VERMONT DEPARTMENT OF ENVIRONMENTAL CONSERVATION
WATERSHED MANAGEMENT DIVISION
STORMWATER PROGRAM

Municipal Separate Storm Sewer System (MS4)
2018 Annual Report

A. Permittee Information	
1. Name of MS4: University of Vermont	
2. Permit Number: 7028 - 9014	
B. Minimum Control Measures	
1. Public Education and Outreach	
1.1 Website address: http://rethinkrunoff.org/; https://www.uvm.edu/~plan/?Page=stormwater.html	
1.2 Participation in Regional Outreach Strategy ☐ No ■ Yes, summary of activities attached	
2. Public Involvement and Participation	
2.1 Participation in Regional Involvement Strategy ☐ No ■ Yes, summary of activities attached	
3. Illicit Discharge Detection and Elimination	
3.1 Stormwater infrastructure mapping complete or continuing: ☐ No ■ Yes	
3.1 Number of stormwater outfalls inspected: None in 2018. See Annual Report Workbook	
3.2 Number of stormwater outfalls tested: None in 2018. See Annual Report Workbook	
3.3 Number of illicit discharges detected and eliminated: None in 2018. See Annual Report Workbook	
3.4 Additional information attached ☐ No ■ Yes	
4. Construction Site Runoff Control	
4.1 Continued implementation of an Erosion Control Ordinance ■ No ☐ Yes	
4.2 Additional information attached ☐ No ■ Yes	
5. Post Construction Management for New Development and Redevelopment	
5.1 Continued implementation of an ordinance for disturbances of greater than one acre that are not subject to the Agency's post-construction permit program ☐ No ■ Yes	
5.2 Additional information attached ☐ No ■ Yes	
6. Pollution Prevention and Good Housekeeping	
6.1 Participation in the Municipal Compliance Assistance Program ■ No ☐ Yes; Participation year:	
6.2 Number of catch basins inspected: 647	
6.3 Number of catch basins cleaned: 81	
6.4 Lane miles swept: 12	6.5 Cubic yards of material collected by street sweeping:
6.6 Number of staff who attended training: None in 2018	
6.7 Additional information attached ■ No ☐ Yes	
C. Flow Restoration Plan Implementation	
1. Summary of FRP implementation in stormwater impaired waters is attached: ☐ NA ■ Yes	
D. Phosphorus Control Plan Implementation	
1. Has a Road Erosion Inventory (REI) been completed for your municipality? ■ NA ☐ No ☐ Yes	

E. Incorporated Previously Permitted Stormwater Systems

1. Has the municipality incorporated permitted stormwater systems into its MS4 authorization? ☐ No ■ Yes

2. If yes, complete the following table or include this information as an attachment

Stormwater Treatment Practice Name	State Stormwater Permit No.	Date of Last Inspection	Maintenance Completed
North Campus Stormwater Treatment Facility	3627-INDS	06/06/2018	■ NA ☐ Yes
East Campus Stormwater Treatment Facility	3471-INDS	05/18/2018	■ NA ☐ Yes
Southwest Campus Stormwater Treatment Fa	3753-INDS	05/21/2018	■ NA ☐ Yes
Colchester Business Park - Wet Pond	3307-9010	06/13/2018	■ NA ☐ Yes
Game Ops Booth - Rooftop Disconnection	3940-INDS	05/21/0208	■ NA ☐ Yes
LM Pavilion - Rooftop Disconnection	3627-INDS.1	06/06/2018	■ NA ☐ Yes
LM Dugouts - Infiltration Trenches	3627-INDS.2A	06/06/2018	■ NA ☐ Yes
Centennial Storage - Infiltration Chambers	3627-INDS.3	06/06/2018	■ NA ☐ Yes
Votey Hall Renovations - Bioretention	3627-INDS.5	06/07/2018	■ NA ☐ Yes
Fleming South Sidewalk	6684-9015		■ NA ☐ Yes
			☐ NA ☐ Yes
			☐ NA ☐ Yes

F. Other Reporting Requirements

1. Summary of stormwater activities planned for next reporting cycle: Refer to Annual Report for summary list of planned activities for 2019

2. Proposed changes to the SWMP: No changes are proposed at this time

3. Reliance on other entities to meet permit obligations: UVM relies on the Chittenden County Regional Stormwater Education Program to meet Minimum

G. Certification

This Annual Report shall be signed by a principal executive officer, ranking elected official or other duly authorized employee consistent with 40 CFR §122.22(b) and certified as follows:

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Lani Ravin, for the University of Vermont & State Agricultural College
Print Name

Associate Planner
Title

Signature

March 29, 2019
Date

2018 ANNUAL REPORT

EPA MS4 PHASE II – GENERAL PERMIT 3-9014
January 1, 2018 to December 31, 2018

Prepared by
Krebs & Lansing Consulting Engineers, Inc.
164 Main Street
Colchester, Vermont 05446

April 1, 2019

Introduction

On January 23, 2019 the University of Vermont submitted a renewal application for the University of Vermont MS4 General Permit (Stormwater Discharges from Small Municipal Separate Storm Sewer Systems) (7028-9014.A1). The renewal permit involved updating the Stormwater Management Plan to comply with the requirements of the new MS4 General Permit that was issued on July 27, 2018.

The purpose of this document is to report on the status of the University's implementation of the permit requirements, including compliance with the standards for reducing the discharge of pollutants from the University's MS4 discharges to the Maximum Extent Practicable (MEP).

History

The University of Vermont first applied for coverage under General Permit #3-9014 on March 10, 2003. The Application was revised and resubmitted on May 9, 2003 after receiving comments from the State of Vermont Agency of Natural Resources. On September 11, 2003 the State of Vermont acknowledged by letter the University's Stormwater Management Plan complies with the terms and conditions of the General Permit. They further indicated that the University's MS4 discharges are eligible for continued coverage under the terms and conditions of the General Permit.

On January 31, 2004, January 31, 2005, April 1, 2006, April 1, 2007, April 1, 2008, April 1, 2009, April 1, 2010, April 1, 2011, April 1, 2012, April 1, 2013, April 1, 2014, April 1, 2015, April 1, 2016, and April 1, 2017 the University of Vermont submitted their MS4 Annual Report.

On February 22, 2008, the University of Vermont prepared an application for coverage under General Permit #3-9014 for the second 5-year term (2008-2012). Additional information was provided on March 3, 2008 as requested by the State of Vermont.

On June 3, 2013, the University of Vermont prepared an application for coverage under General Permit #3-9014 for a third 5-year term (2013-2017). The application was deemed complete and effective on October 1, 2013.

On January 23, 2019, the University of Vermont prepared an application for coverage under the MS4 General Permit #3-9014 for a fourth 5-year term (2018-2023). The application is currently under review.

Permitted Impervious

The table below provides an outline of the permitted impervious by prior permit number and watershed.

Project	**Permitted** Impervious (acres)	**Proposed** New/Redeveloped Impervious in 2018
North Campus Watershed		
North Campus Portion of 7028-9014.A1	25.93 ac	
East Campus Watershed		
East Campus Portion of 7028-9014.A1	43.00 ac	
On-Campus Multipurpose Center 3627-INDS.6		2.96 ac
Southwest Campus Watershed		
South Campus Portion of 7028-9014.A (Facility 1)	18.68 ac	
South Campus Portion of 7028-9014.A (Facility 2)	3.04 ac	
UVM Game Operations Booth - 3940-INDS.R	0.01 ac	
UVM Lake Monsters Pavilion - 3627-INDS.1	0.03 ac	
UVM Lake Monsters Dugouts - 3627-INDS.2A	0.024 ac	
UVM Centennial Storage - 3627-INDS.3	0.63 ac	
UVM Votey Hall Renovations	0.004 ac	

Flow Monitoring Update

The University of Vermont entered into an MOU to have the Agency of Natural Resources administer the stream flow monitoring required by the MS4.

Minimum Control Measures

UVM, as a regulated MS4 must develop, implement, and enforce the six minimum control measure identified below. These measures provide guidance for reducing the discharge of pollutants to the maximum extent practicable (MEP) in order to protect water quality.

1. Public Education and Outreach on Stormwater Impacts
2. Public Involvement and Participation
3. Illicit Discharge Detection and Elimination
4. Construction Site Stormwater Runoff Control
5. Post-Construction Stormwater Management for New Development and Redevelopment
6. Pollution Prevention and Good Housekeeping for Operations

An Annual Report Workbook is included with this report outlining measures taken to meet the requirements of the 6 minimum control measures.

Flow Restoration Plans Implementation Update

Centennial Brook Flow Restoration Plan Project

The University of Vermont partnered with the Vermont Agency of Transportation, the City of Burlington and the City of South Burlington to hire Horsley-Whitten to complete the technical aspects of Centennial Brook's Flow Restoration Plan. The Flow Restoration Plan was submitted to the Agency of Natural Resources on October 1, 2016 and approved on December 11, 2017.

No Flow Restoration Plan improvements located on the UVM property are planned for design or construction during 2019.

Potash Brook Flow Restoration Plan Project

The University only has two properties identified in the Potash Brook Flow Restoration Plan; the Bioresearch Complex and the Forestry Building on Spear Street. Many of UVM properties in Potash are agricultural and exempt from the MS4 permit including Miller Farm, Wheelock Farm and East Woods. The Flow Restoration Plan was submitted to the Agency of Natural Resources on October 1, 2016 and approved on December 11, 2017.

The University anticipates designing and permitting stormwater treatment practices at both sites in 2019 with construction completion in 2020.

Englesby Brook Flow Restoration Plan Project

UVM contacted the City of Burlington and agreed to partner on the Englesby Brook Flow Restoration Plan Project. The University's Southwest Watershed is located in Englesby Brook. Both stormwater detention and treatment facilities are fully compliant with the current state stormwater regulations. No additional stormwater treatment/detention was required of UVM in the FRP. The Flow Restoration Plan was submitted to the Agency of Natural Resources on October 1, 2016 and approved on December 11, 2017.

A number of small projects with expanded impervious are planned for construction in 2019. The outlet structure for Facility #1 will need to be modified to comply with the new Warm Water Fish Habitat Designation that became effective with the issuance of the most recent Water Quality Rules.

Bartlett Brook Flow Restoration Plan Project

The City of South Burlington has hired a consultant who has issued a draft (2/2/2015) Flow Restoration Plan for Bartlett Brook. The only land owned by the University of Vermont in the Bartlett Brook Watershed is the Horticulture Farm, which is not part of UVM's MS4 lands. The University participated in the FRP process regarding the Horticulture Farm, but has no MS4 obligations.

Sunderland Brook Flow Restoration Plan Project

The Town of Essex and Village of Essex Junction has hired a consultant to complete both the Indian Brook and Sunderland Brook Flow Restoration Plans. The University of Vermont does not own any impervious surface in the Indian Brook Watershed. The University of Vermont does not own any impervious in the Sunderland Brook Watershed.

Lake Champlain Phosphorus TMDL

Phosphorus Control Plan

- The University will develop and implement a Phosphorus Control Plan (PCP), that will achieve the level of phosphorus reduction equivalent to the target for developed land consistent with the Lake Champlain TMDLs. The percent reduction targets for UVM properties in each Lake Segment are as follows:

    - Main Lake - 20.2% (Winooski River (Trinity Campus & Colchester Avenue WS), Centennial Brook (North Campus, East Campus and Main Street Watersheds)
    - Shelburne Bay 20.2% (Potash Brook Watershed)
    - Burlington Bay 24.2% (Englesby Brook (Southwest Campus Watershed)

- The MS4 General Permit requires that a Road Erosion Inventory (REI) be completed for each municipality. The University of Vermont, as a Non-Traditional MS4, is exempt from this requirement.

