

Appalachian Power Company  
Claytor Hydroelectric Project  
FERC No. 739

Water Quality Monitoring Plan

June 2009 Plan  
Revised to Reflect Revisions Required by  
Order Issuing New License (12/27/11) Article 406,  
VWPP 09-0892, E. 4  
and VDEQ Letter Dated May 2, 2012  
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## SUMMARY

The Claytor Project (No. 739) is licensed to Appalachian Power Company (Appalachian) and is a conventional hydroelectric project located on the New River in Pulaski County, Virginia.

The purpose of this Water Quality Monitoring Plan (Plan) is to outline how Appalachian proposes to mitigate the low dissolved oxygen conditions observed in the tailrace of the Claytor Project during the Water Quality Study completed for relicensing and how Appalachian will monitor the proposed mitigation to ensure dissolved oxygen levels remain above water quality standards in the tailrace.

The Water Quality Monitoring Plan is being submitted to the Federal Energy Regulatory Commission (FERC) as part of the Application for New License and reflects the measure that Appalachian will be responsible for as the licensee.

## 1.0 INTRODUCTION

The purpose of the Water Quality Monitoring Plan (Plan) is to outline how Appalachian will mitigate the low dissolved oxygen (DO) conditions observed in the tailrace of the Claytor Project during the Water Quality Study completed for relicensing and how Appalachian will monitor the proposed mitigation to ensure dissolved oxygen levels remain above water quality standards in the tailrace.

### 1.1 Claytor Project Lands and Waters

The Claytor Project is located on the New River in Pulaski County, Virginia. The Claytor Project has four generating units, with a combined hydraulic capacity of 10,000 cfs and a generating capacity of 75 MW.

The reservoir behind Claytor dam has a surface area of 4,360 acres at an operating pool elevation of 1846.0 feet National Geodetic Vertical Datum (NGVD) and 100 miles of shoreline. The Project boundary for the Claytor Development is generally 1850 feet NGVD.

The project currently operates on a weekly cycle as a peaking facility from October 16 through April 14. Daily reservoir fluctuations are typically less than one foot, with the weekly fluctuations of 1-2 feet. Appalachian also currently operates the project to maintain stable reservoir elevations at or above 1,844 feet from April 15 through June 15 to protect shallow water spawning habitat in the reservoir. From June 16 through October 15, Appalachian operates the project to maintain more levelized flows downstream from the project.

Under the new license, Appalachian is proposing to operate as a peaking facility from December 1 to March 31. Reservoir fluctuations will be between 1844' and 1846' during this period and the minimum average hourly flow during non-peaking hours will be 1000 cfs or inflow. Appalachian is proposing to operate as a levelized flow facility from April 1 and November 30. Reservoir fluctuations will be between 1845' and 1846' during this period and the minimum average hourly flow will be 750 cfs or inflow, whichever is higher.

## 2.0 PROBLEM STATEMENT: LOW DISSOLVED OXYGEN IN TAILWATER

In 2007, Appalachian retained Normandeau Associates to conduct a Water Quality Study as part of Appalachian's relicensing efforts for the Project. The study identified that during the summer and early fall of 2007, average daily DO levels in the tailrace were consistently below <5 mg/l for more than three months of the study and <4 mg/l for more than two months. These low DO levels resulted from the location of the intake zone for the Claytor Project.

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It is important to recognize that the New River streamflow was extraordinarily low during the majority of the study period. Based on U.S.G.S stream flow records for Allisonia, streamflow was significantly below average during and before the June 18 to October 31 study period. There were periods during the study when daily streamflow into Claytor Lake was below 750 cfs, which is the usual minimum flow requirement and represents the 7Q10 for the site. Based on the review of existing data for the New River downstream of the project, low DO also occurred during 2002 and 2005 which were also low flow years.

DO concentrations recover (return to >5 mg/l) in the New River downstream of the Claytor Project by the time the water reaches the Rt. 11 bridge (5.3 miles downstream of the dam.)

### 3.0 MITIGATION MEASURES FOR LOW DISSOLVED OXYGEN IN THE TAILRACE

In order to enhance DO conditions in the project discharge, Appalachian is proposing to initially explore, by engineering evaluation and experimentation, utilization of the existing deicing bubbler system that is located in front of the head gates in the forebay to increase the DO in the water being discharged from the Project. This system may need to be reconfigured in order to allow either directed air or oxygen flow to selected penstock intake areas to achieve maximum aeration efficiency. Appalachian is proposing to implement the above enhancement measure within one year following the approval of the Management Plan. The system will operate from July through September each year.

Monitoring of the tailrace will be conducted as described in Section 4.0 to ensure the low dissolved oxygen levels in the tailrace have been successfully mitigated (discharge remains above water quality standards of 5 mg/l (average daily) and 4 mg/l (minimum instantaneous.))

