South Dakota Quality Assurance Project Plan for the Stream Discharge Monitoring Program

South Dakota

Department of Agriculture and Natural Resources

Division of Resource Conservation and Forestry

Watershed Protection Program

April 2022

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STREAM DISCHARGE MONITORING PROGRAM

QUALITY ASSURANCE PROJECT PLAN

SUBMITTED BY:

SOUTH DAKOTA DEPARTMENT OF AGRICULTURE AND NATURAL RESOURCES

DIVISION OF RESOURCE CONSERVATION AND FORESRTY

WATERSHED PROTECTION PROGRAM

APPROVED BY:

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South Dakota Watershed Protection Program
Administrator — Date

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South Dakota DANR Quality Assurance Officer
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South Dakota Watershed Protection Program
SDMP Project Officer — Date

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A3: Distribution List

The current version of the Quality Assurance Project Plan (QAPP) will be posted on the DANR website and the South Dakota Stream Discharge Monitoring Program (SDMP) webpage. It will also be saved under the file pathway; R:/work/Discharge and Stage Data/QAQC – SOP/QAPP.

Table 1: Distribution List

Name	Title
Bill Smith	Division Director
Barry McLaury	Administrator Watershed Protection Program, Manager II
Paul Lorenzen	Team Leader/Environmental Scientist Manager I Assessment Team
Kris Dozark	Team Leader/Environmental Scientist Manager I Implementation Team

All personnel involved with stream discharge collecting activities for the South Dakota Department of Agriculture and Natural Resources, Watershed Protection Program (SD DANR WPP) shall receive a copy of this plan and therefore should be thoroughly familiar with WPP discharge collecting, management structure, and procedures. Compliance with QAPP elements results in data collection and management that is valid and suitable for use in discharge curve development, water quality, and Total Maximum Daily Load (TMDL) assessments projects, other programs, and projects.

A4: Project Organization

The following individuals are responsible for the design and implementation of this project:

Roles and Responsibility

The SDMPs project manager will be responsible for coordinating with other DANR personnel to identify waterbodies that will require discharge and stage monitoring. Jeremy Schelhaas, the SDMP project manager will serve as the primary contact for SDMP issues. Jeremy will coordinate with DANR staff in Pierre, Rapid, and Sioux Falls to facilitate the collection of stream discharges across the State. All discharges will be taken by DANR staff that are trained in the proper use of discharge calculating equipment. The SDMPs manager will coordinate with DANR staff regarding discharge results and any recommended follow-up actions that may need to be taken.

An organizational chart to visually demonstrate program hierarchy can be found in the Nonpoint Source Program QAPP.

Management Responsibilities

Quality Assurance (QA) Responsibilities:

The DANR QA Office, Tyler Frideres, will be responsible for interpreting comparison discharge measurements collected across DANR all discharge collection equipment.

Field Responsibilities:

All discharge measurements will be collected by DANR staff that have gone through all applicable training materials and will follow all QAPP guidance and SOP methods. After staff has returned from the field, discharge measurement equipment data files and discharge measurement sheets will be uploaded within two working days to the corresponding location on the DANR's R drive.
Staff from the Rapid City office will be responsible for collecting discharge measurements and maintenances of equipment in the western part of the State.

Staff from the Pierre office will be responsible for collecting discharge measurements and maintenances of equipment in the central part of the State.

Staff from the Sioux Falls office will be responsible for collecting discharge measurements and maintenances of equipment in the eastern part of the State.

SDMP project manager Responsibilities:

The SDMP project manager, Jeremy Schelhaas, will make sure the QAPP is followed as approved and that all DANR staff have access to the most current version of the QAPP and all necessary documents in order to collect accurate discharge measurements. Personnel will be informed of all requirements for the project prior to any discharge collection. Jeremy will also be responsible for the basic operation of the SDMP tasks including:

- determining when critical discharge measurements are needed at monitored sites
- provide technical direction to DANR staff on collecting discharges
- upload discharge measurements into the WISKI database
- utilize BIBER to develop stage-discharge rating curves
- complete or notify other staff of required equipment maintenance
- communicate with the National Weather Service (NWS) to inform them of changes made to Geostationary Operational Environmental Satellite (GOES) sites and updated rating curves

A5: Problem Definition/Background

Several streams across South Dakota have needed stage recording and discharge measurements to be associated with sample collection, TMDL development, or model calibrations. USGS monitored sites are used when reasonably applicable, but in several situations, a USGS site is not an option or is no longer operational. DANR has set up temporary and permanent stage and discharge monitoring sites as needed with technical equipment being deployed on-site and software used to determine discharge.

