

REVIEW PLAN
For
Plans and Specifications
For
Toe Drain Repairs
Falls Lake Dam
Wake County, North Carolina

Wilmington District

September 2011

APPROVED – 20 September 2011

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1. PURPOSE AND REQUIREMENTS

Purpose. This Review Plan defines the scope and level of review activities for Toe Drain Repairs at Falls Lake Dam, Wake County, North Carolina. Review activities consist of District Quality Control (DQC) and Agency Technical Review (ATR). The Documents to be reviewed are Plans and Specifications and a Design Documentation Report (DDR).

b. References.

- (1). ER 1110-2-1150, Engineering and Design for Civil Works Projects, 31 Aug 1999
- (2). ER 1110-1-12, Engineering and Design Quality Management, 21 Jul 2006
- (3). ER 1100-2-1156, Safety of Dams – Policy and Procedures, 31 August 2011
- (3). EC 1165-2-209, Civil Works Review Policy, 31 January 2010

c. Requirements. This review plan was developed in accordance with EC 1165-2-209, which establishes an accountable, comprehensive, life-cycle review strategy for Civil Works products by providing a seamless process for review of all Civil Works projects from initial planning through design, construction, and Operation, Maintenance, Repair, Replacement and Rehabilitation (OMRR&R). The EC provides the procedures for ensuring the quality and credibility of U.S. Army Corps of Engineers (USACE) decision, implementation, and operations and maintenance documents and work products. The EC outlines three levels of review: District Quality Control, Agency Technical Review, and Independent External Peer Review.

(1) District Quality Control (DQC). DQC is the review of basic science and engineering work products focused on fulfilling the project quality requirements defined in the Project Management Plan (PMP). It is managed in the home district and may be conducted by staff in the home district as long as they are not doing the work involved in the study, or overseeing contracted work that is being reviewed. Basic quality control tools include a Quality Management Plan providing for seamless review, quality checks and reviews, supervisory reviews, Project Delivery Team (PDT) reviews, etc. Additionally, the PDT is responsible for a complete reading of the report to assure the overall integrity of the report, technical appendices and the recommendations before approval by the District Commander. The Major Subordinate Command (MSC)/District quality management plans address the conduct and documentation of this fundamental level of review.

(2) Agency Technical Review (ATR). ATR is an in-depth review, managed within USACE, and conducted by a qualified team outside of the home district that is not involved in the day-to-day production of the project/product. The purpose of this review is to ensure the proper application of clearly established criteria, regulations, laws, codes, principles and professional practices. The ATR team reviews the various work products and assures that all the parts fit together in a coherent whole. ATR teams will be comprised of senior USACE personnel (Regional Technical Specialists (RTS), etc.), and may be supplemented by outside experts as appropriate. To assure independence, the leader of the ATR team shall be from outside the parent MSC.

(3) Type II Independent External Peer Review (IEPR). IEPR is the most independent level of review, and is applied in cases that meet certain criteria where the risk and magnitude of the proposed project are such that a critical examination by a qualified team outside of USACE is warranted. In accordance with Section 2035 of Water Resources Development Act (WRDA) of 2007 and EC 1165-2-209, a Type II IEPR Safety Assurance Review shall be conducted on design and construction activities for hurricane and storm risk management and flood risk management projects, as well as other projects where existing and potential hazards pose a significant threat to human life prior to initiation of physical construction and periodically thereafter until construction activities are completed. IEPR should occur on a regular schedule sufficient to inform the Chief of Engineers on the adequacy, appropriateness, and acceptability of the design and construction activities for the purpose of assuring public health, safety, and welfare.

d. Review Management Organization (RMO). The South Atlantic Division (SAD) is designated as the RMO responsible for managing the review activities described in this Review Plan.