- The Phosphorus Control Plan may include reductions calculated based on:
    - **Street sweeping and catch basin cleaning practices.**
        - UVM sub-contracted to have catch basins cleaned and roads swept in 2018. The attached workbook provides data related to this effort.
    - **Implementation of stormwater treatment practice upgrades or retrofits to treat existing impervious after the adoption of the 2002 Vermont State Stormwater Manual.**
        - The University has provided information to the Watershed Management Division regarding volumes of Wet Pond upgrades since the adoption of the 2002 Vermont State Stormwater Manual. We will continue to coordinate with the Agency to determine existing reductions already captured on campus.
        - UVM will evaluate opportunities for phosphorus reduction as new projects move forward.
    - **Implementation of stormwater treatment practices after July 1, 2010, on developed lands that are not subject to the state's operational stormwater permit.**
        - Currently an infiltration chamber system is being permitted for a redevelopment project north of Votey Hall. Much of the runoff from a large paved parking lot currently discharges off site without treatment or detention. The new treatment system would infiltrate at least the WQv storm event for a large portion of the lot.
        - Phosphorus reduction calculations will be completed for any existing treatment practices that meet these criteria.
        - STP's that are planned as part of the Potash Brook FRP will be designed with consideration for meeting phosphorus reduction.
        - UVM will evaluate the potential for infiltration opportunities on the Trinity Campus where the existing soils are mapped to be sandy loam.

Summary of Planned Stormwater Activities - 2019

The following stormwater related activities are planned for completion in 2019.

- Catch basin cleaning, roadway sweeping, and leaf/organic waste management will continue.
- Annual inspections of STP's will be completed.
- Planning and design is underway for FRP improvements at the UVM Bioresearch Facility and Forestry Services sites within the Potash Brook Watershed.
- The Phosphorus Control Plan development will continue. Infiltration opportunities will be evaluated at the northern limits of the main campus and at the Trinity Campus for phosphorus reduction opportunities.
- Dry weather illicit discharge monitoring will be performed at the Trinity Campus.
- A stormwater training meeting will be conducted with relevant UVM Staff.
- The UVM Utility Master Plan will continue to be updated.
- New Individual Stormwater Discharge Permits will be obtained for development on the UVM Campus. The relevant stormwater improvements will be implemented.
- Erosion Prevention and Sediment Control details will be developed and formatted for inclusion in UVM bid documents for non-earthwork projects to ensure unintended earth disturbance is properly managed.

Proposed Changes to the University's Stormwater Management Plan (SWMP)

No changes to the SWMP are proposed for 2019.

Shared Permit Obligations

The University of Vermont is one of many key members in the Regional Stormwater Education Program.

The University of Vermont is one of many key members in the Stream Team, an approved regional stormwater participation program.

END OF REPORT

MCM #1
REGIONAL STORMWATER EDUCATION PROGRAM
RETHINK RUNOFF

JANUARY–DECEMBER 2018
ANNUAL REPORT

Prepared by:

Pluck

209 College Street 3E, Burlington, VT 05401 p 802.224.6975 e hello@pluckvermont.com w pluckvermont.com

pluck

209 College Street 3E, Burlington, VT 05401 p 802.224.6975
e hello@pluckvermont.com w pluckvermont.com

Introduction

Since 2003, Chittenden County's twelve MS4s have worked to pool resources to professionally engage the public in a one message, one outreach effort known as the Regional Stormwater Education Program. Through regular Spring and Summer advertisements to drive people to the program's website, www.smartwaterways.org, this cooperative approach to fulfilling their NPDES Permit Minimum Control Measure #1 (Public Education & Outreach) requirements has built a regional awareness among the public of the need for individual action to assist in fighting stormwater problems.

In the summer of 2016, the MS4s contracted with Tally Ho through their Lead Agency, the Chittenden County Regional Planning Commission, to rebrand the Smart Waterways campaign into a combined effort with the MS4's Minimum Measure #2 regional effort known as the Chittenden County Stream Team. The goal was to create one cohesive organization and outreach effort to both educate the public about stormwater and boost public participation in implementation of projects to combat the negative impacts of stormwater. In spring of 2017. Rethink Runoff was publicly launched, including a new website and revised creative.

In late 2017, Tally Ho transitioned to Pluck, retaining the same client contact. Pluck subsequently took over the creative, administration, and management of Rethink Runoff.

This 2018 Calendar Year report recaps the work done primarily related to Minimum Control Measure #1.

2018 Initiatives

Having completed the initial rebranding to Rethink Runoff and the website redesign in 2017, we focused on updating the advertising in 2018.

We revised initial digital display advertising and introduced three :30 second animations. Each animation targeted a specific action that could help reduce either stormwater runoff, or the chemicals introduced into stormwater drainage. We placed an emphasis on Lake Champlain, creating a link between the small streams throughout the Lake Champlain Basin and their larger impact on the health of the lake. The audio of the :30 second animations was also repurposed as a radio spot.

Display advertising was rolled out seasonally, with new ads appearing throughout the calender year, according to seasonal activities, such as a swimming or fishing. In addition, we included a series of ads identifying pet waste as a contributor to pollution in Lake Champlain via stormwater discharge. Videos were uploaded to Youtube. Video advertising was targeting by subject matter, age, geographic location and other demographics. Videos were also shown on WCAX in limited quantity as well as on Comcast/Infinity cable stations. The radio spot was broadcast locally, in addition to VPR underwriting.

Print advertising in *Seven Days VT* also reflected this seasonal approach, increasing visibility for specific activities at specific times, including a smaller campaign during Clean Water Week.

In addition to advertising, we continued to work on the website. We updated content site-wide. We redesigned the stream monitoring pages, including HTML5 graphs highlighting NaCL, Phosphorus and Turbidity measurements, providing a stronger visual display of information.

We also introduced an Events portal, allowing the Stream Team representative to post events relating to outreach efforts. We also included regional events during Clean Water Week.

For Stream Team outreach, we programmed a new HTML email template for use in MailChimp, that allows monthly e-newsletters sent to our contact list.

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209 College Street 3E, Burlington, VT 05401 p 802.224.6975
e hello@pluckvermont.com w pluckvermont.com

Media Buy Breakdown

Below is a cost breakdown of media buys, compared with spring and fall 2016. Overall, we reduced our television spend and increased our online digital ad spend. Over the past two years, we've also shifted some of our advertising spending to the mid-summer. This helps to provide a longer timeframe for advertising outreach from spring into fall, when many people are focused on the rivers, lakes and streams in the area.

2016 – MEDIA BUY			
SOURCE	SPRING	SUMMER	FALL
RADIO	$4,500	-	$3,258
DIGITAL	$7,500	-	$4,985
TV	$5,500	-	$2,379
PRINT	$2,500	-	
TOTAL	$20,000	-	$10,622

2017 – MEDIA BUY			
SOURCE	SPRING	SUMMER* 05/28–08/02	FALL
RADIO	$3,088	-	$1,080
DIGITAL	$3,600	$3,826	$4,582
TV	$2,015	-	$1,833
PRINT	$1,755	$585	$1,170
TOTAL	$13,191	$4,235	$8,666

2018 – MEDIA BUY			
SOURCE	SPRING	SUMMER* 6/16–08/27	FALL
RADIO	$2,675	-	$1,044
DIGITAL	$3,393.96	$7,533.96	2986.82
TV	$3,710	-	$2,472
PRINT	$1,755	-	$1,006
TOTAL	$8,140.96	$7,533.96	$7,509

* For 2017 and 2018, Summer was initially planned as part of the Spring 2018 budget. Moving forward, the Spring Media Buy will include all purchases made through 7/1. The Fall media buy will include any media buys made from 7/1 the end of the summer.

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e hello@pluckvermont.com w pluckvermont.com

Creative

Advertising during 2017 included redesigned creative, incorporating existing messaging with a new visual language based on Rethink Runoff. Video and radio creative was modified to include a new URL, but otherwise remained the same.

Advertising for 2018 included 2017 creative as well as updated ads released from April–July, tied to spring/summer activities. In addition, we included a mini-campaign promoting Clean Water Week. All ads were rolled out in 8–10 different sizes.

Three :30 second videos were launched in April, May and June. A :30 second radio spot that ran in spring and fall used the voice over of the Fertilizer video spot.

2017 Creative

WATER RECREATION

STREAM TEAM

FERTILIZER

GENERAL CHAMP

SLOW THE FLOW

2018 Creative: Spring Rollout

FERTILIZER

RAIN GARDEN

PET WASTE

FISHING

Summer Rollout

WATER RECREATION

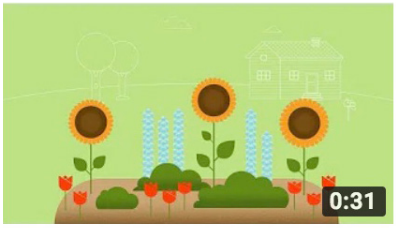
GENERAL CHAMP

Clean Water Week

CLEAN WATER WEEK

Videos

April - Fertilizer
https://www.youtube.com/watch?v=7gTbzJN-oeE



May - Rain Garden
https://www.youtube.com/watch?v=imZKTaOtD04

June - Rain Barrel
https://www.youtube.com/watch?v=r4-NEvelP40

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e hello@pluckvermont.com w pluckvermont.com

Advertising Click-through Rates

SOURCE	IMPRESSIONS	INTERACTIONS/ VIEWS	COST	COST PER CLICK
DISPLAY ADS	4,091,143	3,988	$6,238.46	$1.56
VIDEO (YOUTUBE)	417,346	210,979	$3,942.31	$0.02
WCAX DIGITAL	84,467	35	$750	$21.42

