# Cooperative Stream Investigation Project Plan: Missouri Department of Natural Resources; Missouri Botanical Garden Stream Teams 4149 and 5099

## Windrush Creek
## St. Louis County

## April 2022 – April 2023

Prepared for:

Missouri Department of Natural Resources
Division of Environmental Quality
Water Protection Program
Water Pollution Control Branch

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Division of Environmental Quality
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## 1.0 Introduction

To assist the Missouri Department of Natural Resources (**Department**), Water Protection Program (**WPP**), and the Missouri Botanical Garden, Deer Creek Watershed Alliance project; Randy Sarver of the Department's Environmental Services Program (**ESP**), Water Quality Monitoring Section (**WQMS**), initiated a Cooperative Stream Investigation (**CSI**), project to collect total nitrogen (**TN**), total phosphorus (**TP**), total suspended solids (**TSS**), *E. coli* and chloride samples along with discharge measurements from Windrush Creek, St. Louis County, Missouri. The Windrush Creek watershed is in the upper part of Deer Creek. Upper Deer Creek has the assigned Water Body Identification (**WBID**) number of 4078. Currently, Windrush Creek does not have a unique WBID, but is assigned the generic WBID 3960. The Missouri Use Designation Dataset (**MUDD)** Version 1.0 includes WBID 3960 as a temporary waterbody code that will be replaced with unique WBIDs in the future.

Designated recreational uses for Windrush Creek WBID 3960 are listed as Whole Body Contact – Class B (**WBC-B**) and Secondary Contact Recreation (**SCR**). The Missouri Water Quality Standard (**WQS**) *E. coli* criterion for WBC-B is 206/100 ml Most Probable Number (**MPN**); and SCR is 1134/100 ml MPN. The *E. coli* criterion is based on a geometric mean of at least five samples collected during the recreational season (April 1 – October 31).

Windrush Creek (WBID 3960) and upper Deer Creek (WBID 4078) are not currently on the impaired waterbody list (**303d list**). However, the downstream Deer Creek WBID 3826 was placed on the United States Environmental Protection Agency (**USEPA**) approved Missouri 303(d) list of impaired waters for impairment by chloride in 2006 and for *E. coli* in 2012. The source of *E. coli* and chloride are listed as Urban Runoff/Storm Sewers.

A Total Maximum Daily Load (**TMDL**) for *E. coli* pollution of Deer Creek WBID 3826 was approved in 2019. A high priority TMDL for chloride pollution of Black Creek and Deer Creek has been scheduled for 2025. TMDLs are developed by the Department in accordance with Section 303(d) of the federal Clean Water Act (**CWA**). Section 303(d) of the CWA and federal regulations in 40 Code of Federal Regulations (**CFR**) Part 131 require TMDL development for waters not meeting designated beneficial uses under technology-based controls for pollutants of concern. The purpose of a TMDL is to determine the maximum amount of a pollutant (the load) that a water body can assimilate without exceeding the Missouri WQS for that pollutant based on the relationship between pollutant sources and in-stream water quality conditions. The goal of the TMDL program is to restore designated beneficial uses to water bodies. Therefore, identification of sources and implementation of Best Management Practices (**BMP**) to address the sources are critical to watershed restoration.

Historical monitoring results have documented high nutrients, *E. coli* and chloride concentrations in the Deer Creek watershed. Approximately 20% - 60% of the sources of *E. coli* in the watershed are from wildlife and other animals. The St. Louis Metropolitan Sewer District has progressed in reducing sanitary sewer overflows into area creeks and stormwater permits are

addressing other human sources of *E. coli*. However, it is not feasible to remove wildlife and animal excrement as a source. Therefore an emphasis on voluntary, plant-based solutions to reduce stormwater runoff is the most effective way to address these additional non-point sources of nutrients and *E. coli* in the watershed and is key to reducing pollutant loads from stormwater runoff in the watershed. According to a 2010 USGS study of Metropolitan St. Louis streams, *E. coli* densities and loads typically were many times greater in storm events than at base flow; primarily because loading increased as a result of runoff that contain bacteria contributions from the numerous combined and sanitary sewer overflows within the study area, as well as contributions from nonpoint source runoff. [Occurrence and Sources of *Escherichia* in Metropolitan St. Louis Streams, October 2004 https://pubs.usgs.gov/sir/2010/5150/pdf/sir2010-5150.pdf ]