2. PROJECT INFORMATION AND BACKGROUND

a. Project Description – Falls Lake Dam

- 1) Falls Lake Dam is located in Wake County, North Carolina at Latitude 35° 56', Longitude 78 ° 34'. The dam site is in the upper part of the Neuse River Basin in North Carolina about 10 miles north of Raleigh, and 17 miles east-southeast of Durham.
- 2) The Falls Lake Dam project consists of three main components: an earth embankment dam; an uncontrolled chute spillway; and a concrete outlet works. The earth dam is 1,915 feet long with a maximum height of about 92 feet above the streambed and a crest width of 30 feet. Six types of fill are incorporated in the zoned embankment as follows: impervious fill in the upstream core (Zone 1), semi-pervious fill in the downstream core (Zone 2), pervious sands in the chimney drain and drainage blanket (Zone 3), a rock toe upstream and downstream (Zone 4), upstream stone slope protection (Zone 5), and a gravel filter under the drainage blanket (Zone 6). The spillway is an uncontrolled chute located in the east (left, facing downstream) abutment. It is 100 feet wide with a crest elevation of 264.8 feet, M.S.L. The concrete outlet works consist of approach walls, a multilevel intake structure with four water quality intakes at two levels and an oblong shaped conduit. The inside dimensions of the conduit are 15.0 feet wide by 19.0 feet high and 270 feet long extending through the dam. A stilling basin with training walls is used to control discharge water.
- 3) Public Law 89-298 authorized the Falls Lake project on 27 October 1965 and a construction contract awarded on 18 May 1978. The dam was completed in November 1980 and the intake tower in February 1981. Permanent impoundment of the reservoir began on 13 January 1983 after two partial impoundments. An access modification to the intake tower was completed on 13 March 1983 and conservation pool reached on 7 December 1983.
- 4) A toe drain system, installed along the downstream toe of Falls Dam during construction, was designed to collect internal seepage and discharge it into the Neuse River by gravity flow. The system is composed of 12" ID perforated concrete collector pipes surrounded by gravel filter material to promote seepage collection. The collector pipes are connected to manholes for access and inspection purposes. There are three manholes on the left side of the outlet works (facing downstream) and one on the right side (see Figure 1). Three non-perforated concrete outfall pipes carry the collected seepage to the river. Two of these outfalls are on the left side of the outlet works and one on the right side. Each is equipped with a flap valve on the downstream end to prevent high tailwater conditions from backflowing into the toe drain system. Also, on the left side, a segment of collector pipe discharges directly into the paved ditch which runs along the contact where the dam meets the right abutment.
- 5) Repairs to the toe drain system will include: replacing approximately 830 linear feet of 12-inch diameter perforated reinforced concrete pipe (RCP), and excavation of a V-ditch in the tailrace area of the dam to drain a small pond area at the toe of the dam.
- 6) The toe drain repairs project is funded with 2011 O&M funds.

b. Project Background. The 2007 Periodic Inspection of Falls Lake Dam noted "The 4 toe drain manholes were observed to be dry with no silt or sand deposits. No flows have ever been recorded coming from the outfall pipes". In July 2008 a closed-circuit camera inspection was

performed inside the toe drain system and associated outfall pipes to assess the structural integrity and conditions of the pipes, using a crawler-mounted video camera capable of fitting inside the 12-inch Internal Diameter (ID) concrete pipes. The following is from the inspection report and summarizes the findings of defects and other anomalies that were noticed during the course of the inspection:

- 1) No seepage water was noticed in any section of the toe drain which could indicate clogging of the drain system or that the water table is below the drain system.
- 2) Outfall Pipe No. 1 – An open gap in the connection between Outfall Pipe No. 1 and Manhole No. 1 was observed. A longitudinal crack was observed at the top of the pipe extending from an approximate distance of 13 to 41 feet south-west of Manhole No. 1. Another longitudinal crack was observed at the top of the pipe at an approximate distance of 21 feet east of Manhole No. 1.
- 3) Outfall Pipe No. 2 – A longitudinal crack was observed at the top of the pipe at an approximate distance of 21 feet east of Manhole No. 2.
- 4) Toe Drain Pipe No. 2 – Multiple cracks extending from the bottom to the top of the pipe were observed at an approximate distance of 78 feet south of Manhole No. 2.
- 5) Toe Drain Pipe No. 3 – Three broken joints were noticed at approximate distances of 31, 47, and 150 feet south-east of Manhole No. 3. Circumferential cracks were observed at joints located at approximate distances of 137, 140, and 170 feet south-east of Manhole No. 3.
- 6) Toe Drain Pipe No. 4 – Multiple cracks were observed at the top and bottom of joints located at approximate distances of 137, 140, and 170 feet south-east of Manhole No. 3. Multiple cracks in the pipe were observed at an approximate distance of 141 feet north-east of Manhole No. 3. The drain pipe appeared to have collapsed at a distance of 285 feet north-east of Manhole No. 3.

3. DISTRICT QUALITY CONTROL

District Quality Control and Quality Assurance activities for implementation documents (DDR and P&S) are stipulated in ER 1110-1-12, Engineering & Design Quality Management. The subject project DDR and P&S will be prepared by the Wilmington District using the SAW procedures and will undergo DQC. DQC Certification will be verified by the Agency Technical Review Team.

4. AGENCY TECHNICAL REVIEW

a. Scope. Agency Technical Review (ATR) is undertaken to "ensure the quality and credibility of the government's scientific information" in accordance with EC 1165-2-209 and ER 1110-1-12. An ATR will be performed on the P&S and DDR intermediate and pre-final submittals.

ATR will be conducted by individuals and organizations that are external to the Wilmington District. The ATR Team Leader is a Corps of Engineers employee outside the South Atlantic Division. The required disciplines and experience are described below.

