final design will be included in the Design Documentation Report (Task 6.3).

### 1.3 **TASK 3 – ARCHAEOLOGICAL SURVEY**

Louis Berger Group (LBG) of Marion, IA will complete a Phase I archaeological survey for all land areas located within the impoundment area situated below an elevation of 897 feet above mean sea level. The survey will be performed in accordance with current Guidelines for Archaeological Investigations in Iowa.

- 1.3.1 *Existing Record Review* – LBG will review existing records currently on file at the Office of the State Archaeologist. If necessary, additional research will be conducted to attempt to identify areas that have been subject to previous ground disturbance and thus have little or no potential to contain undisturbed archaeological resources. LBG will develop an archaeological survey plan delineating survey areas which will be submitted to Stanley Consultants and the Client for review prior to commencing survey activities.
- 1.3.2 *Field Survey and Report* - LBG will conduct a field survey of land areas delineated in the archaeological survey plan.
- 1.3.3 *Survey Report* - LBG will prepare a Phase I survey report in accordance with state guidelines that describes the survey methods and findings. The Phase I report will include:
- Appropriate recommendations regarding the eligibility of each affected resource for inclusion in the National Register of Historic Places.
  - Recommendations for additional archaeological study or resource mitigation if any.

For fee estimating purposes, the archaeological survey is assumed to include conducting up to 300 subsurface tests and processing up to 500 artifacts from as many as 10 different sites. The fee will decrease/increase based upon how many fewer/additional sites and artifacts are discovered during the survey.

### 1.4 **TASK 4 – HYDROLOGIC/HYDRAULIC STUDIES:**

The primary purposes of hydrologic and hydraulic studies are to:

- Establish the design flood for the Maquoketa River at the dam.
- Determine the effects of theoretical failure of Lake Delhi Dam.
- Define the dam's hazard classification.
- Establish the total required spillway capacity of the dam.

- Perform hydraulic design of the proposed reconstruction.

1.4.1 *Hydrologic Analysis* - A previous hydrologic study by Ashton Engineering established a Probable Maximum Flood (PMF) for Lake Delhi Dam. Stanley Consultants will review the criteria and parameters used to develop the PMF and perform a new PMF analysis if inconsistencies are found. If needed, the revised PMF will be established using rainfall depth and distribution methods defined in the Iowa Department of Natural Resources (DNR) Publication, *Technical Bulletin No. 16 - Design Criteria and Guidelines for Iowa Dams*.

Hydrograph routing for the PMF will be performed using HEC-HMS software. Return interval floods (100-year, 50-year, etc.) will be established using the nearby USGS Flow Gaging Station (No. 05416900) at Manchester, Iowa with Maquoketa River flows at Lake Delhi Dam determined by proportioning respective drainage areas.

1.4.2 *Hazard Classification* - The proposed dam reconstruction will meet design standards of FERC and DNR. Both FERC and DNR use hazard classification as a criterion to establish the dam's design flood. Currently the hazard classification of Lake Delhi Dam is uncertain.

CONSULTANT will use inundation mapping of the design flood and/or dam failure scenarios to establish the hazard classification of the proposed dam reconstruction for both FERC and DNR classification methods. Once the hazard classification is established for Lake Delhi Dam, CONSULTANT will use the more conservative of the FERC and DNR design floods in design of the dam reconstruction.

The hazard classification analysis will be performed by the following steps:

- Develop HEC-RAS hydraulic model of the Maquoketa River and Lake Delhi Dam (See task 4.3).
- Dam failure scenarios will include:
  - High flow event failure (dam failure + design flow event)
  - Normal conditions failure (sunny day failure).
- Establish failure scenarios' flows and resulting peak water surface elevations in the downstream river channel using HEC-RAS.
- Use HEC-RAS peak water surface elevation to delineate inundation limits using ArcGIS with DNR LiDAR topographic data.
- Reference inundation extents to downstream topography and aerial imagery to assess the potential for loss of human life and property damage.
- Establish hazard classification as low, moderate/significant, or high.

CONSULTANT will present a recommendation for DNR and FERC hazard classifications for Lake Delhi Dam in the Hydrologic and Hydraulic Studies Report (Task 4.4).

NOTE: The determination of the hazard classification will follow DNR methods but will be established through engineering judgment, and will be subject to review and approval by DNR. CONSULTANT is not responsible for opinions or judgments by DNR that differ from CONSULTANT's or the CLIENT's.

Due to the interest in developing hydropower at the site, CONSULTANT will perform analysis and design in compliance with FERC standards and summarize FERC hazard classification and other significant findings in the Hydrologic and Hydraulic Studies Report.