Google Display Ads Overview

Most Popular by Impressions

CALENDER YEAR 2018 NAME
GENERAL CHAMP
PET WASTE
WATER RECREATION

SPRING: 4/15-MEMORIAL DAY NAME
RAIN GARDEN
GENERAL CHAMP
PET WASTE

SUMMER: MEMORIAL-LABOR DAY NAME
WATER RECREATION
PET WASTE
GENERAL CHAMP

FALL: LABOR DAY-10/31 NAME
GENERAL CHAMP
PET WASTE
FERTILIZER

Most Popular by Interaction

CALENDER YEAR 2018 NAME
GENERAL CHAMP
PET WASTE
WATER RECREATION

SPRING: 4/15-MEMORIAL DAY NAME
PET WASTE
RAIN GARDEN
GENERAL CHAMP

SUMMER: MEMORIAL-LABOR DAY NAME
WATER RECREATION
PET WASTE
GENERAL CHAMP

FALL: LABOR DAY-10/31 NAME
GENERAL CHAMP
PET WASTE
FERTILIZER

Most Effective by Cost-per-click

CALENDER YEAR 2018	
TOTAL	TIME PERIOD
WATER REC.	$0.45/CLICK
RAIN GARDEN	$0.46/CLICK
SLOW THE FLOW	$0.63/CLICK

SPRING: 4/15-MEMORIAL DAY	
TOTAL	TIME PERIOD
RAIN GARDEN	$0.39/CLICK
SLOW THE FLOW	$0.39/CLICK
GENERAL CHAMP	$0.39/CLICK

SUMMER: MEMORIAL-LABOR DAY	
TOTAL	TIME PERIOD
WATER REC.	$0.45/CLICK
RAIN GARDEN	$0.54/CLICK
SLOW THE FLOW	$0.64/CLICK

FALL: LABOR DAY-10/31	
TOTAL	TIME PERIOD
WATER REC.	$0.46/CLICK
FERTILIZER	$0.54/CLICK
GENERAL CHAMP	$0.65/CLICK

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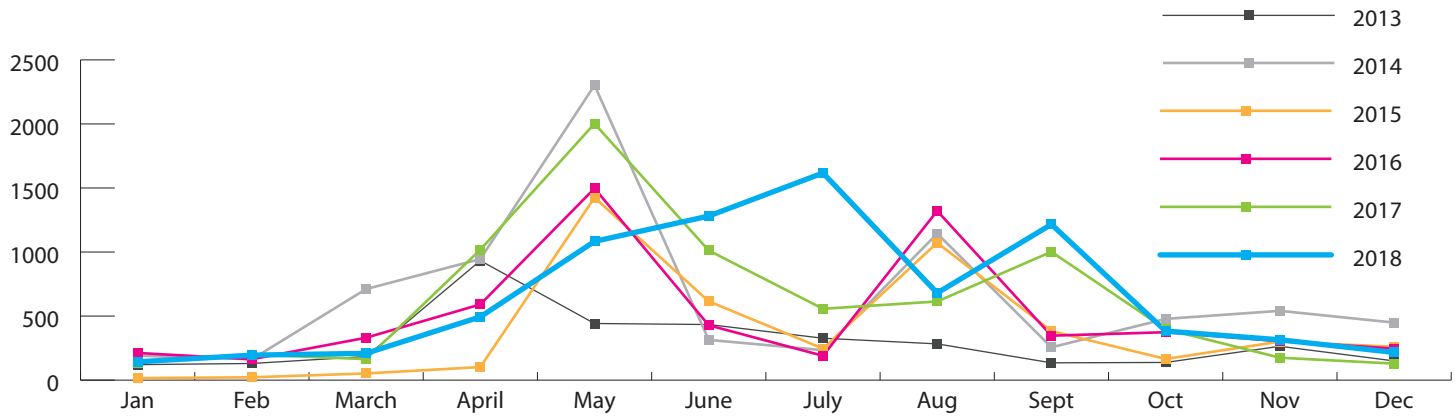
e hello@pluckvermont.com w pluckvermont.com

Website Metrics for 2013–2018



Total Sessions/Visits (1/1–12/31)

TOTAL	TIME PERIOD
7,832	2018
7,407	2017
6,004	2016
4,659	2015
7,728	2014
3,541	2013
2,787	2012

Website visits by device

DEVICE	2018	2017	2016
DESKTOP	50.1%	52.8%	65.7%
TABLET	40.6%	36.4%	24.5%
MOBILE	9.3%	10.8%	9.8%

Top Vermont Cities and Towns, 2018

TOTAL	USERS	
BURLINGTON	1318	19.25%
SOUTH BURLINGTON	767	11.34%
COLCHESTER	519	7.58%
ESSEX/ESSEX JCT.	456	6.66%
SHELBURNE	171	2.5%
WILLISTON	93	1.36%
MONTPELIER	76	1.11%
SAINT ALBANS CITY	71	1.04%
STOWE	66	.96%

New York, 149 Users
Boston, 67 Users

Most visited pages, 2018

TOTAL
HOMEPAGE
GET EDUCATED PROBLEMS & SOLUTIONS/PET WASTE
GET EDUCATED /PROBLEMS & SOLUTIONS/RAIN GARDEN
GET INVOLVED/STREAM TEAM
GET EDUCATED/FOR KIDS
GET EDUCATED/PROBLEMS & SOLUTIONS/FERTILIZER & LAWN CARE
GET EDUCATED/PROBLEMS & SOLUTIONS
ABOUT RETHINK RUNOFF
GET EDUCATED
GET EDUCATED/PROBLEMS & SOLUTIONS/REDIRECT YOUR DOWNSPOUTS

MCM #2
Rethink Runoff Stream Team
2018 Summary of Activities

Social Media

Facebook

- 219 total "likes"- a 23% increase from 2017 (177 in at end of 2017)
- 222 total "follows" (29 posts this year)

Instagram

- 120 total "follows" (13 posts this year)

RRST Website

- See final report from Dave Barron (Pluck Design)

Newsletter and e-correspondence

- As of 11/28/18, there were **508** subscribers to the RRST newsletter which is an 8% increase in 2018 (from 467 in 2017) It is the highest subscription to date. The average open rate for emails was 24%
- Arbor Day Volunteer Solicitation Email Published on 4/4/18 Opens: 99 Clicks: 7
- Summer Newsletter Published 9/13/18 Opens: 97 Clicks: 6
- Fall Newsletter Published on 11/18/18 Opens: 125 Clicks: 17

Organizational Partnerships

The Rethink Runoff Stream Team partnered with 18 different organizations in 2018 (15 non-municipal partners, 3 municipal partners)

- Vermont Community Garden Network (Organized state-wide Day in the Dirt event which resulted in 10 volunteers signing up to help with Rain Garden Cleanup at the Coast Guard station)
- VHB (Rain Garden Cleanup)
- Winooski Valley Parks District (Provided land for S. Burlington Arbor Day tree planting, also hosted the Conservation Field Day)
- US Fish and Wildlife (Cost share on trees for Arbor Day)
- Williston Central School (students volunteered for Arbor Day tree planting)
- Lake Champlain Basin Program (Provided funding for much of Arbor Day tree planting event)
- Intervale Conservation Nursery (Supplied trees and staff for Arbor Day tree planting)
- South Burlington NR Committee (Helped with the Trees For Stream planting on Muddy Brook)
- Community Sailing Center (Invited RRST to participate in an on-board education program during the Maritime Festival)
- Chamberlin School - S. Burlington - (A stormwater lesson was taught to Chris Provost's 4th grade class at the as part of a field trip at the Community Sailing Center in Burlington)

- Milton Youth Coalition (Provided tabling opportunity for RRST at Milton Activities Fair)
- Shelburne Farms (Provided tabling opportunity for RRST at Shelburne Harvest Festival)
- VT DEC (La Rosa Program funded WQ sampling lab analysis)
- ECHO (Provided tabling opportunity for RRST in the museum during Clean Water Week)
- Colchester High School (students volunteered to stencil storm drains in Colchester as part of an AP Environmental Science project)
- Burlington Parks and Rec (Provided tabling opportunity for RRST at Kid's Day)
- Winooski Department of Recreation and Parks (Provided tabling opportunity for RRST at Winooski Wednesdays event)
- Winooski DPW (Assisted in selection of storm drain mural locations, cleaned catch basins and provided day-of support to artists)

Media

The Rethink Runoff Stream Team had **six** media appearances in 2018, exceeding the work plan goal of five articles:

- Article: Call for Tree Planting Volunteers: Williston Observer & The Other Paper (April)
  http://www.willistonobserver.com/streambank-tree-planters-needed/
  http://otherpapersbvt.com/community-tree-planting-event-celebrate-arbor-day-with-your-friends-and-neighbors.html
- Article: The Citizen - Survey Results (May)
  http://www.thecitizenvt.com/2018/05/03/survey-shows-increased-awareness-stormwater-runoff-problem-solutions/
- Article: Call for Stream Team Volunteers, Williston Observer (June)
  http://www.willistonobserver.com/chittenden-county-water-quality-volunteers-needed/
- TV Coverage: Clean Water Week (August)
  http://www.wcax.com/content/news/Lend-a-hand-with-nonpoint-water-pollution-489666141.html
- TV Coverage: Winooski Storm Drain Mural Project (October)
  https://www.wcax.com/content/news/Winooski-mural-aims-to-educate-on-stormwater-pollution-496723301.html
- TV Coverage: Burlington Storm Drain Stenciling (October)
  https://www.mychamplainvalley.com/news/protecting-vermont-s-water-by-rethinking-runoff/1510638055

Outreach

Outreach includes any educational opportunities or tabling events where resources or information are provided to the community about the RRST program. There were **seven** outreach events in 2018, with an estimated total outreach to **470** people.

Outreach events in 2018 targeted the municipalities of **Milton, Shelburne and Burlington. Winooski** carried over from last year due to a venue cancellation experienced in 2017.

- **Burlington** Kid's Day (5/5/18) 150 people reached
- **Burlington** Clean Water Week Tabling at ECHO (8/1/18 & 8/2/18) Reached 117 people total (35 from our 9-municipality area)
- **Burlington** Lake Champlain Maritime Festival. In partnership with the Community Sailing Center, Rethink Runoff took our education ON the lake. The Rethink Runoff coordinator sailed aboard a small sailboat with 4 community members and shared information about the watershed and how to get involved with Stream Team. 3 adults, 1 kid reached
- **Shelburne** Harvest Festival (9/15/17) 61 adults, 77 kids reached
- **Winooski** Wednesdays (9/5/18) Reached 12 adult Winooski residents and 8 kids
- **Milton** Activities Fair (9/27/18) Reached 40 adults and 60 kids from Milton Brought 'Build a Rain Garden" activity and information about green lawn care
- **Burlington** and **Colchester:** Storm Drain Stencils were loaned to Jenna Olson and Karen Adams for independent projects. 39 drains marked. 20 students reached

The 2018 work plan goal for outreach participation was 400 people, which was surpassed. A total of **470** people that were engaged in outreach and educational opportunities in 2018. Chosen outreach towns for 2019 are Essex, Essex Junction, and Colchester.

New Outreach Activity Created: Stream team coordinator, Kristen, created a new activity to bring to tabling events to engage kids and families. The activity is called "Design Your Own Rain Garden." Using a tray of dirt and laminated pictures of plants that thrive in VT rain gardens (taped on toothpicks), participants can imagine in 3-D space what a rain garden might look like in their own backaryd or school. The activity has been a hit so far. To engage adults, the coordinator brought pamphlets about green lawn care and a booklet about how to build a rain garden.

Figure 1: Build-a-Rain Garden Activity at a tabling event at ECHO

Event-Driven Tasks

There were **seven** hands-on events held in 2018. Event-Driven Tasks involve community members in some form of hands-on engagement. This most often means volunteering, but can also include hands-on education activities with school groups.

- Rain Garden Clean Up at Burlington Coast Guard Station (4/28/18)
    - Partnered with VT Community Garden Network to carry out this event
    - 10 volunteers
- Trees for Streams Arbor Day Planting: Williston (5/4/18)
    - Partnered with Winooski Valley Parks District, The Intervale Conservation Nursery, US Fish and Wildlife, The Lake Champlain Basin Program and Williston Central School to carry out this event
    - 50 volunteers (36 students, 14 adults)
    - 560 trees planted along Allen Brook
- Trees for Streams Arbor Day Planting: South Burlington (5/4/18)
    - Partnered with Winooski Valley Parks District, The Intervale Conservation Nursery, US Fish and Wildlife and The Lake Champlain Basin Program and to carry out this event
    - 22 volunteers
    - 840 trees planted along Muddy Brook
- Conservation Field Day at Ethan Allen Homestead (5/16/18)
    - Reached 71 students from S. Burlington, Colchester and Essex
    - This environmental education event was hosted by WVPD at Ethan Allen Homestead in Burlington. 5th grade students from regional schools spent the day rotating through a series of workshops focused on conservation stewardship. RRST coordinator taught a workshop about stormwater
- Stream Team Water Quality Volunteer Training Day at WNRCD office (7/9/18)
    - 14 people trained, materials distributed for stream sampling
- Stormwater Lesson with Chamberlin School at the Community Sailing Center (CSC)
    - 26 students (4th graders from S. Burlington) participated in a field trip at the CSC. Kristen provided 1.5 hours of watershed education at the end of the sailing segment. Students used markers and paper to trace the watershed around their school, sung a song about watersheds and interacted in small groups with hands-on watershed models. They experimented with what happened when "rain" from a spray bottle hit different surfaces and then distributed "pollution" (sprinkles, confetti, etc.) on the landscape to see where it would flow.
- Winooski Storm Drain Mural Project - Winooski (10/10/18)
    - Partnered with the Winooski DPW and local artists to carry out this event
    - 3 artists painted a total of 2 murals. Artists reported speaking to about 75 people about the project while they were out painting.