ATR comments are documented in the DrCheckssm model review documentation database. DrCheckssm is a module in the ProjNetsm suite of tools developed and operated at ERDC-CERL (www.projnet.org).

At the conclusion of each ATR effort, the ATR team will prepare a Review Report summarizing the review. Review Reports will be considered an integral part of the ATR documentation and shall:

- Identify the document(s) reviewed and the purpose of the review;

- Disclose the names of the reviewers, their organization affiliations, and include a short paragraph on both the credentials and relevant expertise of each reviewer;
- Include the charge to the reviewer;
- Describe the nature of their review and their findings and conclusions;
- Identify and summarize each unresolved issues (if any); and
- Include a verbatim copy of each reviewers comments (either with or without specific attributions), or represent the views of the group as a whole, including any disparate and dissenting views.

b. ATR Disciplines. As stipulated ER 1110-1-12, ATR members will be sought from the following sources: regional technical specialists (RTS); appointed subject matter experts (SME) from other districts; senior level experts from other districts; Center of Expertise staff; experts from other USACE commands; contractors; academic or other technical experts; or a combination of the above. The ATR Team will be comprised of the following disciplines; knowledge, skills and abilities; and experience levels.

Geotechnical Engineering and Engineering Geology. The team member should be a registered professional with experience that encompass geologic and geotechnical analyses that are used to support the development of Plans and Specifications for design and or repair of dams.

Civil Engineering. The team member should be a registered professional engineer with civil/site work project experience that includes design and or repair of dams.

Cost Engineering. The Cost Engineering Expert should be a registered professional with a minimum 10 years demonstrated experience in the preparation of cost estimates, cost risk analyses and cost engineering. Team member should be familiar with similar projects across US.

ATR Team Leader. The ATR Team Leader should have experience with design and or repair of dams and have performed ATR Team Leader duties. ATR Team Leader may be a co-duty to one of the review disciplines.

5. INDEPENDENT EXTERNAL PEER REVIEW

a. General. EC 1165-2-209 provides implementation guidance for both Sections 2034 and 2035 of the Water Resources Development Act (WRDA) of 2007 (Public Law (P.L.) 110-114). The EC addresses review procedures for both the Planning and the Design and Construction Phases (also referred to in USACE guidance as the Feasibility and the Pre-construction, Engineering and Design Phases). The EC defines Section 2035 Safety Assurance Review (SAR), Type II Independent External Peer Review (IEPR). The EC also requires Type II IEPR be managed and conducted outside the Corps of Engineers

b. Type I Independent External Peer Review (IEPR) Determination. A Type I IEPR is associated with decision documents. No decision documents are addressed/covered by this Review Plan. A Type I IEPR is not applicable to the implementation documents covered by this Review Plan.

c. Type II Independent External Peer Review (IEPR) Determination (Section 2035). This toe drain repair project does not trigger WRDA 2007 Section 2035 factors for Safety Assurance Review (termed Type II IEPR in EC 1165-2-209) and therefore, a review under Section 2035 is not required. The factors in determining whether a review of design and construction activities of a project is necessary as stated under Section 2035 along with this review plans applicability statement follow.

- (1) The failure of the project would pose a significant threat to human life.

This project will include replacement of 830 linear feet of 12-inch ID perforated reinforced concrete pipe (RCP). Replacement of toe drain pipe will involve excavation or trenching of riprap from Zone 4D of the dam up to depths of 10-feet. Failure or loss of the toe drain will not pose a significant threat to human life.

(2) The project involves the use of innovative materials or techniques.

This project will utilize methods and procedures previously used by the Corps of Engineers on other similar works.

(3) The project design lacks redundancy.

The toe drain repairs replaces existing 12-inch diameter perforated RCP with new 12-inch perforated RCP. The project is considered to be maintenance and does not change the design of the toe drain system.

(4) The project has a unique construction sequencing or a reduced or overlapping design construction schedule.

This project's construction does not have unique sequencing or a reduced or overlapping design.

6. MODEL CERTIFICATION AND APPROVAL

This Toe Drain Repairs Project does not use any engineering models.

7. BUDGET AND SCHEDULE

a. Project Milestones.

Completion of Pre-Final Submittal – 8 SEPTEMBER 11

District Quality Control – 9 SEPTEMBER 11

BCOE Review – COMPLETED

ATR Review – 23 SEPTEMBER 11 to 6 OCTOBER 11

Advertisement – 10 NOVEMBER 11

b. ATR Estimated Cost. The ATR will be conducted 12 SEPTEMBER 11 to 23 SEPTEMBER 11. It is envisioned that each reviewer will be afforded 24 hours review plus 4 hours for coordination. The estimated cost range is \$10-15,000.