NOTE: BASIC SERVICES do not include additional work by CONSULTANT to assist with hydropower redevelopment.

1.4.3 *Hydraulic Analysis* – CONSULTANT will use the HEC-RAS model of the Lake Delhi Dam and Maquoketa River developed by the DNR for the 2010 Report on the Breach of Delhi Dam as the basis of hydraulic analysis. CONSULTANT will review the model and backup information and revise as

necessary. Revisions to the model will be documented. Once the project HEC-RAS model has been established it will be used for:

- Dam failure analysis.
- Hazard Classification.
- Analyzing spillway and dam reconstruction alternatives.
- Design of hydraulic aspects of dam reconstruction.
- Estimating water surface profiles and flood extents for 100-yr and 50-yr floods
- Evaluating hydraulic impacts of upstream bridges.
- Demonstrating proposed dam reconstruction provides sufficient hydraulic capacity to pass the applicable DNR design flood.

1.4.4. *Hydrologic and Hydraulic Studies Report* – CONSULTANT will develop a Hydrologic and Hydraulic Studies Report which will summarize:

- Hazard classification (DNR and FERC)
- Analysis methods and findings
- Hydraulic aspects of the proposed design

The report will be submitted to the CLIENT for review. Following approval by the CLIENT, the report will be submitted to the DNR for approval and other interested agencies.

## **1.5 TASK 5 –RECONSTRUCTION DESIGN ALTERNATIVES:**

CONSULTANT will develop and assist in evaluating a minimum of three dam reconstruction alternatives and the selection of one alternative for final design and construction.

1.5.1 *Project Kick-Off Meeting* – CONSULTANT will attend a Design Alternatives Kick-Off Meeting at the project site. While visiting the project site, CONSULTANT will complete a reconnaissance and inspection of the project features. CONSULTANT’s inspection team will consist of the Project Manager and the Mechanical, and Electrical discipline leads. The team will inspect the dam, downstream channel, walls, spillway structure, gates, powerhouse, electrical systems, gate and trash rack motors, access ways, and operating platforms. The inspectors will review these components for any defects or changes since the last inspection and for use in developing reconstruction strategies.

It is assumed that sufficient as-constructed drawings exist to document the spillway and powerhouse construction. If not, a 3-Dimensional radar survey of the existing concrete structures may be required to allow development of repair/rehabilitation alternatives, as well as construction drawings for the selected alternatives. If a structure survey is required, Stanley will provide the Client with a fee proposal for completing this work.

1.5.2 *Alternatives Development Meeting* – This meeting will be held at the project site following completion of initial geotechnical, structural and hydrologic/hydraulic analysis. Attendees will include CONSULTANT, CLIENT, and other stakeholders and representatives from regulating agencies (DNR, USACE, FWS, SHPO and others) designated and invited by CLIENT. The objective of the meeting will be to develop and discuss potential reconstruction and repair alternatives and ultimately select three to four alternatives for further development and evaluation by CONSULTANT.

1.5.3 *Alternatives Refinement* – CONSULTANT will refine and evaluate reconstruction alternatives by developing conceptual designs and cost estimates for each alternative.

Conceptual designs will be shown on engineering exhibits which will include plan, profile, and section views of each reconstruction alternative.

Conceptual estimates of probable construction costs for each alternative will be developed using construction material quantities estimated from the engineering exhibits.

NOTE: Estimates of probable construction costs at the conceptual level are approximate and subject to change based on design refinement, revisions, schedule, and/or material price fluctuations.

CONSULTANT will compare and evaluate the alternatives using a set of project specific parameters. With input from CLIENT, CONSULTANT will develop a set of parameters for a comparative evaluation of the reconstruction alternatives using a scoring matrix. Weights and scores used in the alternatives evaluation will be developed collaboratively with CLIENT. Parameters may include:

- Discharge capacity
- Construction and operation and maintenance costs
- Regulatory compliance
- Day-to-day pool level control
- Frequency of auxiliary spillway activation
- Impacts to hydroelectric potential
- Impacts to recreation
- Constructability
- Construction schedule
- Risks to other stakeholders
- Public perception

1.5.4 *Alternative Selection Meeting* – This meeting will be held at the project site. CONSULTANT will present conceptual level designs and estimated costs for each of the alternatives. A preliminary scoring matrix will be presented and input solicited from the client on scores and weights. The objective of the meeting will be to select the preferred alternative for reconstruction.

1.5.5 *Alternatives Analysis Report* - The alternative designs, cost estimates, analysis, and evaluation will be summarized in an *Alternatives Analysis Report*. A draft version will be submitted to CLIENT for comment and a final version will be provided to the CLIENT for documentation of the alternative selection process.