Hands-on participation events in 2018 targeted the towns of Winooski, South Burlington, and Williston. Details about engagement in those communities can be seen above.

A total of 74 people participated in hands-on RRST events in 2018. A total of 94 people volunteered their time in a RRST activity in 2018; just falling short of the 100 volunteer goal. Chosen project towns for 2019 are Burlington, Milton, and Shelburne

RRST Outreach Demographic Impacts

The table on this next page displays the interaction from each of the nine MS4 communities at tabling events and 2018 project events and workshops. Please note: this is not a comprehensive list of all 703 people reached, as town residence was only acquired when offered.

Town	# of participants
Burlington	255
Colchester	25
Essex Town	20
Village of Essex Junction	10
Milton (O)	100
Shelburne (O)	58
Williston*	59
South Burlington*	81
Winooski* (O)	95
TOTAL	703

Table 1: Interaction with RRST by member town (* = 2018 project towns (O) = outreach town)

City of Winooski Project: Storm Drain Murals

RRST coordinated a storm drain mural event for the City of Winooski in 2018. A "call for artists" was published by the Essex Reporter on May 31, 2017 and the opportunity was shared with artists involved in past RRST projects. Four concepts were submitted by two artist teams and two were selected to be painted around catch basins pre-selected with guidance from the City's Public Works Department.

On the morning of October 10, 2018, the three artists, Holly Greenleaf, Rachael Forando, and Stephen Welter were stationed at their assigned catch basins: Holly at the catch basin outside Chick's Market at the corner of River St and Hickock St. and Rachael and Stephen as an artist team on Winooski Falls way by the bus stop. The artists signed contracts stipulating the requirements and procedures they had to adhere to in order to participate in the project. Instead of traffic paint, self-priming porch and floor enamel was used by all artists. Public Works staff assisted with thoroughly cleaning the areas to be painted and ensuring safety of the artists by providing traffic cones and vests. All murals were completed by the end of the day. Throughout the day, the RRST coordinator checked in with the artists. Each artist was given a pack of Rethink Runoff stickers and a mailing list sign up sheet. Artists reported speaking with about 75 passers-by about the project. They gave away about 30 stickers, and 2 people signed up for the mailing list. WCAX covered the story (see link in Media list above) and Facebook likes and shares were higher for this post than any other post in RRST history. About 2,800 people digitally interacted with the post.

The total estimated cost to plan, manage, and implement this project was **$1,411.** The approximate personnel time used to plan and execute the project was 20 hours ($900). The artists were paid a $250 stipend each; a total of $500. The mileage was about $11.

Figure 2: Winooski murals (Chick's Market: artist Holly Greenleaf, left Winooski Falls Way: artists Rachael Forando and Stephen Welter, right)

Town of Williston Project: Arbor Day Community Riparian Buffer Planting

On May 4, 2018, 50 community volunteers (including 36 students from Williston Central School) joined a crew from The Intervale Center at Allen Brook behind the Williston Central School soccer fields in Williston to plant native trees along the bare banks of this stretch of river. Volunteers planted 560 trees, covering 1.4 acres of river with native vegetation.

Prior to the volunteer day, RRST coordinator used funds from the Lake Champlain Basin Program (LCBP) Trees for Streams grant to scope sites and secure landowner agreements for the planting projects. RRST money was used to solicit volunteers and coordinate the volunteer work days on the day of the planting event.

The estimated cost to RRST to plan and carry out the tree planting event was approximately **$1,530**. Supplies, including trees and tree protection, were purchased with funds from the LCBP grant and cost-share from the US Fish and Wildlife Partners. Personnel time used to plan and execute the project was roughly 33 hours or $1,400. Refreshments were approximately $30 and mileage was approximately $15.

Figure 3: Volunteers in Williston plant trees along Allen Brook on Arbor Day, 2018 (5/4/18)

Figure 4: Some major partners for both Arbor Day Riparian Buffer Planting Projects

Town of South Burlington: Arbor Day Community Riparian Buffer Planting

On May 4, 2018, 16 community volunteers joined RRST coordinator and a crew from The Intervale Center at Muddy Brook Wetland Reserve in South Burlington to plant native trees along the bare banks of this stretch of river. Volunteers planted approximately 400 trees, covering one acre of river with native vegetation.

Prior to the volunteer day, RRST coordinator used funds from the Lake Champlain Basin Program (LCBP) Trees for Streams grant to scope sites and secure landowner agreements for the planting projects. RRST money was used to solicit volunteers and coordinate the volunteer work days on the day of the planting event.

The estimated cost to RRST to plan and carry out the tree planting event was approximately **$1,530**. Supplies, including trees and tree protection, were purchased with funds from the LCBP grant and cost-share from the US Fish and Wildlife Partners. Personnel time used to plan and execute the project was roughly 33 hours or $1,400. Refreshments were approximately $30 and mileage was approximately $15.

Figure 5: Volunteers in S. Burlington plant trees along Muddy Brook on Arbor Day, 2018 (5/4/18)

Water Quality Monitoring Program Summary

RRST has maintained an ongoing water quality monitoring program since 2012. These urban or suburban streams are impacted by sedimentation, excessive nutrient loading, high temperatures, bacteria, and other pollution. With another year of support from VT DEC's LaRosa program, RRST collected biweekly water quality samples at twenty three sites on twelve streams in 2018 (an increase by five sites and three streams from 2017). Thirteen volunteers and one intern helped collect grab samples on five, biweekly Tuesdays from 7/10 - 9/4. Grab samples were analyzed for turbidity, total phosphorus, and chloride. These parameters were also sampled at five of the sites during one rain event on 8/18. See the 2018 Water Quality Monitoring

Report in Appendix A for more information.

The training day for citizen science samplers took place on 7/9/18. RRST coordinator demonstrated sampling procedures, described the data collection sheets and answered questions. Throughout the season, volunteers returned their samples to the WNRCD office after sampling, and the RRST coordinator ensured all samples were accounted for and delivered to the UVM lab. All volunteers received a hand-written thank-you card at the end of the sampling season. A volunteer appreciation event is planned for spring 2019. Volunteers expressed an interest in having an educational experience, rather than a pizza party, so the plan is to host a tour of the Essex Wastewater Treatment Plant, followed by snacks.

New this year, the RRST coordinator sent bi-weekly emails to WQ volunteers to check in about sampling procedure and share interesting local water tidbits. This frequent communication was well received by the volunteers. The coordinator also solicited feedback on the training materials and field data sheets and made significant edits for 2019 to improve clarity.

WNRCD sponsored an (unpaid) water quality intern for the sampling season. James Mazzola, a recent graduate, helped collect 5-8 samples each sampling day. He also helped the RRST coordinator scope the five new sampling sites for safety and suitability and helped update directions for all sites, adding pictures and more descriptive landmarks.

Stream	*Location*	*Site ID*	*Lat / Long*
Centennial Brook	Grove Street in Burlington (by the parking lot for Schmanska Park)	Centennial 10	44.48453, -73.18423
	Patchen Road in South Burlington (through cemetery)	Centennial 20	44.47402, -73.17334
Indian Brook	Parking lot B of Essex High School	Indian 10	44.49668, -73.11093
	Lang Farm in Essex	Indian 20	44.50442, -73.09190
Malletts Creek	McMullen Road	Milton 10	44.60855, -73.10693
Munroe Brook	Route 7 and Bay Road (by Red Apple Motel)	Munroe 10	44.40532, -73.21735
	Spear & Webster Intersection (just south of Kwiniaska Golf Course)	Munroe 20	44.38984, -73.20103
Morehouse Brook (one old site: 10 one new site: 20)	Landry Park Winooski (Eastern trib)	Morehouse 10	44.50035, -73.19226
	Landry Park Winooski (main branch - west of Morehouse 10)	Morehouse 20	44.50041, -73.19444
Muddy Brook (20- site changed for safety)	River Cove Road in Williston	Muddy 10	44.47293, -73.13505
	S. Brownell Road Williston	Muddy 20	44.44196, -73.13228
	Van Sicklen Road in Williston	Muddy 30	44.42823, -73.14622
Potash Brook (40 - site changed for safety)	Kindness Court in South Burlington near Humane Society	Potash 10	44.44572, -73.21348
	Farrell Street in South Burlington near	Potash 20	44.44660, -73.20415

	Klinger's Bakery		
	Dorset Street in South Burlington	Potash 30	44.45150, -73.17849
	Kimball Ave South Burlington	Potash 40	44.45394, -73.14809
Engelsby Brook	Pine St in Burlington near Champlain Elementary Community Gardens	Engelsby 10	44.45627, -73.21394
	Behind UVM Redstone Campus in Burlington	Engelsby 20	44.46654, -73.19741
Alder Brook (new)	Off Chapin Road in Essex	Alder 10	44.51742, -73.06559
Bartlett Brook (new)	By Shearer Chevrolet in South Burlington	Bartlett 10	44.42596, -73.21345
Sunnyside Brook (new)	Mountain View Drive in Colchester	Sunnyside 10	44.50654, -73.17823
Sunderland Brook (new)	In Pearl Street Park in Essex Junction	Sunderland 10	44.50179, -73.12983
	Off Pine Island Road in Colchester	Sunderland 20	44.51685, -73.20421

Table 2: 2018 Stream Sampling Site Locations

Figure 6: ***Volunteers sampling at Indian 10, Indian 20 and Muddy 30 on 8/7/18***

Town	Number of Stream Team Volunteers
Essex Junction	3
Colchester	2
S. Burlington	2
Burlington	2
Williston	2
Shaftsbury	1
Hinesburg	1

Table 3: Stream Team Water Quality Sampling Volunteers by town

Adopt-a Rain Garden Program Summary

The Stream Team's Adopt-a-Rain Garden program is an opportunity for individuals to assist in keeping Chittenden County's public rain gardens functional and attractive. This involves basic maintenance activities like picking up trash, pruning, pulling weeds, installing new mulch, and informing the coordinator of non-functioning gardens. There are currently eleven public rain gardens managed by RRST. In 2018, there were four official adopters, but about 10 community members volunteered time to clean the Coast Guard Station garden this year as part of the Vermont Community Garden Network's Day in the Dirt event. Efforts will be made in 2010 to find individuals or groups to adopt all gardens.

This summer, the RRST coordinator visited all the gardens to remove out of date signage. The signs will be re-laminated with the current RRST logos and information and will be returned next spring. The re-branding of the signs has been organized by Dave Barron of Pluck Designs.

An assessment of each garden was conducted in summer 2018 and the status of each is provided below.:

Callahan Park Rain Garden
Location: 45 Locust St., Burlington
This garden has been functioning well for some time thanks to efforts by Brad Ketterling, who has adopted this garden for several years. In 2017, Burlington Public Works brought a load of mulch to the garden and Brad spread the mulch and kept up with weeding and monitoring the garden. Several, understory shrubs and flowers have been shaded out by larger, over-story plants that need to be thinned. There are several locations that also need to be replanted, so efforts will be made to locate surplus plants that can be added in 2019.

