# EDI Metadata Template (2016)[[1]](#footnote-0)

Data should be in csv text file. If starting with an Excel spreadsheet, please make sure it does not contain any formulas and comments on cells. If you need comments put them in their own column. If data were used in a database and major table linking is necessary to analyze, please de-normalize into a flat file, not just database table exports.

## Dataset Title

Water chemistry time series for Beaverdam Reservoir, Carvins Cove Reservoir, Falling Creek Reservoir, Gatewood Reservoir, and Spring Hollow Reservoir in southwestern Virginia, USA 2013-2017

## Short name or nickname you use to refer to this dataset:

Reservoir water chemistry dataset

## Abstract

Depth profiles of dissolved organic carbon and total and dissolved nitrogen and phosphorus were sampled from 2013 to 2018 in five drinking water reservoirs in southwestern Virginia, USA. These reservoirs are: Beaverdam Reservoir (Vinton, Virginia), Carvins Cove Reservoir (Roanoke, Virginia), Falling Creek Reservoir (Vinton, Virginia), Gatewood Reservoir (Pulaski, Virginia), and Spring Hollow Reservoir (Salem, Virginia). Beaverdam, Carvins Cove, Falling Creek, and Spring Hollow Reservoirs are owned and operated by the Western Virginia Water Authority as primary or secondary drinking water sources for Roanoke, Virginia, and Gatewood Reservoir is a drinking water source for the Town of Pulaski, Virginia. The dataset consists of depth profiles of water chemistry samples measured at the deepest site of each reservoir adjacent to the dam. Additional water chemistry samples were collected at a gauged weir on Falling Creek Reservoir’s primary inflow tributary. The samples were collected approximately fortnightly from March-April, weekly from May-October, and monthly from November-February at Falling Creek Reservoir and Beaverdam Reservoir, approximately fortnightly from May-August in most years at Carvins Cover Reservoir, and approximately fortnightly from 2014-2016 in Gatewood and Spring Hollow Reservoirs. Depth profiles of dissolved inorganic carbon were also collected in 2018, but the analytical method for this analyte is still in development and these should be considered as preliminary data only.

## Investigators

(list in order as for a paper with e-mail addresses, organization and preferably ORCID ID, if you don’t have one, get it, it’s easy and free: <http://orcid.org/>) add table rows as needed

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| N/A |  |  |  |  |  |  |
|  |  |  |  |  |  |  |

## Keywords

Virginia Tech, Stream Team, Carey Lab, Western Virginia Water Authority, Falling Creek Reservoir, nitrate, soluble reactive phosphorus, dissolved organic carbon, dissolved inorganic carbon, ammonium, total nitrogen, total phosphorus, lake, reservoir, lakes

## Funding of this work:

Add rows to table if several grants were involved, list only the main PI, start with main grant first:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| PI First Name | PI Middle Initial | PI Last Name | PI ORCID ID | Title of Grant | Funding Agency | Funding Identification Number |
| Cayelan | C. | Carey | [0000-0001-8835-4476](http://orcid.org/0000-0001-8835-4476) | N/A | Western Virginia Water Authority | N/A |
| Cayelan | C. | Carey | [0000-0001-8835-4476](http://orcid.org/0000-0001-8835-4476) | Dynamics of coupled P-Fe-Mn cycling in drinking water reservoirs and implications for water quality | Institute of Critical Technology and Applied Science | N/A |
| Cayelan | C. | Carey | [0000-0001-8835-4476](http://orcid.org/0000-0001-8835-4476) | N/A | Virginia Tech Global Change Center | N/A |
| Cayelan | C. | Carey | [0000-0001-8835-4476](http://orcid.org/0000-0001-8835-4476) | N/A | Fralin Life Sciences Institute | N/A |
| Cayelan | C. | Carey | [0000-0001-8835-4476](http://orcid.org/0000-0001-8835-4476) | **SCC-IRG Track 2: Resilient Water Systems: Integrating Environmental Sensor Networks and Real-Time Forecasting to Adaptively Manage Drinking Water Quality and Build Social Trust** | National Science Foundation | 1737424 |
| Cayelan | C. | Carey | [0000-0001-8835-4476](http://orcid.org/0000-0001-8835-4476) | **Collaborative Research: Consequences of changing oxygen availability for carbon cycling in freshwater ecosystems** | National Science Foundation | 1753639 |

## Timeframe

* Begin date: 2013-04-04
* End date: 2018-12-17
* Data collection ongoing/completed: ongoing