## 1.7 **TASK 7 – PERMITTING AND AGENCY COORDINATION**

CONSULTANT will evaluate permitting implications of the proposed project. Reconstruction of the spillway will require approval from the DNR and the United States Army Corps of Engineers (COE) under the Rivers and Harbors Act (Section 10) and the Clean Water Act (Section 404).

Permitting will be through the COE/DNR Joint Permit process. CONSULTANT will prepare an application package for submittal to COE with copies sent simultaneously to both the Floodplain and Sovereign Lands Section at DNR. Included in the submittal will be a separate packet with the forms and information specific to the Dam Construction Permit. It is understood that the CLIENT will directly pay for any applicable fees associated with necessary permits.

It is assumed that a single set of permit documents will be submitted covering both the embankment reconstruction and the spillway structure rehabilitation.

CONSULTANT will obtain and prepare all necessary permit application forms and exhibits. Completed permit documents will be provided to the CLIENT for review and submittal to regulating agency. The permitting process will include:

1.7.1 COE Section 404 - The application will be prepared with the assumption that COE will require an Individual Section 404 Permit. COE will prepare and send out a Public Notice giving agencies, organizations, and individuals an opportunity to comment on the project. The applicant will be required to respond to any expressed opposition. CONSULTANT will prepare permit application documents and assist with comment responses.

- 1.7.2 DNR Section 401 - Section 401 Water Quality Certification (aka 401 Cert) specifically addresses the project's potential impacts to water quality that will have to be avoided, minimized and possibly mitigated. CONSULTANT will prepare permit application documents.
- 1.7.3 DNR Sovereign Lands - It will be necessary to obtain a *Sovereign Lands Construction Permit* for this project. As indicated, the Joint Application process will include a copy of the application to the Sovereign Lands Section for their review. This process will include a review within DNR by threatened & endangered (T&E) species staff and DNR fisheries personnel. The T&E review will identify any state-listed plant or animal species known in the project area. It will be necessary to assess the likelihood that any of these species will be impacted by the project. The fisheries personnel will likely request the proposed project includes consideration for fish passage. It may not be feasible to provide an external "fish ladder" but the issue will likely have to be addressed. Stanley Consultants will prepare permit application documents and assist with DNR coordination.
- 1.7.4 DNR Floodplain Development Permit - Construction in a floodplain requires a floodplain permit oriented to dam construction which includes complete application forms and providing information specific to dam construction. Stanley Consultants will prepare permit application documents and assist with DNR coordination. Submittal requirements include:
- Completed and signed Water Storage Permit Application (Task 7)
  - Two sets of certified plans (Task 6)
  - Engineering Design and Hydraulics & Hydrology Report (Tasks 4)
  - Soil & Foundation Investigation Report (Task 1)
  - Structural Evaluation Report (Task 2)
  - Sedimentation rate assessment (Task 4)
  - Gated low level outlet design (Task 4 and 6)
  - Hazard assessment (Task 4)
  - Summary of Engineering Data (Tasks 4 and 5)
- 1.7.5 State Historic Preservation Office (SHPO) - A Phase I Cultural Resource Survey will be performed that will encompass the entire former lake bottom. An archaeological report will be prepared that will summarize the findings and address potential project impacts to both historic and prehistoric resources (Task 3). It will be necessary to develop a Programmatic Agreement with the State Historic Preservation Office that will provide a plan for avoiding, minimizing or mitigating impacts to any significant resources encountered. Stanley Consultants will assist with development of the Programmatic Agreement and coordination with SHPO.
- 1.7.6 U.S. Fish & Wildlife Service (FWS) - FWS will be sent a Public Notice by COE. FWS will review the project for potential impact on federally-listed T&E species. Bald eagles are no longer a listed species but if any potential impacts are identified, application will be made to FWS for a Bald Eagle Permit. The project area will be reviewed for the potential for federally-listed T&E species to occur in the area. If any potential exists, the Moline, Illinois Field Office of FWS will be contacted during preparation of the application. Any T&E concerns identified by FWS will be addressed in the application and the Moline office will be sent a copy of the application package at the same time it is submitted to the COE. CONSULTANT will assist with coordination with FWS.

Additional permits that may arise that are not identified in Task 6 are considered ADDITIONAL SERVICES and not included in BASIC SERVICES.

NOTE: Any local permits required for construction will be the Contractor's responsibility.

### **3.0 ADDITIONAL SERVICES:**

Services requested by the CLIENT that are NOT included in BASIC SERVICES, shall constitute ADDITIONAL SERVICES. ADDITIONAL SERVICES shall be authorized by the CLIENT prior to the commencement of services.