Chamberlain School
Location: 262 White Street, South Burlington
This garden was installed in partnership with WNRCD and the Let it Rain Program in 2013. This is one of several rain gardens on the grounds of Chamberlain Elementary. School teacher Chris Provost adopted this garden again in 2018 and has actively maintained it for several years.

Coast Guard Station
Location: Depot Street, Burlington
This small garden is located in the parking lot abutting the bike path next to the Burlington Coast Guard Station. In 2014, RRST worked with the ECHO summer kids program to engage elementary school children in cleaning the garden and in 2015 a local resident, Wiley Reading, adopted the garden. The garden did not

have an adopter from 2016-2018, but this garden got a "boost" of energy from 10 community volunteers through the Day in the Dirt event hosted by the Vermont Community Garden Network in spring of 2018. It is in good condition. Efforts will be made to find a volunteer for 2019.

Correctional Facility

Location: 7 Farrell St., South Burlington

This garden is visible from the road and appears to be functioning well. Originally, employees of the prison adopted this garden and would occasionally clean the garden with inmates. There has been a lot of staff turnover in the past few years without a clear adopter. No formal adoption of this garden was made in 2018. MS4 representative, Tom DiPietro, has been in communication with Correctional Facility staff about proper maintenance. He will continue to be the main contact for 2019, with support offered from The Stream Team as needed. There is not a RRST garden sign at this garden, but one will not be installed here as visiting the area is discouraged.

Farrell Park

Location: Swift Street, South Burlington

This garden is unique in terms of its design. It is called an "advanced wetland stormwater filter" and was installed in 2012. Stormwater enters the garden through an inlet, flows through the gravel wetland filter media, is cleaned and exits through other end. The garden requires very little maintenance because it has a flushing system that prevents sediment from building up. This garden had an active adopter for its entire life, until 2015 when the adopter moved away. The garden was never in need of additional plants or maintenance. It would not be appropriate to add mulch to this garden. RRST would like to find another adopter in 2019, primarily to weed the site and to bring any issues to our attention.

Landry Park

Location: North St., Winooski

This garden was constructed in 2006 as two, separate gardens along the narrow strip of grass between a fence at Landry Park and the road. Over the years, the gardens have become overgrown, but Winooski DPW officials believe it still functions well, even with the tall, dense shrubs. A few years ago, nearby road construction altered the slope of the road carrying larger volumes of water into the garden. The increased flows have killed some of the vegetation and caused gullies to form, but the vegetation seems to have rebounded. It would be beneficial to the functionality of the garden to have the sediment vacuumed out and RRST has spoken with the City of Winooski DPW about this maintenance task. It is expected to be completed in spring 2019. In 2016, a group of UVM students in an Ecosystem Design course developed recommendations to repair the garden. There is no current adopter; and RRST coordinator will attempt to find one for the 2019 season.

Williston Town Hall Annex

Location: 7900 Williston Rd, Williston

This small garden near the entrance walkway to the Annex building and the parking lot has had an active adopter since 2014: Rita Desseau. Rita maintained the garden in 2018, but additional work needs to be done at this site to weed, thin larger shrubs, re-plant in bare spots, and mulch the garden.

Williston Library (aka. Dorothy Alling Memorial Library)
Location: 21 Library Lane, Williston
The Williston Library garden is in good condition and is primarily being cared for by the staff of the library. The flowering plants may need to be thinned out in 2019. This garden was previously cared for by Andrew Wolf.

South Burlington High School (formerly the location of the South Burlington Library)
540 Dorset St., South Burlington
WNRCD received a grant to construct a rain garden at the entrance to what was the South Burlington Library (now South Burlington High School) in 2013. The rain garden received minimal maintenance by the library staff over the years, and was formally adopted in 2016 by Amy Niggel's Cub Scout 678 pack. The pack's leadership changed hands in 2018 and the new cubmaster Bill Kett agreed to continue maintenance of the garden with his pack.

South Burlington Fire Department
575 Dorset St., South Burlington
The City of South Burlington installed this bioretention area/rain garden in 2015 to improve stormwater management at the Fire Department. Cub Scout pack 678 volunteered to adopt this rain garden as well in 2019.

Rain Garden	Adopter 2018	Previous adopters
Chamberlin School, South Burlington	Chris Provost and students	Chris Provost
Coast Guard Station, Burlington	None	Wily Reading
Landry Park, Winooski	None	None
Williston Annex	Rita Dessau	Rita Dessau
Williston Town Library	Town Library Staff	Andrew Wolf
Callahan Park, Burlington	Brad Ketterling	Brad Ketterling
Farrell Park, South Burlington	None	None
Department of Corrections, South Burlington	None	Dana Scofield and Lori Farley
Brownell Library, Essex Junction	None	None

South Burlington Fire Station	Cub Scouts 678 (Bill Kett)	Cub Scouts 678 (Amy Niggel)
South Burlington Library	Cub Scouts 678 (Bill Kett)	None

Table 4: 2018 Rain Garden Adopters

2018 Staffing Notes

In 2018, WNRCD experienced a full staff turnover. At the end of May 2018, Holly Kreiner left her position with WNRCD and was replaced by Kristen Balschunat. In July 2018, District Manager Corrina Parnapy left her position, and was replaced by Gianna Petito. Kristen has taken primary responsibility for Stream Team activities.

2018 Water Quality Monitoring Report

Monitoring Team

The Rethink Runoff Stream Team (formerly known as the Chittenden County Stream Team) is a program that engages citizens across a nine-municipality region to implement projects that reduce non-point source pollution and stormwater volume at the local level. The participating towns are Burlington, Colchester, Essex, Essex Junction, Milton, Shelburne, South Burlington, Williston, and Winooski. The Water Quality Monitoring program is managed by the Chittenden County Regional Planning Commission Clean Water Advisory Committee MS4 subcommittee, coordinated by the Winooski Natural Resources Conservation District, and made possible through the support of the Vermont Department of Environmental Conservation LaRosa program. This report describes the results from the 2018 collection season; the seventh, consecutive year data was collected by this volunteer-led stream water quality monitoring effort in Chittenden County.

When, Where, and What the Stream Team Monitors

The Rethink Runoff Stream Team (RRST) has collected biweekly water quality samples at several pollutant "impaired" or "stressed" stream sites in Chittenden County since 2012. These urban or suburban streams suffer from excessive nutrient loads, sodium chloride, sedimentation, high temperatures, bacteria, and/or other pollutants. Samples were collected on six different dates in 2018: on five, scheduled bi-weekly dates and on one unscheduled "high-flow" date (i.e. during a rain event). High-flow sampling provides a snapshot of the potentially, elevated or diluted pollutant-loads moving through these systems when it rains. Samples were analyzed for turbidity, total phosphorus, and chloride at all 23 sites.

Biweekly sampling dates occurred on July 10th, July 24th, August 7th, and August 21st and September 4th, and all regular bi-weekly sampling occurred during dry/baseflow conditions. The proposed sampling dates (originally 6/26/18-8/21/18) were pushed two weeks later due to staff turnover within WNRCD to give the new Stream Team coordinator time to prepare for the volunteer training and sampling season. One rainy day sampling event occurred on August 18th at sites on Indian, Muddy, Potash, Centennial and Morehouse brooks. Table 1 indicates total rainfall in inches for the day of sampling and the day immediately preceding sampling. While baseflow sampling days all had less than 0.5 inches of rainfall, freshet sampling on August 18th had 1.65 inches.

Report prepared by: Kristen Balschunat & Gianna Petito
Winooski Natural Resources Conservation District

Funded by: LaRosa Partnership, VT Department of Environmental Conservation Watershed Management Division

Table 1. Average regional rainfall, in inches, for the preceding day and day of sampling. Rainfall data for each day was gathered from several station sites across the sampling region (Burlington, Colchester, and Essex) and a daily mean was calculated. Daily means were then summed for the preceding and day-of sampling events. Rainfall data was collected from the National Oceanic and Atmospheric Administration through their daily summaries maps: https://gis.ncdc.noaa.gov/maps/ncei/summaries/daily The specific sampling sites and their locations are listed in Table 2. A map of the sites is shown in Figure 1.

Date	Total Rainfall (inches)
07/10/18	0.4
07/24/18	0.3
08/07/18	0.362
08/18/18	1.65 (freshet)
08/21/18	0
09/04/18	0.2

Table 2. Rethink Runoff Stream Team 2018 Water Quality Sampling Sites. Note that sites located further up a streamshed are labeled with high numbers except at Sunderland where this labeling was switched and Sunderland 20 is actually downstream of Sunderland 10. Stream Team will look into fixing this labeling anomaly with our records and those of the lab starting next field season.

Stream	*Location*	*Site ID*	*Lat / Long*
Centennial Brook	Grove Street in Burlington (by the parking lot for Schmanska Park)	Centennial 10	44.48453, -73.18423
	Patchen Road in South Burlington (through cemetery)	Centennial 20	44.47402, -73.17334
Indian Brook	Parking lot B of Essex High School	Indian 10	44.49668, -73.11093
	Lang Barn in Essex	Indian 20	44.50442, -73.09190
Malletts Creek	McMullen Road	Milton 10	44.60855, -73.10693
Munroe Brook	Route 7 and Bay Road (by Red Apple Motel)	Munroe 10	44.40532, -73.21735
	Spear & Webster Intersection (just south of Kwiniaska Golf Course)	Munroe 20	44.38984, -73.20103
Morehouse Brook (One new site: 20)	Landry Park Winooski (Eastern trib)	Morehouse 10	44.50035, -73.19226
	Landry Park Winooski (main branch - west of Morehouse 10)	Morehouse 20	44.50041, -73.19444

Muddy Brook (20- site changed)	River Cove Road in Williston	Muddy 10	44.47293, -73.13505
	S. Brownell Road Williston	Muddy 20	44.44196, -73.13228
	Van Sicklen Road in Williston	Muddy 30	44.42823, -73.14622
Potash Brook (40 - site changed)	Kindness Court in South Burlington near Humane Society	Potash 10	44.44572, -73.21348
	Farrell Street in South Burlington near Klinger's Bakery	Potash 20	44.44660, -73.20415
	Dorset Street in South Burlington	Potash 30	44.45150, -73.17849
	Kimball Ave South Burlington	Potash 40	44.45394, -73.14809
Engelsby Brook	Pine St in Burlington near Champlain Elementary Community Gardens	Engelsby 10	44.45627, -73.21394
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Alder Brook (new)	Off Chapin Road in Essex	Alder 10	44.51742, -73.06559
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	Off Pine Island Road in Colchester	Sunderland 20	44.51685, -73.20421

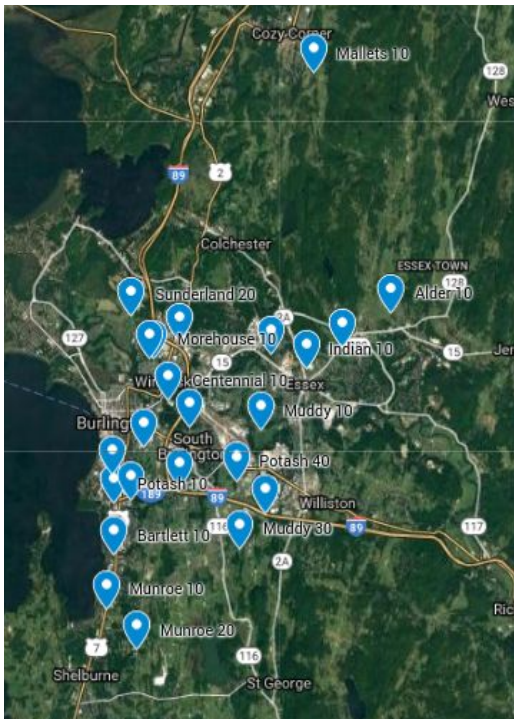


Figure 1: 2018 Rethink Runoff Stream Team Sample Sites. An interactive version of this map is available here:

https://drive.google.com/a/winooskinrcd.org/open?id=1K98F4bBO2E6p5lLKgSw7bxRSpQlzoo8Q&usp=sharing

Phosphorus Results

Phosphorus is an essential nutrient for plants and animals that is naturally limited in most freshwater systems. Even a modest increase can set off a chain of undesirable events, such as algal blooms, accelerated plant growth, low dissolved oxygen, and the subsequent die off of aquatic life. Although phosphorus occurs naturally in soils and rocks, additional phosphorus enters waterways through runoff from sources such as fertilized lawns and cropland, pet waste, failing septic systems, animal manure from storage areas or livestock access, wastewater treatment plants, and streambank erosion.