## Geographic location

Beaverdam Reservoir

* Verbal description: Beaverdam Reservoir is located in Vinton, Virginia, USA
* North bounding coordinates (decimals): 37.322865
* South bounding coordinates (decimals): 37.311961
* East bounding coordinates (decimals): -79.813848
* West bounding coordinates (decimals): -79.824834

Carvins Cove Reservoir

* Verbal description: Carvins Cove Reservoir is located in Roanoke, Virginia, USA
* North bounding coordinates (decimals): 37.409127
* South bounding coordinates (decimals): 37.365345
* East bounding coordinates (decimals): -79.944052
* West bounding coordinates (decimals): -79.978642

Falling Creek Reservoir

* Verbal description: Falling Creek Reservoir is located in Vinton, Virginia, USA
* North bounding coordinates (decimals): 37.309589
* South bounding coordinates (decimals): 37.302660
* East bounding coordinates (decimals): -79.836009
* West bounding coordinates (decimals): -79.839249

Gatewood Reservoir

* Verbal description: Gatewood Reservoir is located in Pulaski, Virginia, USA
* North bounding coordinates (decimals): 37.054358
* South bounding coordinates (decimals): 37.038190
* East bounding coordinates (decimals): -80.858492
* West bounding coordinates (decimals): -80.891880

Spring Hollow Reservoir

* Verbal description: Spring Hollow Reservoir is located in Salem, Virginia, USA
* North bounding coordinates (decimals): 37.231092
* South bounding coordinates (decimals): 37.217594
* East bounding coordinates (decimals): -80.170407
* West bounding coordinates (decimals): -80.179076

## Taxonomic species or groups

N/A

## Methods

**SAMPLING TIMES**

Most sampling occurred between the hours of 9:00 and 15:00, and are denoted in the DateTime as 12:00. Some sampling occurred outside of these hours, including some overnight sampling; these instances are noted by the actual sampling time within the DateTime column. For more information about nighttime sampling, see Doubek et. al. 2018.

**SAMPLE COLLECTION AND EQUIPMENT**

Total nitrogen (TN) and total phosphorus (TP)

Unfiltered water samples were collected at specified depths for each reservoir using a 4L Van Dorn water sampler (Wildco, Yulee, Florida, USA). Sample timestamps for samples collected between approximately 9 a.m. and 3 p.m. were standardized to noon. Samples collected for projects that required sample collection at specific times of day were standardized to the top of the hour during which they were collected (i.e., a sample timestamp of 16:00 indicates a sample taken between 4 and 5 p.m.). Samples were stored in acid-washed 125 mL polypropylene bottles and frozen within 12 hours. Samples were generally analyzed within one year of collection date.

Soluble reactive phosphorus (SRP), nitrate (NO3), ammonium (NH4), dissolved organic carbon (DOC), and dissolved inorganic carbon (DIC)

Water samples were collected at specified depths for each reservoir using a Van Dorn water sampler and were filtered with a 0.7 µm glass fiber filter (Thomas Scientific GF/F) before being stored in acid-washed 125 mL polypropylene bottles. Sample timestamps for samples collected between approximately 9 a.m. and 3 p.m. were standardized to noon. Samples collected for projects that required sample collection at specific times of day were standardized to the top of the hour during which they were collected (i.e., a sample timestamp of 16:00 indicates a sample taken between 4 and 5 p.m.). Samples were frozen within 12 hours. Samples were generally analyzed within six months of collection date.

**CHEMICAL ANALYSES AND EQUIPMENT**

TN and TP

Samples were digested with alkaline persulfate (Patton and Kryskalla 2003) and then analyzed colorimetrically using flow injection analysis (APHA 2005). TN was analyzed using the cadmium reduction method (APHA 1998) and TP was analyzed using the ascorbic acid method (Murphy and Riley 1962) on a Lachat Instruments XYZ Autosampler ASX 520 Series and QuikChem Series 8500 (Lachat ASX 520 Series, Lachat Instruments, Loveland, Colorado, USA).

SRP, NO3, NH4

Samples were analyzed colorimetrically using flow injection analysis (APHA 2005). SRP was analyzed using the ascorbic acid method (Murphy and Riley 1962), NO3 was analyzed using the cadmium reduction method (APHA 1998), and NH4 was analyzed using the Berthelot Reaction method (Solorzano 1969, APHA 2005) with a common modification as to the source of the hypochlorite ion as described in Zhang et al. 1997 on a Lachat Instruments XYZ Autosampler ASX 520 Series and QuikChem Series 8500 (Lachat ASX 520 Series, Lachat Instruments, Loveland, Colorado, USA).

