# PLAN FOR QUALITY CONTROL/QUALITY ASSURANCE REVIEW FORT CALHOUN NUCELAR FACILITY GEOTECHNICAL INVESTIGATION AND TESTING PROGRAM

This Quality Control/Quality Assurance (QA/QC Plan) has been prepared in accordance with the scope of services contract between HDR and McCook Geotechnical Engineering. The intent of the plan is to provide a mechanism for independent technical review of procedures and equipment used in obtaining geotechnical field data and laboratory test data in connection with the evaluation of the site foundation soils at the site. The data will be used in comparing post-flood conditions with data available from original and historical investigations.

Technical review of the project will be performed in an ongoing manner. As part of the Quality Control process, all final submittals will have an Independent Technical Review (ITR) performed by Danny McCook, with auxiliary reviews of geologic logging and other testing by responsible HDR personnel including:

- Pat Poepsel, Geotechnical Project Manager
- John Christiansen, Geotechnical Engineer on the Engineering Support Team
- John Charlton, Geologist on the Support Team

An ITR sign-off form has been developed and is included in this QA/QC Plan. The ITR will specifically look for compliance with applicable ASTM Test Standards and other appropriate guidance, appropriateness of data used, including level of detail, consistency, accuracy, comprehensiveness, and reasonableness of results.

1. QA/QC Plan Preparation
2. Standard Penetration Testing.
   - 2.1. The ITR reviewer will examine the following elements of the Standard Penetration Testing activities to ensure compliance with technical and SOW requirements for the planned work:
     - 2.1.1. Calibration of hammer records
     - 2.1.2. Conformance to applicable ASTM and other industry standard documents such as the Reclamation document on precautions in performing the test included in the list of references.

2.1.3. Observations of representative tests on a spot-check basis, with continuous oversight provided by the Contractor and a responsible HDR representative.

3. Shelby Tube Sampling

3.1. The ITR reviewer will examine the following elements of the Shelby Tube Sampling activities to ensure compliance with technical and industry standard practice and documents.

3.2. Conformance to D1587 Standard Practice for Thin-Walled Tube Sampling of Soils for Geotechnical engineering materials/processes.

3.3. Observations of representative activities on a spot-check basis, with continuous oversight provided by the Contractor and a responsible HDR representative.

3.4. Photographs of extruded samples.

3.5. Appropriate chain of custody forms and procedures.

4. CPT Investigation. At the completion of this step, the ITR reviewer will provide a written review of the submitted information. The review will evaluate the completeness and accuracy of the information provided. Information to be reviewed includes the following information as a minimum:

4.1. Calibrations made prior to investigation

4.2. Clarity of generated plots

4.3. Appropriateness of information to previously known character of the foundation

4.4. Observations of field testing.

5. Other Drill Holes and Sampling

5.1. The ITR reviewer will provide training in soil classification and provide advice on protocol for sampling and testing based on his experience.

5.2. The ITR reviewer will examine the following elements of the boring information obtained in addition to the CPT and SPT data.

5.2.1. Accuracy and appropriate detail provided in hole logs. ITR review will be provided by spot checks. Continuous oversight will be provided by Contractor QC and responsible HDR personnel.

5.2.2. Conformance to ASTM field logging terminology included ASTM D2488 Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). Verified by Spot Checks by ITR Reviewer and continuous oversight and certification of accuracy by HDR technical representative.

5.3. Sample labeling and chain of custody will be verified by continuous oversight from responsible HDR representatives including approval of forms for recording data.

**6.** Inclinometer Installations

6.1. The ITR reviewer will examine the following elements of the Inclinometer Tube installation and initial reading to ensure compliance with technical and industry standard practice and documents.

6.1.1. The background of installers will be reviewed to ensure adequate experience in installation of the equipment.

6.1.2. Manufacturer equipment manuals will be verified and procedures certified as being followed by installers

6.1.3. Calibrations of equipment including spiral twist survey data will be included with installation logs.

6.1.4. The grout mix will be reviewed to ensure that it is compatible with industry standards such as that shown in the TRB publication:

(Cornforth, 2005; Dunnicliff, 1988).
A non-shrink grout is typically used, typically requiring a combination of cement and bentonite. Example of the mix is presented in the Table 1. Non-shrink grouting provides a tight casing installation that can conform to very small ground deformations.
18 *Circular E-C129: Use of Inclinometers for Geotechnical Instrumentation on Transportation Projects*

**TABLE 1 Cement–Bentonite Grout Mix Example**

| **Materials** | **Soft Soil Environment** | **Medium to Hard Soil Environment** |
|---|---|---|
| Portland Cement | 94 lb (43 kg) | 94 lb (43 kg) |
| Bentonite (powder) | 39 lb (18 kg) (as required) | 25 lb (11 kg) (as required) |
| Water | 75 gal (284 l) | 30 gal (114 l) |

6.1.5. Appropriate embedment into unyielding formations will be verified by nearby other investigations, including previous historical data and current SPT investigations. Appropriate depth will be considered at least 10 feet into bedrock.