Phosphorus sample results continue to be high across all sampling sites. The VT 2016 water quality standard for phosphorus in Class B warm water medium-gradient streams is 27 µg/L but the mean 2018 phosphorus level for every site exceeded this standard (see Table 2).

Table 3. 2018 RRST Phosphorus Results Summary: Mean phosphorus levels in µg/L during both baseflow (dry) and high-flow (rain) sampling events in 2018. Values exceeding the Vermont chronic chloride standard of 27 µg/L are shown in red. Sites denoted with an * had at least one sampling date in which blank or dupe results were flagged. Recalculated means with this data removed resulted in very similar values such that it was decided to keep them for descriptive statistics reporting purposes. Raw data is presented in Appendix C.

Location	Mean Phosphorus during Baseflow - Dry Conditions	Phosphorus during Rain Event
Alder 10*	102.06	--
Bartlett 10	57.02	--
Centennial 10	50.94	88.9
Centennial 20*	62.44	--
Englesby 10*	82.12	--
Englesby 20	98.56	--
Indian 10	41.66	180
Indian 20	97.48	--
Mallets Creek 10	39.68	--
Morehouse 10	30.9	48.8
Morehouse 20	35.86	76.5
Muddy 10	50.4	--
Muddy 20	41.6	--

Muddy 30	116.46	92.3
Munroe 10*	60.86	--
Munroe 20	88.96	--
Potash 10	44.66	--
Potash 20	35.82	--
Potash 30	89.58	--
Potash 40	318.54	--
Sunderland 10	92.94	--
Sunderland 20	55.26	--
Sunnyside 10	27.36	--

Phosphorus levels in Chittenden County Streams 2012-2018

Since the onset of this monitoring program in 2012, mean concentrations of phosphorus during baseflow have remained notably above the 27 µg/L standard at all stream sites. In fact only 7 out of the 23 sites sampled have ever exhibited phosphorus concentrations below this standard (Indian 20, Malletts 10, Morehouse 10 and 20, Potash 10 and 20, and Sunnyside 10). Out of these 7, only one site (Sunnyside 10) reports a median below the standard but the 1-yr sampling mean still falls above the standard (see Table 2 above). Sites of notable historic levels include Engelsby 20, Muddy 10, 20 and 30, Munroe 20, Potash 40, and Sunderland 10.

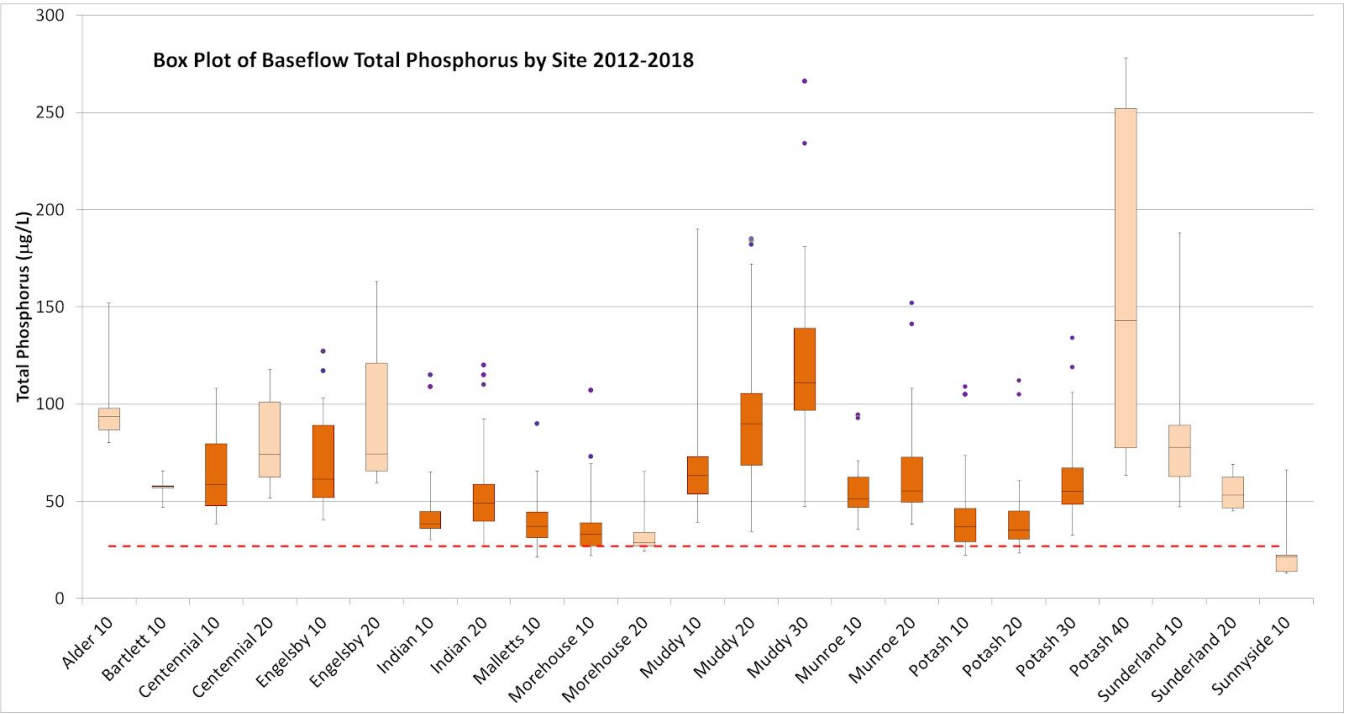


Figure 2. Comparison of total phosphorus levels across sites 2012-2018. Box plots indicate first and third quartiles and median values of total phosphorus concentrations for all sites. These values were calculated including sampling dates that may or may not have associated flagged dupe or blank samples. Lighter colored boxes indicate 1-2 years of sampling data, darker boxes indicate 6-7 years of sampling data. Dots indicate outliers which were identified as equal to or greater than 2 times the site's standard deviation. Red line indicates Vermont's 2016 Water Quality Standard of 27 micrograms/L.

Figure 2 suggests that phosphorus levels increase as sampling moves upstream. To test this hypothesis, RRST used scatter plots to graph phosphorus data over time by stream and ran statistical analyses on 8 streams that had more than one sampling site. Of the 8 streams that have more than one sampling location, 6 indicated a statistically significantly different value of phosphorus between sites, all of which presented statistically significantly higher concentrations of total phosphorus upstream . Table 4 summarizes the results of these tests. Appendix D summarizes statistics and graph visualizations. This result was somewhat surprising and merits more consideration since we assumed that total phosphorus increased in concentration as water moves downstream and more inputs are introduced.

Table 4 Statistical Results of Phosphorus trends along stream lengths. Statistical tests selected because data either had too small a sample size or was not normally distributed and therefore it was not appropriate to do a Paired T-test. While Wilcoxon Signed Rank recognizes dependent samples as could be the case up and down the same stream, the Kruksal-Wallis was the best tool available to reporter but it assumes independent samples so results should be seen with caution. Location of higher concentration was estimated through graphing. Note that all values and sampling dates were included in analysis as long as they could be paired (in the case of the Wilcoxon Signed Rank), including outliers and those flagged with dupe or blank concerns.

Stream	# of Sites	Statistical Test Used	Statistically significant difference?	Location of higher concentration?
Centennial	2	Wilcoxon Signed Rank	Y	Upstream
Engelsby	2	Wilcoxon Signed Rank	N	--
Indian	2	Wilcoxon Signed Rank	Y	Upstream
Morehouse	2	Wilcoxon Signed Rank	N	--
Munroe	2	Wilcoxon Signed Rank	Y	Upstream
Sunderland	2	Wilcoxon Signed Rank	Y	Upstream
Muddy	3	Kruksal-Wallis	Y	Upstream
Potash	4	Kruksal-Wallis	Y	Upstream

Figure 2 also suggests that Muddy Brook has shown consistently high levels of Phosphorus as compared to other sites including some extremely high outliers. Interestingly, temporal data is suggesting a non-significant downward trend of Phosphorus concentrations at sites Muddy 20 and Muddy 30 with Muddy 10 holding relatively constant. This is unique to Muddy Brook and it's not clear what land use changes or restoration efforts could have contributed to this. Figures 3 and 4 show the suggested trends for Muddy 20 and 30 respectively.

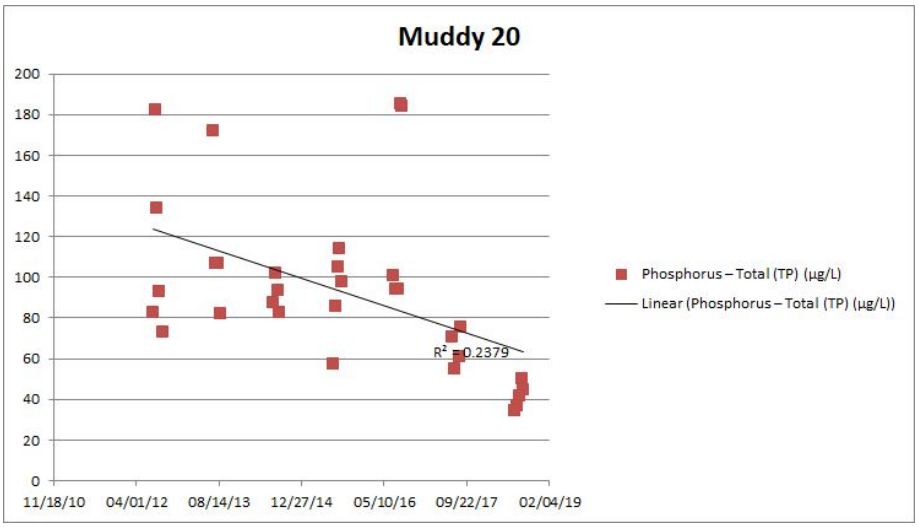


Figure 3. Total Phosphorus in Muddy 20 since 2012. Scatter plot visually suggests a downward trend but R2 of the best fit line is still only about 0.24 and not significant.