DOC and DIC

DOC was analyzed using the persulfate catalytic method (Brenton and Arnett 1993) on a TOCA 1010 from OI Analytical from 2013-2016 (OI Analytical 1010 Total Organic Carbon Analyzer with 1051 autosampler, College Station, TX USA) and on a Vario TOC Cube from Elementar from 2016-2017 (vario TOC cube, Elementar Analysensysteme GmbH, Hanau, Germany). Carbon in samples is oxidized to carbon dioxide (CO 2 ) either by reaction with acid or by catalyzed combustion at 850 C. Resulting carbon dioxide is detected by nondispersive infrared (NDIR) spectrometry.

DN

Sample is combusted using the Vario TOC Cube from Elemantar at 850 degrees C. Total bound nitrogen in the combustion product is converted to nitrogen monoxide (NO) by oxidative pyrolysis then reacts with electrolyte in the electrochemical cell producing a measurable current.

References

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Brenton R, Arnett T. 1993. Method of analysis by the U.S. Geological Survey National Water Quality Laboratory – Determination of dissolved organic carbon by UV-promoted persulfate oxidation and infrared spectrometry. Denver, CO: U.S. Geological Survey.

Murphy J, Riley JP. 1962. A modified single solution method for the determination of phosphate in natural waters. Anal Chim Acta 27:31.6.

Patton CJ, Kryskalla JR. 2003. Methods of Analysis by the U.S. Geological Survey National Water Quality Laboratory—Evaluation of Alkaline Persulfate Digestion as an Alternative to Kjeldahl Digestion for Determination of Total and Dissolved Nitrogen and Phosphorus in Water. Denver, CO: U.S. Geological Survey.

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Solorzano, L. 1969. Determination of ammonia in natural water by the phenolhypochlorite method. Limnol Oceanogr 14:799-801.

USEPA. 2004. RSKSOP-175 STANDARD OPERATING PROCEDURE Sample Preparation and Calculations for Dissolved Gas Analysis in Water Samples Using a GC Headspace Equilibration Technique, Revision No.2 <http://www.epa.gov/region1/info/testmethods/pdfs/RSKsop175v2.pdf> Retrieved 20APR2015.

Zhang, J.Z., Orter, P., Fisher, Ch. J. and Moore, L.D. 1997. Determination of ammonia in estuarine and coastal waters by gas segmented flow colorimetric analysis. Methods for determination of chemical substances in marine and estuarine environmental matrices. 2nd ed. EPA/7664-41-7.

## Data Table

* Column name: exactly as it appears in the dataset. Please avoid special characters, dashes and spaces.
* Description: please be specific, it can be lengthy
* Unit: please avoid special characters and describe units in this pattern: e.g. microSiemenPerCentimeter, microgramsPerLiter, absoptionPerMolePerCentimeter
* Code explanation: if you use codes in your column, please explain in this way: e.g. LR=Little Rock Lake, A=Sample suspect, J=Nonstandard routine followed
* Data format: please tell us exactly how the date and time is formatted: e.g. mm/dd/yyyy hh:mm:ss plus the time zone and whether or not daylight savings was observed.
* If a code for ‘no data’ is used, please specify: e.g. -99999