DANR staff has been collecting discharge measurements since the spring of 2000. Equipment used to collect discharges and store data has changed multiple times over the years and has progressively gotten better and more reliable. Marsh-McBirneys were used at the start, then the FlowTracker and ADCPs tethered to log data cables or radio transmitters became available. The current discharge calculating equipment utilized by DANR consists of FlowTracker 2s, StreamPros, and a RiverRay equipped with GPS.

Methods for storing and processing discharge data have also changed greatly over that time. Some of the early data collected by the SDMP has been lost or doesn't contain enough information to be as useful with today's software. It is important to recognize the quality of the data collected, keep relevant data in an

organized manner, and ensure data is collected with proper technique and standards by all DANR staff that collect and process discharge information.

The nature of streams is always changing. A flood one year can scour and change the profile of a stream in short order, while years of low flow can deposit sediment. This makes the SDMP an ongoing effort requiring the involvement of several DANR staff.

Goals and Objectives:

The goal of this project is to monitor discharge for sites of interest to DANR across the State. Information collected from discharge measurements will provide valuable data for the development or maintenance of discharge curves. Discharge curves developed by the SDMP have been used in the development of Total Maximum Daily Load (TMDL) reports for lakes and rivers across the State in the Watershed Protection Program. The discharge curves and stage data have also been valuable for other groups across DANR in determining historic site conditions and developing policies for the future.

DANR discharge monitoring sites have transitioned or will transition to GOES, a satellite platform that sends real-time stage readings to a National Oceanic Atmospheric Administration (NOAA) website for customer download. This gives the ability for NOAA to also display collected data graphically through a GIS map portal that is accessible by the public. Here the public can get information on the current conditions of sites of interest to them. The sites will have a stage or elevation displayed along with a current flood rating. Some sites even have prediction capabilities that assist in warning the public of future flooding conditions. Through the SDMP, DANR will work with NOAA to maintain the streaming of information to NOAA's sites and provide discharge curves when available. This website is available at:

https://water.weather.gov

In 2018 the Big Sioux Flood Information System Model was developed by RESPEC at DANR's direction. Much like the NOAA website, there is stage-discharge feeding into this GIS map for public viewing. In addition to the current readings at these sites, flooding graphics are available representing multiple elevations of the streams in the area. The SDMP will maintain the monitoring sites for this model and provide information if/when the model is needed to be updated.

https://bigsiouxfis.org

The SDMP has always looked for ways to improve. Whether it is in collecting, storing, or processing data to deploying equipment and methods used in the field. SDMP's intends to use best practices and stay up to date on equipment and methods.

A6: Project Description and Schedule

The DANR Stream Discharge Monitoring Project (SDMP) is a Watershed Protection Program's ongoing discharge monitoring initiative that encompasses the entire state. Staff in corresponding regions travel their watersheds throughout the ice-out season to collect discharges that represent monitored sites.

This QAPP provides information regarding the collection, data transferring/storage, and analysis of discharges for the SDMP. A list of all sites and responsible regions for routine stage and discharge collection is included in Appendix A.

Discharge collection will occur during the months of March through November, but the timing may be subject to ice-covered conditions. Discharges will be collected from bridges using tethered ADCPs or

instream using FlowTracker 2s and measuring tapes. A tagline may also be deployed if needed for site conditions that are not compatible with the previous methods.

Event discharge collection will take place to obtain peak flow conditions if conditions such as large rain events occur. With the help of NOAA's Advanced Hydrologic Prediction Service, some sites may have predictions on when a large discharge event will occur and DANR staff can plan accordingly. Other sites on the NOAA GIS site can be monitored in real-time to determine if the stage of the river is such that a discharge is desirable to collect.