To assist in improving water quality, a project through the Missouri Botanical Garden's Deer Creek Watershed Alliance has been funded through the 319 Nonpoint Source Implementation Grant Program. The project was designed in four phases, which include: Phase I (subgrant #G09-NPS-13); Phase II (subgrant #G11-NPS-15); Phase III (subgrant G14-NPS-04); and Phase IV (subgrant G19-NPS-11). All phases implement BMPs that help address the stream bacteria impairment and improve the water quality of Deer Creek. BMP implementation will include practices like rain gardens, bioswales, woodland and riparian corridor restoration, permeable pavers, rain barrels, etc. To date, more than 447 BMP installations have been completed in the watershed through this project, resulting in load reductions of 187 tons of sediment, 92 lbs. of nitrogen, and 18 lbs. of phosphorus per year. When possible, pre-implementation and post-implementation water quality data will be collected to satisfy the monitoring components of the 319 Grants.

Windrush Creek has been identified by the Deer Creek Watershed Alliance as a priority area for BMP implementation. Figure 1 shows the Windrush Creek watershed and its proximity to the upper segment of Deer Creek (WBID 4078). Upper Deer Creek WBID 4078 is also a priority area and was the focus of a CSI project in 2020-2021.

## 2.0 Project Objectives

This study will focus on the collection of current water quality data from Windrush Creek in St. Louis County, Missouri.

The following objectives have been established for the Windrush Creek CSI project:

1. Collect monthly samples for TP, TN and TSS from April 2022 through April 2023.
2. Collect monthly *E. coli* samples during the recreational season (April 1, 2022 – October 31, 2022).
3. Collect monthly chloride samples during November 2022 through April 2023.
4. Measure stream discharge in association with each sampling event.
5. Send TN, TP, TSS, and chloride samples to the Department’s ESP for analyses using USEPA approved/accepted standard methods.

6. Analyze temperature, conductivity, and water transparency as field parameters in conjunction with monthly samples. Analyses will use Missouri Stream Team, Volunteer Water Quality Monitoring (**VWQM**) Program procedures.
7. Use resulting nutrient, TSS and *E. coli* bacteria data to establish concentrations and loading prior to implementation of BMPs.
8. Use resulting chloride data to assess water quality.

## 3.0 Project Planning

Beginning in November 2021, Mr. Randy Sarver, VWQM Coordinator with the Department, and Ms. Stacy Arnold began discussion to investigate the possibility of a CSI Project on Windrush Creek. Ms. Arnold is a Stream Team, Level 3, VWQM volunteer; a member of Stream Team's 2926 & 4149; serves on the Board of Stream Teams United; works as the Deer Creek Watershed Alliance Planning Coordinator for Missouri Botanical Garden; and was a VWQM cooperator in the 2020-2021 Deer Creek CSI Project.

On November 15, 2021, Ms. Arnold performed field reconnaissance of Windrush Creek to look for access to monitoring locations.

On December 17, 2021, Mr. Sarver, Ms. Arnold and Mr. Steve McCarthy discussed the details of the Windrush Creek CSI Project. Mr. McCarthy is a Stream Team, Level 3, VWQM volunteer; is a member of Stream Team 5099; and was a VWQM cooperator in the 2020-2021 Deer Creek CSI Project. Mr. McCarthy was asked to participate in the Windrush Creek monitoring project and has agreed to assist.

## 4.0 Sampling Location

Sampling will be focused at three locations on Windrush Creek. See Figure 2 for a map of the sampling locations.

Site 4078/5.3/0.1 (WBID 3960) is located immediately upstream from Villa Coublay Drive. GIS map derived UTM coordinates are: 724329 Easting and 4280897 Northing.

Site 4078/5.3/0.4 (WBID 3960) is located immediately upstream from North Graeser Road. GIS map derived UTM coordinates are: 724240 Easting and 4281292 Northing.

Site 4078/5.3/0.8 (WBID 3960) is located immediately upstream from Ladue Road. GIS map derived UTM coordinates are: 724133 Easting and 4281685 Northing.