7. Assignment of Laboratory Tests.

7.1. ITR Reviewer will Certify that laboratory tests are assigned appropriately prior to initiation testing on any group of samples. Appropriateness will be based on Statement of Work requirements and field logs to group assignments based on CPT and SPT data together with available historical data to reduce duplication of testing on similar results.

7.2. Validate Lab Results. ITR will review sample test results at 25 % completion of initial testing effort. Final ITR will certify validation of test results at 100 % completion of tests.

7.3. Data Compilation. gINT logs will be back checked by HDR responsible reviewers Christiansen and Charlton with QC check forms. First 25 % of test holes will be reviewed and final report will be reviewed prior to approval. Review will include evaluation of accuracy of GIS data and plan view of borings.

8. Groundwater Monitoring Wells

8.1. ITR Reviewer will ensure that Contractor personnel and HDR responsible personnel have available copies of applicable ASTM Standard Test Methods and that proposed equipment conforms to requirement of test. Checklist has been followed in installing piezometers. Site Personnel responsible for overall review.

8.2. Well Installation Documentation. ITR reviewer McCook will review final completed piezometers installation records for completeness and conformance to established procedures and recording formats

9. Prepare data review information for report

9.1. Prepare map showing locations of all sampled holes

9.2. Prepare GIS data for all sampling locations

9.3. Plan and Profile Development

9.4. Boring Logs (Checklist Number 7)

9.5. Final Plan. ITR reviewer McCook and HDR responsible personnel including Christiansen and Charlton will perform final review of completed plans and plots of data before final submittal

**10.** Miscellaneous Reviews

10.1. Periodic teleconferences and data reviews will be conducted between ITR reviewer and responsible HDR personnel.

10.2. Periodic reports will be prepared by ITR reviewer summarizing observations and recommendations based on available data.

**11.** Final Report

11.1. ITR reviewer McCook will approve final geotechnical QA/QC report with assistance of HDR responsible personnel including Christiansen, Poepsel, and Charlton.

# EXHIBIT A

## SCOPE OF SERVICES

Perform Quality Assurance tasks related to geotechnical investigations at OPPD's FCS.

Task 1: Assist the project management team and the HDR lead geotechnical engineer with the development of a detailed QA/QC plan for all field exploration and laboratory testing to be completed for the OPPD FCS project. Development of a draft plan for review by the BOSC review and then a final plan responding to comments by the BOSC should be anticipated.

Task 2: Lead the implementation of the QA/QC plan during all field exploration and lab testing activities. It is anticipated that the following activities (including travel time and expenses as agreed to with the PM team) will be included under this task:

Attend appropriate training to obtain clearances to access the site and observe drilling and testing activities under the QA/QC plan.

Prepare for, and conduct training of geologic/geotechnical and geophysical personnel performing activities at the site on the QA/QC plan.

Perform review of field and laboratory activities including appropriate formal audits to evaluate and document compliance with the QA/QC plan.

Review of field and laboratory work products by the teams performing the explorations including a) calibration of SPT testing hammer, b) field logs, c) gINT logs (draft and final), d) sampling procedures, sample handling, chain of custody, and lab testing procedures, e) summary logs and presentation of field and laboratory results on project drawings and in report sections.

Other observations and documentation as required for implementation of the QA/QC plan for the project.

Review locations and proposed depths of CPT soundings, calibration of CPT instruments, including size of cone and saturation of pore pressure transducer, and also correlations between SPT and CPT.

Develop a table that presents the purpose, anticipated conditions, sampling, lab testing, and instrumentation requirements for each hole.

Review corrections proposed for either SPT or CPT

Review locations and calibrations of geophysical testing, and calibration of geophysical results with field penetration and laboratory test results.

Task 3: Prepare a summary QA/QC report for inclusion in the project documentation. It is anticipated that both draft and final reports will be required.

Task 4: Perform other tasks as assigned. This could include the following:

Attend meetings or conference calls to present results of the QA/QC program activities.

Assist the geotechnical evaluation team members with assessment activities as may be necessary.