Table 2: Discharge Collection Equipment for DANR Staff

Sample Type	Designated Flow	Velocity Range	Profiling Range	Temperature Range	Other Limitations
FlowTracker (1 or 2)	Low flow	±.003 to 13ft/s	0.1ft to height of wading rod	-4°F to 113°F	The stream needs to be safely wadable.
StreamPro	Mid-Range Flow	**Water mode** **12:** ±16ft/s **13:** <±0.8ft/s	**Water mode** **12:** 0.33ft to 19.6ft **13:** 0.33ft to 3.2ft	24.8 °F to 104°F	Low flow velocities can be difficult to detect. Over 5ft/s may require the use of the larger boat due to rapid movement in turbulent waters.
RiverRay	High flow	±16ft/s default ±20ft/s max	1.3ft to 262ft	23 °F to 113°F	Low flow velocities can be difficult to detect. Heavier than StreamPro.

Stage data for sites connected to NOAA's Geostationary Operational Environmental Satellite Program (GOES) will be downloaded at least bi-monthly, once at the beginning and once in the middle of the month to prevent data loss. Information on GOES is only available for about a month, thus downloading it bi-monthly will prevent the loss of ability to retrieve the data through the system. Sites that are not connected to GOES will be downloaded each time discharges are collected or annually to prevent data loss.

Changes to the discharge sampling approach identified in this QAPP will be documented as necessary. The schedule for the 2022 SDMP field season is shown in Table 2. Please note that this table is an estimated timeline of events for the year.

Table 3: Estimated Time for 2022 SDMP Field Season

TASK	2021- 2022														
	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
QAPP development	X	X	X	X	X	X									
QAPP Approval							X								
Discharge Comparisons						X	X	X							
Discharge collection	X	X				X	X	X	X	X	X	X	X	X	X
Analysis/Database management	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

A7: Data Quality Objectives and Criteria

The primary data-driven objective for the SDMP program is to determine continuous discharge on streams of interest to DANR. This is achieved by collecting discharge measurements in a wide range of conditions to develop discharge curves and applying them to stage records for the site. Results from the discharge data will be used by the State of South Dakota to develop TMDLs, use with water rights, update NOAA, and inform the public.

DANR will follow the criteria for deciding if data quality objectives have been met in terms of Completeness, Representativeness, Comparability, Precision, and Accuracy.

Completeness is a measure of the amount of valid data obtained from measurement systems compared to the amount that is expected to be obtained under optimum conditions. For a discharge to be utilized with confidence as a data point on the discharge curve, the data must be complete, i.e., there must be enough valid data from analysis to facilitate making the assessment. A discharge will be considered complete if it has met the standards set in the SOP and is accompanied by a valid discharge sheet with at least one time, date, and a staged reading.

Representativeness expresses the degree to which data accurately and precisely represents the characteristics of that which is being measured. Discharge measurements will be collected in such a manner that a discharge curve has data points representing the site at staggered intervals of the stage without large gaps.

Comparability expresses the confidence with which one data set can be compared to another. Comparability can be obtained through the use of standard discharge measuring equipment and procedures. The comparability of data is achieved by the commitment of SD DANR staff to use standardized methods, where possible, including the SD DANR SOP Volume I, USGS guidelines for

ADCP measurements, or documented modifications thereof that provide equal or better results. A separate discharge gathering team should take flows at the same location once a year during steady conditions to compare techniques and resulting measurements. This information is to be stored on the instrument history log.

Precision is a measure of the reproducibility of the measurement when an analysis is repeated. If a site has a discharge curve available, a comparison of the rating discharge and collected discharge should be made. The obtained discharge should be within 5 percent of the rating. If the discharge departs by more than 5 percent another discharge should be collected with different measuring equipment if feasible. Precision will be assessed through duplicate discharge measurements.

Accuracy shows how close the discharge value is to the "true" value. Accuracy will be assessed through the project by the collection of comparison measurements. A comparison measurement should come within 5% of documented discharge or reading from an independent method. All discharge measuring equipment should have a comparison measurement taken at least once every 3 years, and documented on the instrument history log located on DANR's shared drive at:

R:\Work\Discharge and Stage Data\ADCPMaintenanceLogs

An external temperature is also to be taken with a trusted thermometer during each discharge measurement to gauge the accuracy of the internal discharge equipment. This is to be documented on the Discharge Measurement Sheet for the site and in the WindRIver II software.

Please refer to Section 6.0 A of the SD DANR WPP SOP Volume I for taking discharge measurements.