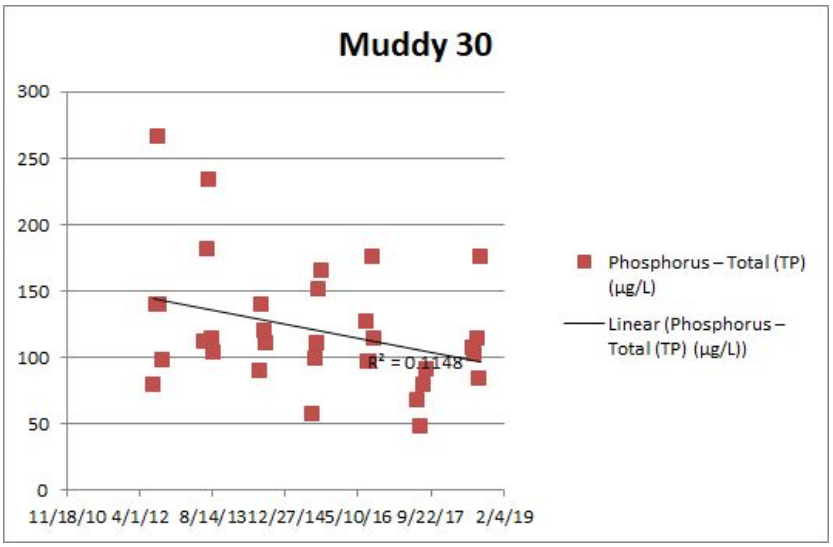


Figure 4. Total Phosphorus in Muddy 30 since 2012. Scatter plot visually suggests a downward trend but R2 of the best fit line is still only about 0.12 and not significant.

Chloride Results

Chloride is a component of salt found naturally in minerals and in oceans. While a low level of instream chloride can originate from natural sources, higher levels are generally due to the use of deicing salts. Elevated chloride levels in surface waters can negatively impact the health and reproduction of aquatic species, according to the Vermont Surface Water Management Strategy. The Stream Team took grab samples of chloride, which do not provide adequate data to label a stream impaired or acute, however, the data acts as a spot check. For reference, the Environmental Protection Agency's (EPA) and State of Vermont's (VT) current water quality standard for chloride is 230 mg/L (chronic criteria) and 860 mg/L (acute criteria). 230 mg/L is the highest concentration of chloride to which aquatic life can safely be

exposed for one hour once every 3 years. 860 mg/L is the highest concentration of chloride to which aquatic life can safely be exposed for four consecutive days once every 3 years.

Table 5. 2018 RRST Chloride Results Summary: This table depicts mean chloride levels in mg/L during baseflow (dry) and high-flow (rain) sampling events in 2018. Values exceeding the Vermont chronic chloride standard of 230 mg/L are shown in red. No sites had a sampling date in which blank or dupe results were flagged for chloride. Raw data is presented in Appendix C.

Location	Mean Chloride in Dry Conditions Only	Chloride during Rain Events
Alder 10	10.93	--
Bartlett 10	256	--
Centennial 10	728	248
Centennial 20	176.2	--
Englesby 10	401.8	--
Englesby 20	711.8	--
Indian 10	257.6	41.55
Indian 20	180.5	--
Mallets Creek 10	50.09	--
Morehouse 10	133.17	38.65
Morehouse 20	490.1	111
Muddy 10	231.2	--
Muddy 20	596	--
Muddy 30	34.2	35.7
Munroe 10	341.4	--
Munroe 20	169.54	--
Potash 10	570.4	--
Potash 20	600.2	--
Potash 30	330	--

Potash 40	737.1	--
Sunderland 10	187.2	--
Sunderland 20	168.2	--
Sunnyside 10	773	--

While in 2017 only thee sampled brooks presented mean values above of 230 mg/L, in 2018 nine brooks presented exceedances although this increase is partially attributed to the addition of new sampling sites of concern. Similar to 2017, chloride levels were higher during baseflow conditions in the majority of cases which is suspected to be due to dilution. Chloride grab sample levels exceeded 860 mg chloride/L, in Centennial 10 and Engelsby 20 in 2018. Both streams exceeded this value on 7/10/18 and 7/24/18. This is the first time this value was surpassed in any individual sample over this seven year period. This could result in a need for more continuous monitoring at these sites to gain continuous-flow data.

Chloride levels in Chittenden County Streams 2012-2018

Since the onset of this monitoring program, mean chloride levels at Centennial 10 and Potash 10, 20 and 30 have remained notably above 230 mg/L standard. Recently added sampling sites have also presented alarmingly high data including Engelsby 20, Morehouse 20, Potash 40, and Sunnyside 10.

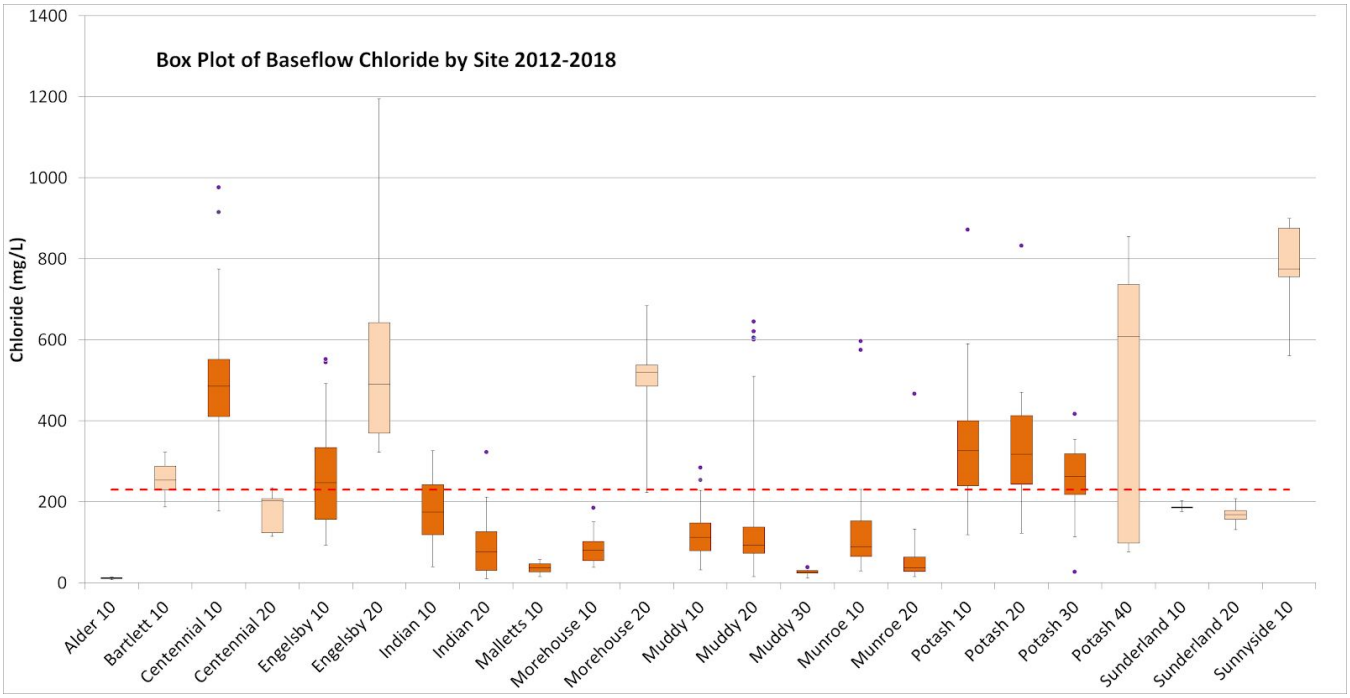


Figure 5 - Comparison of Chloride levels across sites 2012-2018. Box plots indicate first and third quartiles and median values of chloride levels (mg/L) for all sites. Lighter colored boxes indicate 1-2 years of sampling data, darker boxes indicate 6-7 years of sampling data. Dots indicate outliers which were identified as equal to or greater than 2 times the site's standard deviation. EPA's and Vermont's standard for 4-day average chloride levels (230 mg/L) is shown by the red line.

There is not as clear a link between location in the watershed and chloride levels as there is for phosphorus levels but several streams presented statistically significantly different chloride levels across sampling sites. Of the 8 streams that have more than one sampling location, 7 indicated a statistically significantly different value of Chloride between sites. This information could be useful in pin-pointing chloride pressure points along the stream length for intervention purposes. Table 6 summarizes the results of these statistical tests. Appendix E summarizes statistics and graph visualizations.

Table 6 Statistical Results of Chloride trends along stream lengths. See Table 4 note for details.

Stream	# of Sites	Statistical Test Used	Statistically significant difference?	Location of higher concentration?
Centennial	2	Wilcoxon Signed Rank	Y	Downstream
Engelsby	2	Wilcoxon Signed Rank	Y	Upstream
Indian	2	Wilcoxon Signed Rank	Y	Downstream
Morehouse	2	Wilcoxon Signed Rank	Y	Upstream
Munroe	2	Wilcoxon Signed Rank	Y	Downstream
Sunderland	2	Wilcoxon Signed Rank	N	--
Muddy	3	Kruksal-Wallis	Y	Midstream (site 20)
Potash	4	Kruksal-Wallis	Y	Unclear

Chloride data from this sampling program suggests that of the 14 sites that have been sampled for 6 or more years, chloride levels are trending upwards in 10 of them (Centennial 10, Engelsby 10, Indian 10 and 20, Malletts 10, Muddy 30, Munroe 10 and 20,and Potash 10 and 20). These trends are not statistically significant but highlight an important stressor to monitor closely. Appendix F documents graphs of these trends.

Aggregated data also suggests a general increasing trend in chloride. Figure 6 below shows that e mean, median, and standard deviation values have all increased slightly over time.

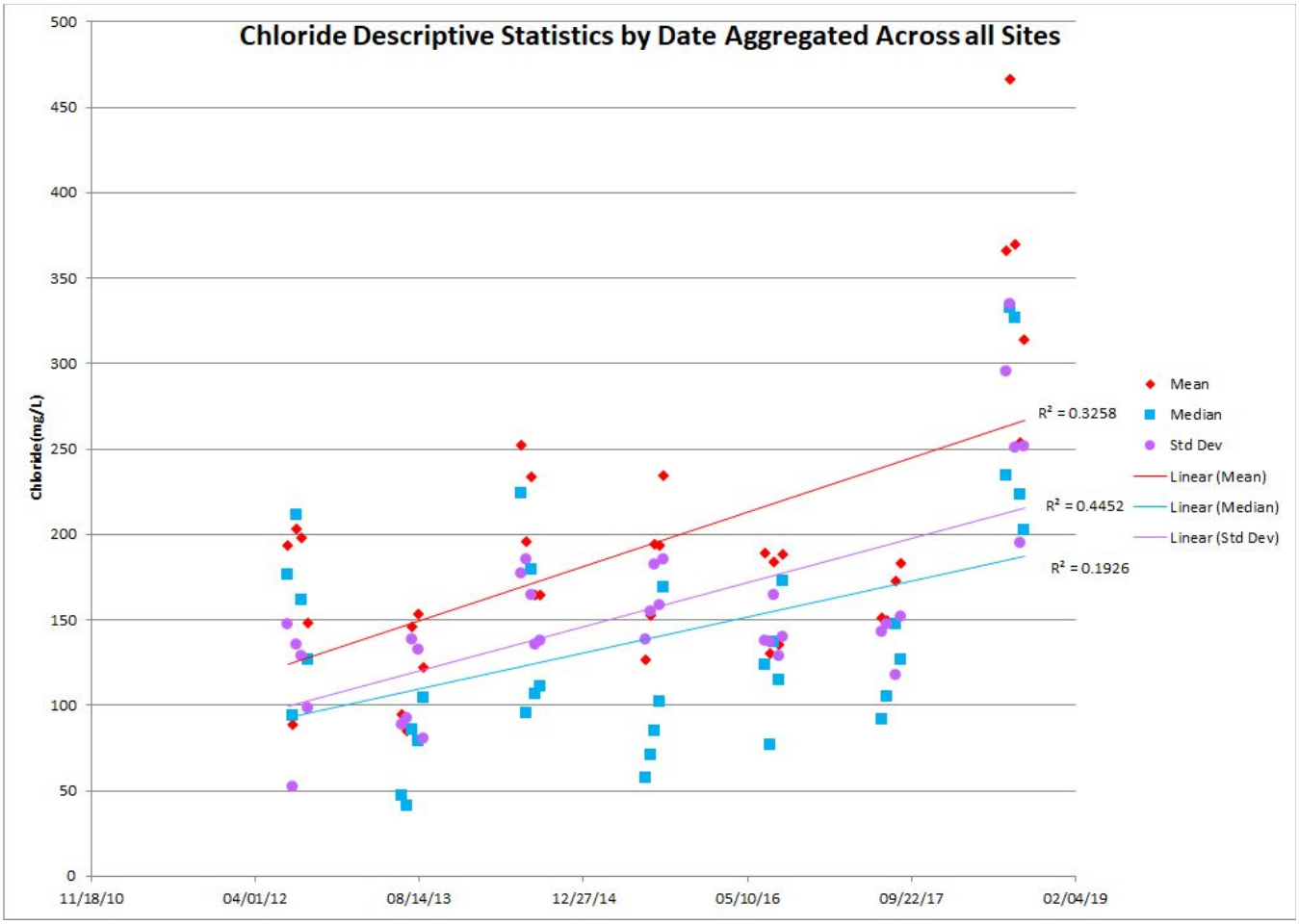


Figure 6. Descriptive Statistics for chloride data gathered across sites aggregated by date. Each sampling date since June 2016 had chloride values across sites averaged to determine mean, median, and standard deviation for the entire sampling area.