**Table 1: Water Chemistry**

|  |  |  |  |
| --- | --- | --- | --- |
| Column name | Description | Unit or  code explanation or date format | Empty value code |
| Reservoir | Three-letter code corresponding to sampled reservoir | BVR=Beaverdam Reservoir, CCR= Carvins Cove Reservoir, FCR=Falling Creek Reservoir, GWR=Gatewood Reservoir, SHR=Spring Hollow Reservoir |  |
| Site | Sampling site within each reservoir | 50=Deep hole or site nearest to dam in each reservoir, 100=Inflow stream of Falling Creek Reservoir, 20=Upstream pelagic site nearest to inflow stream at Falling Creek Reservoir |  |
| DateTime | Date and time of sampling. All data were collected in the eastern time zone of the U.S.A., with daylight savings time observed | YYYY-MM-DD HH:MM:SS |  |
| Depth\_m | Water depth where the sample was collected or sensor reading was measured | meter |  |
| TN\_ugL | Total nitrogen concentration | microgramsPerLiter | NA |
| TP\_ugL | Total phosphorus concentration | microgramsPerLiter | NA |
| NH4\_ugL | Ammonium concentration | microgramsPerLiter | NA |
| NO3NO2\_ugL | Nitrate-nitrite concentration | microgramsPerLiter | NA |
| SRP\_ugL | Soluble reactive phosphorus concentration | microgramsPerLiter | NA |
| DOC\_mgL | Dissolved organic carbon concentration | milligramsPerLiter | NA |
| DIC\_mgL | Dissolved inorganic carbon concentration | milligramsPerLiter | NA |
| DC\_mgL | Dissolved carbon concentration | milligramsPerLiter | NA |
| DN\_mgL | Dissolved nitrogen concentration | milligramsPerLiter | NA |
| Flag\_TN | Data flag for total nitrogen (TN) | 1 = sample not taken  2 = instrument malfunction  3 = sample below detection  4 = negative value set to zero  5 = demonic intrusion  6 = non-standard method  7 = sample run multiple times and values averaged |  |
| Flag\_TP | Data flag for total phosphorus (TP) | 1 = sample not taken  2 = instrument malfunction  3 = sample below detection  4 = negative value set to zero  5 = demonic intrusion  6 = non-standard method  7 = sample run multiple times and values averaged |  |
| Flag\_NH4 | Data flag for ammonium (NH4) | 1 = sample not taken  2 = instrument malfunction  3 = sample below detection  4 = negative value set to zero  5 = demonic intrusion  6 = non-standard method  7 = sample run multiple times and values averaged |  |
| Flag\_NO3NO2 | Data flag for nitrate nitrite (NO3NO2) | 1 = sample not taken  2 = instrument malfunction  3 = sample below detection  4 = negative value set to zero  5 = demonic intrusion  6 = non-standard method  7 = sample run multiple times and values averaged |  |
| Flag\_SRP | Data flag for soluble reactive phosphorus (SRP) | 1 = sample not taken  2 = instrument malfunction  3 = sample below detection  4 = negative value set to zero  5 = demonic intrusion  6 = non-standard method  7 = sample run multiple times and values averaged |  |
| Flag\_DOC | Data flag for dissolved organic carbon (DOC) | 1 = sample not taken  2 = instrument malfunction  3 = sample below detection  4 = negative value set to zero  5 = demonic intrusion  6 = non-standard method  7 = sample run multiple times and values averaged |  |
| Flag\_DIC | Data flag for dissolved inorganic carbon (DIC) | 1 = sample not taken  2 = instrument malfunction  3 = sample below detection  4 = negative value set to zero  5 = demonic intrusion  6 = non-standard method  7 = sample run multiple times and values averaged |  |
| Flag\_DC | Data flag for dissolved carbon (DC) | 1 = sample not taken  2 = instrument malfunction  3 = sample below detection  4 = negative value set to zero  5 = demonic intrusion  6 = non-standard method  7 = sample run multiple times and values averaged |  |
| Flag\_DN | Data flag for dissolved nitrogen (DN) | 1 = sample not taken  2 = instrument malfunction  3 = sample below detection  4 = negative value set to zero  5 = demonic intrusion  6 = non-standard method  7 = sample run multiple times and values averaged |  |

## Notes and Comments

From 2013 to 2017, multiple whole-ecosystem manipulations were conducted at Falling Creek Reservoir. These manipulations include intermittent operation of hypolimnetic oxygenation and pulsed epilimnetic mixing engineering systems. For a detailed description of the hypolimnetic oxygenation engineered system, see Gerling et al. (2014) and for a detailed description of the epilimnetic mixing engineered system, see Chen et al. (2017). These systems were operated over time following Table 1 in Gerling et al. (2016), Table 1 in Munger et al. (2016), and Table 2 in McClure et al. (2018).

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Gerling, A.B., Browne, R.G., Gantzer, P.A., Mobley, M.H., Little, J.C., and C.C. Carey. 2014. First report of the successful operation of a side stream supersaturation hypolimnetic oxygenation system in a eutrophic, shallow reservoir. *Water Research.* 67: 129-143. doi: 10.1016/j.watres.2014.09.002

Gerling, A.B., Z.W. Munger, J.P. Doubek, K.D. Hamre, P.A. Gantzer, J.C. Little, and C.C. Carey.2016**.** Whole-catchment manipulations of internal and external loading reveal the sensitivity of a century-old reservoir to hypoxia. *Ecosystems.* 19:555-571. DOI: 10.1007/s10021-015-9951-0

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Munger, Z.W., C.C. Carey, A.B. Gerling, K.D. Hamre, J.P. Doubek, S.D. Klepatzki, R.P. McClure, and M.E. Schreiber. 2016. Effectiveness of hypolimnetic oxygenation for preventing accumulation of Fe and Mn in a drinking water reservoir. *Water Research*. 106: 1-14. DOI: 10.1016/j.watres.2016.09.038.

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1. This document liberally borrows from similar documents at SBC and GCE [↑](#footnote-ref-0)