An evaluation (demonstration study) of the effects of any proposed mitigation measure for low dissolved oxygen (DO) concentrations in the tailrace on reservoir fisheries and water quality will be completed.<sup>1</sup>

A period of 1 (one year) will be provided to evaluate a new mitigation measures for low DO in the tailrace (effectiveness demonstration study) should any implemented measure fail to raise DO levels to state water quality standards described in Section 4.1 of the Water Quality Monitoring Plan.<sup>1</sup>

Appalachian will provide alternative mitigation should the results of the study (demonstration study or effectiveness demonstration study) conclude that the actions taken to date are not effective. Such alternative mitigation will be developed in consultation with the

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Water Quality / Water Management Technical Review Committee within 120 days of concluding the study, and such alternative mitigation will be approved by VDEQ. <sup>1,2</sup>

Information related to the results of the evaluation and experimentation any mitigation measure<sup>3</sup> will be provided to the interested stakeholders and consultation will occur as described in Section 4.1<sup>3</sup>.

#### 4.0 MONITORING AND CONSULTATION MEASURES

The purpose of this section of the Plan is to outline the proposed water quality monitoring protocol, the process for consultation with the state agencies and other interested stakeholders and Plan revisions.

##### 4.1 Monitoring Methods

Monitoring and assessment of the proposed implementation of DO enhancement measures on dissolved oxygen in the tailrace of the Claytor Project will be conducted for five (5) years following issuance of the new license. A minimum of five (5) dissolved oxygen and temperature monitoring locations will be identified between Claytor dam and the Route 11 bridge, located downstream of the project. The locations will be approved by the Water Quality/Water Management Technical Review Committee provided for in the Water Quality Monitoring Plan. Monitoring equipment will be deployed at each identified monitoring location. <sup>2</sup> The continuous monitors will collect data year-round to ensure Project effects on dissolved oxygen are not experienced outside of the identified period of concern. The study period will be extended if a low flow event does not occur within the initial five-year period (inflows of less than 826 cfs), or if depressed dissolved oxygen levels (<5.0 mg/l apart from inflow) continue during the initial five-year period. The appropriate period for extending the study, and any proposed changes to the study methods, will be determined in consultation with the Water Quality / Water Management Technical Review Committee, as detailed in the Water Quality Monitoring Plan.<sup>2</sup>

If a low flow period persists over several days or if DO is persistently less than 5.0 mg/l, monitoring will be conducted both with and without the enhancement measure in place to assess its effectiveness. Data will be downloaded on a biweekly basis and compared with operation of the generating units at Claytor. More frequent download of data may be required during stratification periods to review data and initiate any mitigation method<sup>3</sup> evaluation based on DO results. The dissolved oxygen and temperature monitor(s) will be maintained and calibrated within acceptable timeframes based on the manufacture's recommendations and on-site experience.

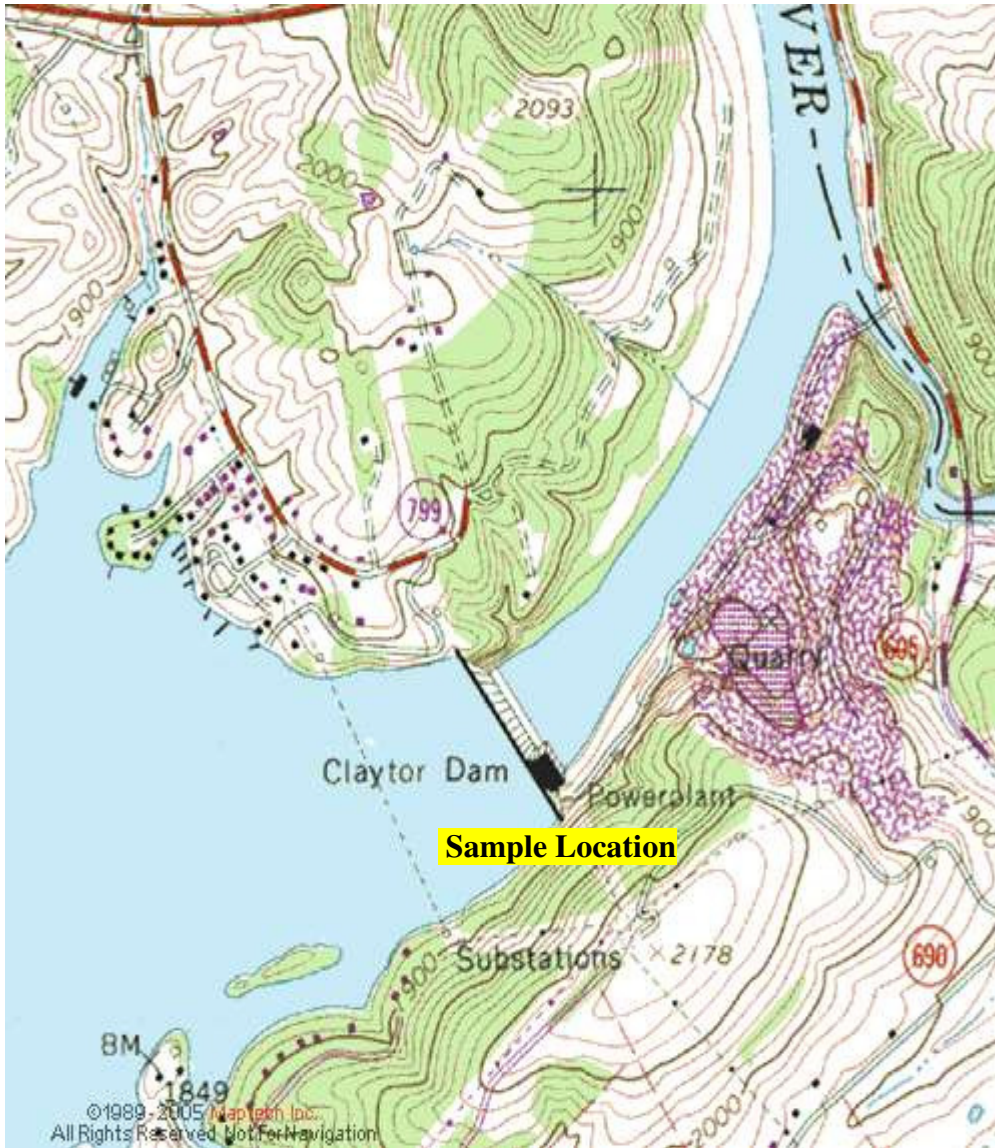
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In addition, at least once per year during the five-year monitoring period, monitoring will be conducted along two transects above Claytor Dam as sampled during the Water Quality Study for relicensing (Figure 1). This reservoir monitoring will be conducted during generation mode and during the anticipated stratification period between the beginning of July and the end of September. Water quality parameters that will be measured will consist of dissolved oxygen and temperature at 1-meter intervals from surface to bottom at four locations across two transects. One transect will be in or near the forebay and the other transect will be 1 km upstream of the dam. Measurements will be made in accordance with DEQ-accepted protocols for field measurements of this type. DEQ protocols can be found in the document titled "Standard Operating Procedures Manual for the Department of Environmental Quality Office of Water Quality Monitoring and Assessment". If there is a sustained period of low inflow conditions (< 826 cfs) from July to September and/or DO observations reveal persistent depressed concentrations (<5 mg/l apart from inflow) from July to September, additional monitoring in the forebay will be conducted.

