



May 14, 2010

Mr. Tom L. Frederick, PE, Executive Director  
Rivanna Water & Sewer Authority  
695 Moores Creek Lane  
Charlottesville, VA 22902

**Subject: Preliminary Design Report, Rivanna Water & Sewer Authority's New Ragged Mountain Dam, Albemarle County, Virginia, Preliminary Engineering Design Services (Schnabel Project No. 09170036.00)**

Dear Mr. Frederick:

**SCHNABEL ENGINEERING, LLC** (Schnabel) is pleased to submit our reports and associated drawings relating to preliminary engineering design services for this project. The preliminary engineering design reports consist of an Alternatives Assessment Report, a Geologic and Geotechnical Data Report, and Preliminary Design Report (see Enclosure). These reports include figures and appendices with relevant data collected for this preliminary engineering design study. The Preliminary Design Report of the Enclosure includes its Appendix D only. The remaining appendices and drawings are submitted under separate cover. This preliminary engineering design study was performed in accordance with the engineering services agreement by and between Rivanna Water & Sewer Authority (RWSA) and Schnabel Engineering, LLC dated September 23, 2009, amended November 12, 2009, and associated amended work authorizations.

RWSA has retained Schnabel to provide preliminary engineering design services for a new dam that would increase the impoundment capacity of raw water for the Ragged Mountain Reservoir (Charlottesville Reservoir). As part of these preliminary design services, Schnabel provided a geotechnical assessment and investigation program, which included the investigation of potential borrow sources for shallow rock for use as aggregate for a Roller Compacted Concrete (RCC) gravity dam. However, during the course of this investigation, borings and geophysical surveys conducted revealed soil overburden typically exceeding 40 ft in depth at most locations. Considering these subsurface conditions, Schnabel recommended that an alternatives assessment be performed to identify whether an earthen dam would be a cost effective alternative to the RCC gravity dam, originally considered. With the consent of RWSA, Schnabel proceeded with the alternatives assessment.

Based upon the preliminary opinion of cost and the technical and community/environmental impact evaluations performed for the two dam design alternatives in advance of preliminary design, Schnabel recommended that RWSA select an earthen embankment dam at the proposed project location. With the consent of RWSA and their Independent Technical Review Team (ITRT), Schnabel proceeded with a modified scope of field investigation and associated laboratory testing to better define the subsurface

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Rivanna Water & Sewer Authority  
New Ragged Mountain Dam

condition for an earthen dam foundation, spillway structures, and on-site borrow sources for shell and core materials.

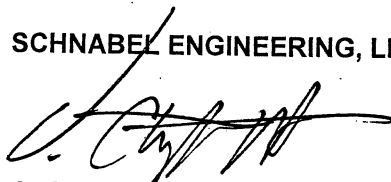
Schnabel has also provided Preliminary Design Services, which included a preliminary geotechnical engineering analysis to evaluate the performance characteristics of an earthen dam, including seepage, settlement, and stability modeling based upon the subsurface exploration data and laboratory data obtained from the geologic and geotechnical data report. The Preliminary Design Services also included evaluation of hydrologic and hydraulics analysis and design. The preliminary design phase, which included development of the major components of the project, allowed for development of the preliminary design opinion of construction costs. The Preliminary Design Report is included as an Enclosure.

Based upon these findings, Schnabel is of the opinion that an earthen dam can be constructed within the cost range of approximately \$20,213,000 to \$26,951,000. This range of opinion of construction cost is based upon the construction market in 2010 dollars, and considers an accuracy estimated between a minus of 10% to a plus of 20%. Note also that the preliminary design report presents Schnabel's opinion of engineering costs related to the final design and construction of an earthen dam, which should be considered as part of the total project costs.

We appreciate the opportunity to be of service for this project.

Sincerely,

**SCHNABEL ENGINEERING, LLC**



O. Christopher Webster, PE  
Principal



Randall P. Bass, PE  
Principal

OCW:RPB

Enclosure: Preliminary Design Report (with Appendix D only)