**Figure 1**
**Map of Upper Deer Creek and Windrush Creek Priority Watersheds**

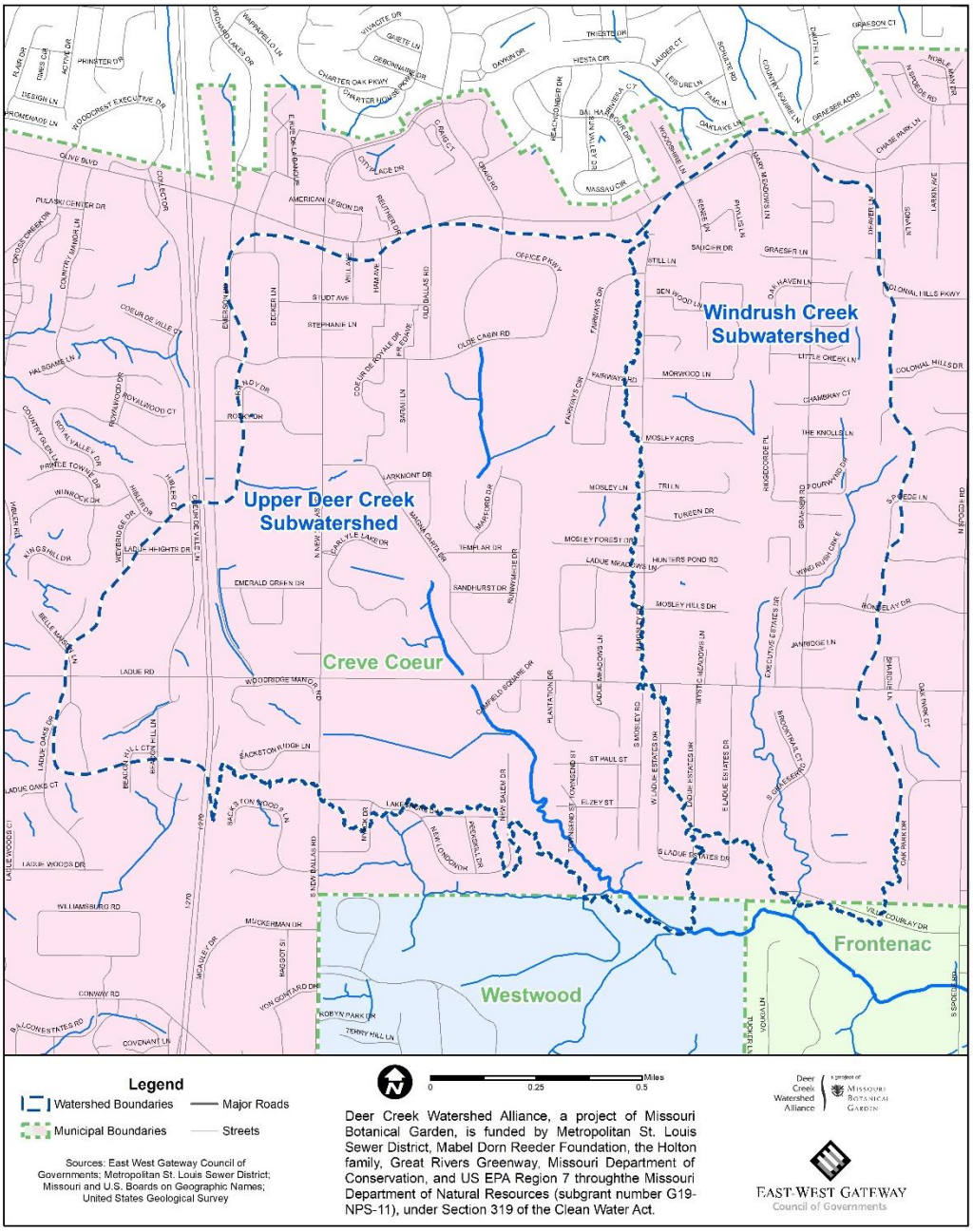

**Figure 2**
**Map of Windrush Creek Sampling Location**

## 5.0 Sampling Method

Standard method samples for TP, TN, TSS, and chloride parameters, will be collected according to standard operating procedures (SOP) MDNR-ESP-001: Required/Recommended Containers, Volumes, Preservatives, Holding Times, and Special Sampling Considerations; and MDNR-ESP-005: General Sampling Consideration Including the Collection of Grab, Composite, and Modified Composites from Streams and Wastewater Flows.