A continuous DO monitor will be deployed at the Allisonia USGS gauge station (No. 03168000) from April 1 to November 1 to monitor inflow to the project. Monitoring records of DO will be maintained by Appalachian and summarized in an annual report filed with the Commission.<sup>1</sup>

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Figure 1. Dissolved Oxygen and Temperature Monitoring Location Map.



**\* 5 locations  
Downstream**

**Note: The first transect in the reservoir will be in or near the forebay. A second transect in the reservoir (not shown) will be located 1 km upstream of the dam. A total of five monitors will be placed downstream. Sites will be identified through consultation with the Technical Review Committee.<sup>2</sup>**

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## 4.2 Consultation

Appalachian will establish a Water Quality / Water Management Technical Review Committee (Technical Review Committee) to review and comment on the monitoring results. This committee will consist of representatives from Virginia Department of Environmental Quality, Virginia Department of Game and Inland Fisheries, Virginia Department of Conservation and Recreation, Friends of Claytor Lake, Friends of the New River, county government and other interested stakeholders. The Technical Review Committee will meet at least once per year to review the monitoring results and additional meetings will be held on an as-needed basis.

As part of the annual review process, the Committee will assess the success of the enhancement measures in terms of maintaining the state standard DO requirements in the project discharge. Should it be determined that the enhancement measures do not prevent low dissolved oxygen, then Appalachian will investigate other potential mitigation measures.

## 4.3 Report

Appalachian will provide an annual report outlining the monitoring results, analyses and recommendations for continued monitoring or additional measures for addressing dissolved oxygen to the Technical Review Committee for review and comment. The Technical Review Committee will be given thirty (30) days for review and comment. These comments will be provided to the Federal Energy Regulatory Commission as documentation of consultation.

A revised report will then be compiled for submission to the Federal Energy Regulatory Commission. Included in this report will be 1) monitoring data and analyses, 2) recommendations for continued monitoring, 3) assessment of the current method of DO enhancement or, if needed, additional measures to address dissolved oxygen, 4) any other support documents including documentation of consultation with the Technical Review Committee and a summary of the other water quality monitoring results that have been completed outside of the license as described in Section 4.4. and 5) a discussion of Technical Review Committee comments and recommendations.

## 4.4 Coordination with other Water Quality Monitoring Efforts

The Virginia Department of Environmental Quality and the Friends of Claytor Lake conduct water quality monitoring on the lake for parameters that are not related to the operation of the Project. A complete report of all water quality monitoring parameters is located in the Water Quality Study Report dated December 2008 that was compiled for the relicensing of the Project. The Friends of Claytor Lake's

monitoring is a voluntary effort. To aid in these efforts, Appalachian will provide funding assistance outside of the license to the Friends of Claytor Lake for as long as this program is in place. Appalachian will request the results of their monitoring and include the information in the annual report to the Technical Review Committee and the Commission. In addition, Appalachian will provide all its monitoring data collected as part of its management plan to Virginia Department of Environmental Quality and Friends of Claytor Lake.