A8: Special Training and Certification

DANR staff collecting discharges will require training on the use and handling of equipment, along with the documentation of collected data. Jeremy, the SDMP project manager, has received training through the United States Geological Survey (USGS) on the use of ADCPs to collect discharges. He has also received training from KISTERS on the operation of the WISKI database that houses all discharge information that is used to develop discharge curves. The SDMP project manager will ensure that all staff has access to available training materials.

A9: Documents and Records

Documentation and record collection are an integral part of maintaining proper QA protocols. The project manager, Jeremy Schelhaas, will make sure that before any discharge measurements are collected, all DANR staff have a copy of the most current version of the SDMP's QAPP. After discharges are collected DANR staff will place all discharge software related files and Discharge Measurement Sheets at:

R:\Work\Discharge and Stage Data\Discharge Files\Files to be Upload

The SDMP project manager will enter all data collected from these two locations onto the WISKI database. Staff will download stage data and enter it directly into the WISKI database.

B1: Data Generation and Acquisition

Sampling Design (Experimental Design):

South Dakota DANR staff will collect discharge measurements across the State at the set monitoring sites shown in Appendix A. The equipment used to collect the discharge will vary depending on local

conditions and which device will result in the best result. All procedures outlined in the SOP for operating discharge equipment shall be followed. ADCP measurements collected on a laptop should be stored on a separate flash drive after completion of the discharge. The discharge sheet shall be filled with all relevant data and saved at the proper location on the DANR shared drive, along with the equipment discharge file, within two working days after staff returns to the office.

Sampling Schedule:

Discharge collection will take place from spring thaw until the water freeze. Ideal sampling will include:

- Spring Runoff
- High Flow
- Low Flow
- Multiple Intermediate Flows

Sample Identification:

Discharge monitoring locations and descriptions have been assigned by the State of South Dakota and can be found in Appendix A.

B2: Sampling Methods

Sampling Methods:

Discharge measurement sampling methods are described in section 6A of the SD DANR WPP SOP Volume I.

Comparison Discharge Measurement:

A comparison discharge measurement is collected in the same manner as a regular measurement, then compared to a discharge from a valid stage rating curve at a stable site or independent technique. This could be done with another piece of discharge collecting equipment collected immediately after taking the first discharge. The discharge should be within 5% of the independent discharge. Comparison discharge measurements should be done after receiving new equipment, sending equipment in for work, updating equipment software, and be done at least once every 3 years. Results of the comparison measurements must be documented under the corresponding equipment at:

R:\Work\Discharge and Stage Data\ADCPMaintenanceLogs

Corrective Actions:

Corrective actions for deficiencies will be addressed immediately in the field or after post-processing of the discharge. If a valid stage rating curve is available for a site and there is greater than a 5% discrepancy from the rating, another flow should be collected immediately after the first. Use of another device if available is recommended but not necessary. If it is found that a discharge is not reliable during post processing, it is at the SDMP Managers' discretion to give it a poor rating or discard the data.

B3: Sample Handling, Custody, and Documentation

This section does not apply to this QAPP.

B4: Analytical Methods

Software will be used in the analysis of all discharge measurements collected. For discharges collected with StreamPro or RiverRay the USGS designed software QREV will be utilized to analyze the data and give the discharge a quality rating. Dischargers collected with a FlowTracker will utilize the FlowTracker software for rating.

B5: Quality Control

This section does not apply to this QAPP.

B6: Instrument/Equipment Testing, Inspection, and Maintenance

Testing will be completed before each measurement utilizing the manufacturers' software. Another test will be completed through comparison measurements.

B7: Instrument/Equipment Calibration and Frequency

Teledyne recommends factory calibration of ADCP equipment for temperature and transducer beam angle every two to three years. SONTEK FlowTrackers do not require periodic calibration unless damage occurs.

B8: Inspection/Acceptance of Supplies and Consumables

The procurement of supplies, equipment, and services must be controlled to ensure that specifications are met for the high quality and reliability required for each field and/or laboratory function. Upon receipt of materials or equipment, the Project Officer or Local Coordinator receives and signs for the materials. All items are inspected for the quality of the product. All chemicals are dated upon receipt. All supplies are stored appropriately and are discarded upon expiration date in accordance with local, state, and federal regulations.

B9: Non-direct Measurements

This section does not apply to this QAPP.