Each sample will be accompanied by an appropriate Chain-of-Custody, as detailed in MDNR-ESP-002: Field Sheets and Chain-of-Custody Record. Sample collection and chain-of custody training will be provided to the volunteers by the ESP, VWQM Coordinator Discharge will be measured following the SOP MDNR-ESP-113: Flow Measurement in Open Channels, and will be reported on the Chain-of-Custody. Training will be provided to the volunteers by the ESP, VWQM Coordinator.

On the day of collection, properly preserved and packaged nutrient, TSS, and chloride samples will be delivered to a drop-off location for shipment to the Department's ESP for analyses. A memorandum of understanding has been developed between the Missouri Department of Health and Human Services to facilitate sample shipment to Jefferson City from sites throughout the state. Information concerning the most applicable drop-off location is as follows:

Facility: St. Luke's Hospital
Address: 232 South Woodsmill Road, Chesterfield
Phone: (314) 205-6984
Contact Person: Don Darren
Location: 2nd Floor Lab
Pick-up Time: 1:40 p.m.
Hours of Operation: 7:00 am - 5:30 pm

Also on the day of collection, *E. coli* samples will be relinquished to Ms. Elisa Edge, a Department Environmental Specialist with the ESP, WQMS. Ms. Edge is housed at Route 66 State Park, has a complete set of IDEXX equipment, and will analyze the samples prior to the 8-hour holding time limit.

## 5.1 Sampling Schedule

Standard method nutrient samples, TSS samples, and discharge measurements will be collected monthly from April 2022 – April 2023. Standard method *E. coli* samples will be collected from April 2022 – October 2022. Standard method chloride samples will be collected from November 2022 – March 2023. VWQM field analyses will occur in conjunction with each standard method sample collections. One set of duplicate samples will be randomly collected from one sampling station during each sampling event (see Table 1 –Sample Collection Schedule).

**Table 1**
**Sample Collection Schedule (2022 – 2023)**

| | April | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | March | April |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Standard Method Nutrient Samples** | | | | | | | | | | | | | |
| **Standard Method TSS Samples** | | | | | | | | | | | | | |
| **Standard Method *E. coli*** | | | | | | | | | | | | | |
| **Standard Method Chloride** | | | | | | | | | | | | | |
| **Discharge** | | | | | | | | | | | | | |
| **VWQM Field Analyses** | | | | | | | | | | | | | |
| **Duplicate Standard Method Samples** | | | | | | | | | | | | | |

### 5.2 Stream Team Sampling Responsibilities

- Use appropriate methods to collect and preserve monthly TP, TN, TSS, *E. coli* and chloride water samples for standard method analyses.
- Prepare equipment and perform field analyses of temperature, conductivity, and water transparency using VWQM methods. Record the data in a field notebook.
- Fill out appropriate sample information on the Department's Chain-of-Custody.
- On the same day as collection, and prior to the designated pickup time, drop the nutrient, TSS, and chloride samples at the courier locations for shipment to the Department's ESP.
- On the same day of collection, deliver the *E. coli* samples to Ms. Edge within 6 hours of collection.

### 5.3 Department Sampling Responsibilities

- Provide sample containers
- Provide chain-of-custodies for samples.
- Provide training for TP, TN, TSS, *E. coli* and chloride sample collection and preservation.
- Provide $H_2SO_4$ preservative for TP and TN sample preservation.
- Provide training for performing stream discharge measurements.
- Provide training for proper chain-of-custody use.
- Provide sample labels
- Provide shipping containers for shipping samples.
- Pick up shipped samples at the Health Department Laboratory in Jefferson City.

## 6.0 Stream Flow Measurements

When possible, monthly stream flow measurements will be taken during each sampling event (see Table 1). Flow measurement training will be provided to Ms. Arnold and Mr. McCarthy following the SOP MDNR-ESP-113, Flow Measurements in Open Channels.

### 6.1 Stream Team Flow Measurement Responsibilities

- Provide the flow meter and associated equipment.
- Attend training provided by the ESP, VWQM Program Coordinator.
- Follow Department Standard Operating Procedure for measuring open channel flow.
- Collect discharge measurement in association with water samples.
- Record discharge measurements on the Department's Chain-of-Custody form.

### 6.2 Department Flow Measurement Responsibilities

- Provide flow measurement training.

- Provide the Department's SOP MDNR-ESP-113.
- Provide flow measurement data collection forms.

## 7.0 Sample Analysis

Analyses of samples will follow two general approaches. One approach will use USEPA approved/accepted standard methods; the other will use VWQM methods.

### 7.1 Standard Method Nutrient Analyses

The standard analytical methods used by ESP for TP and TN analyses are:

- Total Phosphorus (USGS I-2650-03 – Modified by ESP)
- Total Nitrogen (USGS I-2650-03 – Modified by ESP)

### 7.2 Standard Method TSS Analyses

The standard analytical methods used by ESP for TSS analysis is:

- Method #2540, part D; Standard Methods for the Examination of Water and Wastewater, 23nd Edition, 2017

### 7.3 Standard Method *E. coli* Analyses

The standard method used by ESP for *E. coli* analysis is:

- The Department's Standard Operating Procedure MDNR-ESP-109, Analysis of *E. coli* and Total Coliforms Using IDEXX Colilert and Quanti-Tray Test Method, based on USEPA methods.

### 7.4 Standard Method Chloride Analyses

The standard analytical method used by ESP chloride analysis is:

- SM 4500 Cl- G; Mercuric Thiocyanate Flow Injection Analysis.

### 7.5 VWQM Method Analyses

At the time of sample collection for standard method analyses, water will be analyzed streamside using VWQM Program SOPs. Parameters to be collected include temperature, conductivity, and water transparency. Temperature and conductivity will be analyzed using Hach Pocket Pro model meters; and water transparency will be analyzed using a VWQM water transparency tube.

Applicable VWQM Program SOPs can be found at http://www.mostreamteam.org/training-materials-and-resources.html .

## 8.0 Data Reporting

Standard method data generated from CSI projects are collected for specific purposes. In order to meet the objectives of this project, data must be available for assessment purposes. The Windrush Creek CSI Project data will be entered and housed in the ESP Laboratory Information Management System (**LIMS**).

### 8.1 Stream Team Data Reporting Responsibilities

- Results from discharge measurements will be reported as a field parameter on the appropriate Department Chain-of-Custody.
- Since analyses for temperature, conductivity, and water transparency will utilize VWQM Program procedures, the results will be reported on an Excel spreadsheet at the end of the project.

### 8.2 Department Data Reporting Responsibilities

- Analytical results for TP, TN, TSS, *E. coli*, and chloride will be reported via the ESP LIMS.
- Analytical results for temperature, conductivity, and water transparency will be reported via an Excel spreadsheet.
- Analysis will be charged to Labor Distribution Profile (**LDPR**) code, Volunteer Monitoring (**FEVLM**) and will automatically be provided to the Project Manager in the WPP. After receipt by the WPP, data will be entered into the Water Quality Assessment (**WQA**) database.
- A final report will be written by the ESP, VWQM Coordinator.

## 9.0 Quality Assurance/Quality Control (QA/QC)

Accurate and precise data is needed in any monitoring project. As part of quality assurance, one field audit will be conducted by the VWQM Coordinator. Additionally, standard QA/QC procedures incorporated into specific SOPs will be followed during the project and one duplicate sample will be collected for all sampling dates (see Table 1 Sample Collection Schedule).

### 9.1 Stream Team QA/QC Responsibilities

- Follow standard procedures for field analyses, sample collection and sample preservation.
- Collect one duplicate sample for nutrients, TSS, chloride and *E. coli* during each sampling event (see Table 1 – Sampling Collection Schedule).

## 9.2 Department QA/QC Responsibilities

- Review chemical parameter data for values outside QC limits.
- Review training with volunteers if necessary.
- Make one yearly field audit during the life of the project.
- Update the project plan as necessary.

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