B10: Data Management

Field discharge collection must include a Discharge Measurement Sheet and a discharge equipment software data file that need to be uploaded for placement in the WISKI database by the SDMP manager. Within two working days of staff getting back to the office, the Discharge Measurement Sheet should be scanned and uploaded with the discharge equipment software file to:

R:\Work\Discharge and Stage Data\Discharge Files\Files to be Upload

After the information is uploaded to WISKI, the Discharge Measurement Sheets will be stored at:

R:\Work\Discharge and Stage Data\Discharge Files\Discharge Measurement Sheets

Original discharge equipment software files uploaded to WISKI will be stored in the corresponding site named folder at:

R:\Work\Discharge and Stage Data\Discharge Files\Monitored Sites

Discharge sheets require the following minimum information:

- Th date of sample - this can be entered in the date text box, or next to the site name for sheets covering multiple days
- The site name-This should include the WQM# if available, stream name, and location description
- Start and end time- If a time other than local time is used, it must be stated
- Wire weight reading before and after measurement- this must be recorded to the nearest 100th decimal position
- Wire weight bar reading
- Independent temperature check

Other information on the Discharge Measurement Sheet can be completed in the field or when back in the office.

While most stage monitoring sites can be downloaded from the internet, some require downloading of data recorders at the site. The stage records downloaded on-site should be downloaded once in the spring and once in the fall to prevent data loss and uploaded to the same file location as the other files to be uploaded. After these files are uploaded, they will be deleted from the "Files to be Uploaded" folder. Stage monitoring data available by internet download should be downloaded to the WISKI database every two weeks to prevent data loss.

The maintenance log file name should include the regional office where the equipment is assigned, equipment name, and serial number. The maintenance log for Discharge measuring equipment must be filled out and stored at:

R:\Work\Discharge and Stage Data\ADCPMaintenanceLogs

C1: Assessment and Response Actions

DANR staff is responsible for discharge collection and QA/QC procedures. Corrective actions for deficiencies will be addressed immediately in the field or will be resolved when the project manager uploads information to the WISKI database.

The State of South Dakota will use the following assessments for SDMP:

Surveillance:

The project manager will keep in regular contact with any staff collecting discharge measurement and stage data. As data is entered into the database it will be evaluated for completeness and grading. Measurements will be compared to previous measurements to ensure all readings are reasonable. Stage data will be assessed as needed. If a measurement or reading is found to be unreasonable, the project manager will investigate the cause and implement corrective actions. This may include follow-up with team members, equipment replacement, or adjustment of program parameters.

Peer Review:

Staff members will have access to the WISKI database for review of monitored sites.

Systems Audit:

A full scale systematic, qualitative review of equipment, personnel, training, procedures, record keeping, data validation, data management, and reporting aspects of the SD DANR WPP program will be completed by the SD DANR QAO, Tyler Frideres, every 5 years to evaluate SD DANR WPP QA/QC Procedures.

C2: Reports to Management

On an annual basis, the SDMP manager will submit a report detailing all discharges collected for the year to the WPP administrator and team leaders. The report may include:

- Results of performance and system audits
- Quality assurance issues
- List of training activities including dates
- Corrective actions and results
- A list of all QA documents, including status, and if the document is for a new or continuing project; (this would be a list of all SOPs, QAPPs, PIPs, SAPs and indicate if they are new, under revision, or approved)

D1: Data Review, Verification, and Validation

The objective of the data review is to assess whether or not the data collected achieved the quality objectives of the project. All discharge information is reviewed by the SDMP manager. QREV is utilized to analyze and grade ADCP data collected through Windriver, and the FlowTracker software will be utilized to analyze and grade discharges collected with a FlowTracker. From this software, the discharges are uploaded directly into WISKI. The discharge measurement sheet data collected in the field will be checked against the data imported through the software for accuracy. Data review, verification, and validation are key steps in the transition from the assessment and TMDL phase to the implementation phase. Data review, verification, and validation are the responsibility of the Project Officer and are accomplished by following quality assurance guidelines and criteria addressed in the SD DANR WPP-SOP, Volume I.

D2: Verification and Validation Methods

Data verification will include a review of the discharge measurement sheets and discharge processing software. Items verified include:

- Temperatures recorded by the ADCP and independent are within tolerances
- Discharge is reasonable for stage
- Dates and times are correct along with time zone and entered properly into WISKI
- Wire weight readings are correct and relative to stage reading.

D3: Reconciliation with User Requirements

All data and related information obtained during the course of this project will be entered into WISKI. Here the data will be stored, and users will be able to view desired data.

Appendix A: South Dakota DANR Discharge List

Stream	Site Location	Responding Region	WQM #
Medicine Creek	At Kennebec	Pierre	WQM 141
Medicine Knoll	At Canning	Pierre	WQM 142
Belle Fourche	At Belle Fourche	Rapid City	WQM 130
Box Elder Creek	At New Underwood	Rapid City	WQM 79
French Creek	At Lame Jonhnny Rd	Rapid City	WQM 514
Rapid Creek	Rapid City at East Patrick St	Rapid City	WQM 173
Spearfish Creek	At Old Belle Rd	Rapid City	WQM 89
Whitewood Creek	At Deadwood	Rapid City	WQM 85
Batchler Creek	At 474th Ave	Sioux Falls	WQM 185
Beaver Creek	At Hwy 18 in Canton	Sioux Falls	WQM 183
Big Sioux	At Brandon	Sioux Falls	WQM BS31
Big Sioux	At Canton	Sioux Falls	WQM 65
Big Sioux	At Egan	Sioux Falls	WQM BS06
Big Sioux	at Estelline	Sioux Falls	WQM BS08
Big Sioux	At Fairview	Sioux Falls	
Big Sioux	At Flandreau	Sioux Falls	WQM 18
Big Sioux	At I-90	Sioux Falls	WQM 23
Big Sioux	At Jasper St near Dell Rapids	Sioux Falls	WQM 3
Big Sioux	At Richland	Sioux Falls	WQM 32
Big Sioux	At Trent	Sioux Falls	
Brule	At Highway 50	Sioux Falls	WQM BS49
Choteau Creek	At 312th St	Sioux Falls	WQM 134
Lac Qui Parle	At Gary	Sioux Falls	WQM 45
Lake Pelican	Northwest Lake Pelican	Sioux Falls	
Lake Thompson	At 218th St	Sioux Falls	
Medary Creek	At 473rd Ave	Sioux Falls	WQM 187
North Deer Creek	At 209th St	Sioux Falls	
North Fork Whetstone	At 480th Ave	Sioux Falls	WQM 189
North fork Yellow Bank	At 486th Ave	Sioux Falls	WQM 688
Six Mile Creek	At 209th St	Sioux Falls	CENTBSRT0
South Fork Whetstone	At 479th Ave	Sioux Falls	WQM 90
Split Rock Creek	At 484th Ave	Sioux Falls	
Vermillion	Above Lake Vermillion WQM 154	Sioux Falls	WQM 154
Vermillion	At Vermillion	Sioux Falls	WQM 5
Vermillion	Near Wakonda	Sioux Falls	WQM 4
Vermillion	North of Montrose	Sioux Falls	WWM 150
Vermillion	Vermillion 61 near Chancellor	Sioux Falls	WQM 61
Emanuel	Near Springfield	Sioux Falls/Pierre	WQM 181
Moccasin Creek	South Aberdeen	Sioux Falls/Pierre	WQM 94
Mud Creek	At 148th St	Sioux Falls/Pierre	WQM 145
Snake Creek	At Hwy 281	Sioux Falls/Pierre	WQM 146
Turtle Creek	Near Tulare	Sioux Falls/Pierre	WQM 130
Wolf Creek	At 277th St	Sioux Falls/Pierre	WQM 157

Appendix B: South Dakota DANR Discharge Sheet

Discharge Measurement Sheet

Estimated StreamPro Transducer Depth: 0.17ft
Estimated RiverRay Transducer Depth: 0.21ft

Crew/Project		Date	

Site	Time	Time Zone	Bridge to Water Tape Measure - **describe location**	WW Check Bar	Wire Weight or Staff	Gauge Reading	ADCP Only: Bed Movement (ft/sec)	ADCP Only: Bed Test Error (%)	Indep. Temp. Check		Average Flow Speed (ft/sec)	Average Area	Average Total Q (CFS)	Total Q Error (%)
	Start									WinR				
	End									Qrev				
	Start									WinR				
	End									Qrev				
	Start									WinR				
	End									Qrev				
	Start									WinR				
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