Turbidity Results

The turbidity of a water sample refers to its cloudiness. This measurement is based on the amount of algae, microbes, and sediment suspended in the water. High turbidity levels can negatively impact aquatic life by raising water temperature, decreasing forage and cover, and harming gill function, and has the potential to increase the presence and number disease-causing organisms. Turbidity measurements can also be used as an indicator for erosion and increased nutrient levels in streams. The Vermont Water Quality Standards state that turbidity should not exceed 10 NTU (nepholometric turbidity units) in cold-water fish habitat and 25 NTU in warm-water fish habitat.

Table 7. 2018 RRST Turbidity Results Summary. Mean turbidity levels in NTU baseflow (dry) and high-flow (rain) sampling events in 2018. Overall mean values exceeding the Vermont standard of 25 NTU are shown in red. Raw data is presented in Appendix C.

Location	Mean Turbidity in Dry Conditions Only	Turbidity during Rain Event
Alder 10	30.9	--
Bartlett 10	11.402	--
Centennial 10	5.198	18.2
Centennial 20	3.462	--
Englesby 10	6.92	--
Englesby 20	2.242	--
Indian 10	7.738	64.9
Indian 20	9.104	--
Mallets Creek 10	4.772	--
Morehouse 10	5.938	8.52
Morehouse 20	2.816	21.3
Muddy 10	6.252	--
Muddy 20	5.928	--
Muddy 30	17.68	11.5
Munroe 10	6.724	--
Munroe 20	18.9	--
Potash 10	4.868	--
Potash 20	1.488	--
Potash 30	10.782	--
Potash 40	39.32	--
Sunderland 10	8.032	--

Sunderland 20	10.106	--
Sunnyside 10	11.044	--

Mean baseflow turbidity levels did not exceed the VT Water Quality standard for turbidity of 25 nephelometric units (NTU) for warm-water fish habitat in 2018 except at Potash 40 and Alder 10. This represents an increase of two sites as compared to 2017 but one of these sites was newly added in 2018. As suspected, turbidity concentrations were mostly higher during rain events, and surpassed standards on Indian Brook alone.

Turbidity Levels in Chittenden County Streams 2012-2018

Mean, baseflow turbidity values have only rarely exceeded the VT standard for warm-water streams of 25 NTU over the seven year sampling period. Of note, however, is the high turbidity recorded for new sampling sites Alder 10 and Potash 40. Higher turbidity in Alder 10 is not surprising because the site is comparatively more agricultural with a couple farms and potential field runoff nearby. Turbidity has not been included in sampling support requests for the 2019 field season but will be revisited in 2020.

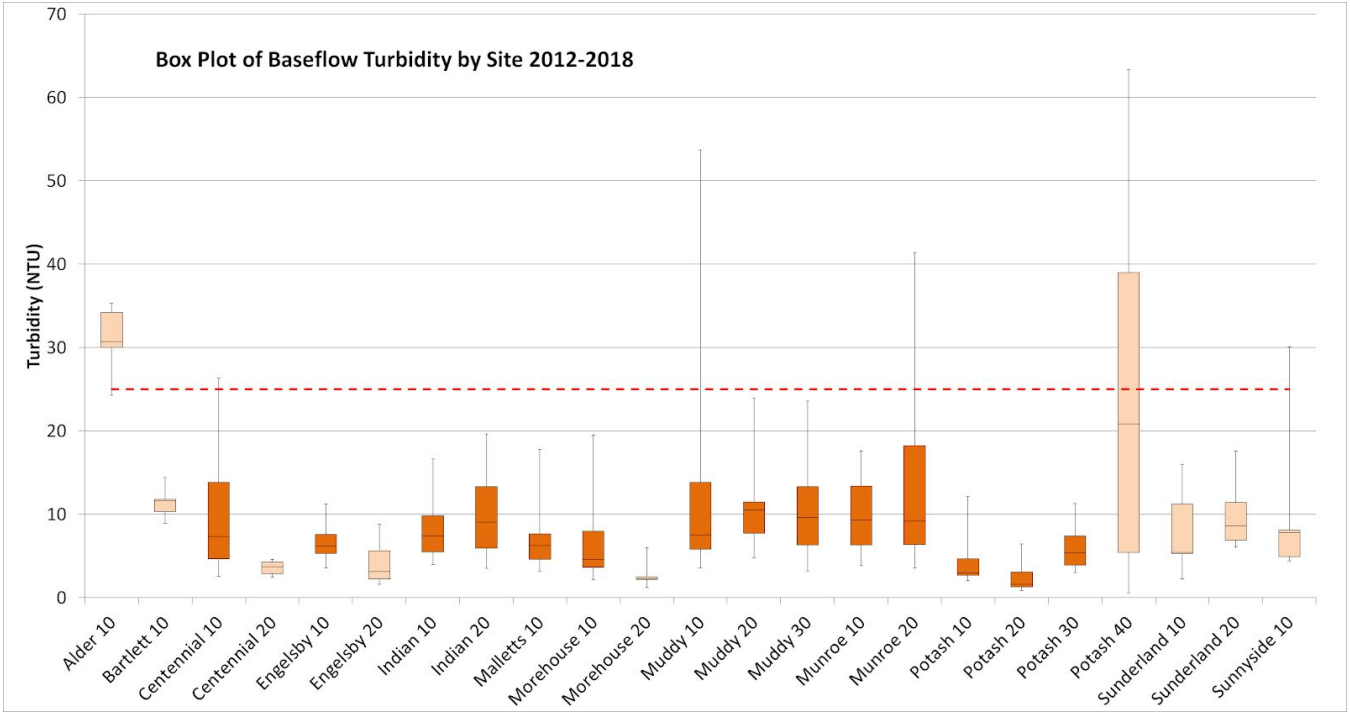


Figure 7 - Comparison of turbidity levels 2012-2018 during baseflow (dry) conditions. The standard proposed by the State of Vermont for mean turbidity at baseflow in medium gradient, warm water streams (25 NTU) is indicated by the red line. These values were calculated including sampling dates that may or may not have associated flagged dupe or blank samples.

Importantly, it was challenging to secure valid turbidity data for the 2018 sampling season. Appendix A will reveal a mean relative percent difference between duplicate and actual samples above the acceptable 15%. Some but not all of this was due to having very low sample values in relation to test sensitivity.

This adds to the Stream Team's resolve to remove this parameter from future sampling activities for the time being.

Turbidity was statistically significantly different along only two streams (Morehouse and Potash). The Morehouse site results, while significant, both fell under the water quality standards such that the difference is of less interest to the research team. In contrast, Potash 40 presented turbidity levels which both exceeded water quality standards and were significantly different from other sites along that brook. The sampling team suspects this could be due to the unique hydrology of Potash 40 which is located among a complex of artificial wetlands within an industrial park. The water has no noticeable flow rate or direction and presents less as a stream and more as a marsh. It is suspected that in-stream sampling practices might disturb a lot of bottom sediment in such a setting thereby leading to higher turbidity readings. Considering this, Potash 40 has been removed from the 2019 sampling program.

Visualization revealed no notable trends in turbidity data over time and it is therefore not currently recognized as a high priority threat.

Conclusion

The Rethink Runoff Stream Team has monitored chloride, phosphorus, and turbidity in various, stormwater impaired streams in Chittenden County for the past seven consecutive years (2012-2018). The 2018 season's results are similar to those obtained over the past six years, and indicate that all stream sites have sustained phosphorus levels well above the Vermont standard and that chloride is becoming a prevalent and growing concern.

Phosphorus levels in almost all sampled streams have remained two to four times the Vermont water quality standard of 27 µg/L. Muddy Brook continues to maintain high levels of phosphorus although values are potentially trending downwards. Six streams sampled also showed statistically significantly higher concentrations of total phosphorus upstream as opposed to downstream which presents an opportunity to explore localized stressors. It's important to consider that while phosphorus levels are presenting high in many sites, turbidity levels are low. This provides some clues as to sources of phosphorus and should inform phosphorus reduction efforts. For example, it is possible these high phosphorus values can be attributed to more urban-like runoff such as car wash detergents, liquid lawn fertilizers, and pet waste.

Chloride levels continue to surpass standards in several streams, most notably at Centennial 10, Engelsby 20, Morehouse 20, Potash 40, and Sunnyside 10. For the first time in Stream Team's sampling history, chloride levels exceeded the EPA's and VT's acute standard of 860 mg chloride/L on the same two sampling dates at both Centennial 10 and Engelsby 20. As mentioned in prior year reports it is suspected that Engelsby's high levels are due to a nearby parking lots on the UVM campus but further assessments should consider rising stressors across the sampling region at all sites of concern.

Low turbidity values in most sites reveal this does not appear to be a significant stressor in the Chittenden County area although research team should consider potential sediment inputs upstream of

Alder 10 for remediation. After seven years of showing minimal concern, turbidity will be abandoned at most locations in the 2019 season.

There will be a few sampling adjustments made to the 2019 sampling effort. Potash 40 will be removed because of its unique and confounding hydrological conditions that complicates data analysis. Munroe 10 seems to be located physically too close to Munroe 20 to be giving any valuable information on landscape impacts so it will similarly be abandoned. Munroe 20 will be kept, however as a valuable data point because a housing development is planned and will be implemented upstream soon. Finally, Bartlett 10 will be removed because it is already sampled by a team from UVM.

It became clear this year that, moving forward, the Stream Team needs explicit guidance and documented practices in the QAPP for dealing with outliers and data points whose duplicates or blanks were flagged. For 2018 analysis all data points were included because those whose duplicates or blanks were flagged, still had values less than two standard deviations from the mean. Outliers, similarly, only presented when multi-year data was assessed such that for 2018-specific descriptive statistics, all data points were included. Given the small sampling sizes, however, (5 - 6 data points per site per year) this may not be a reliable practice for future analysis and consultation will be sought from the La Rosa Partnership for technical guidance on this practice.

Finally, it is the goal of this team to improve outward reporting of these data such that each stream could eventually receive some type of scorecard and summary sheet across the multiple parameters evaluated. We expect that scoring, and then ranking streams holistically is one step towards simplifying where to direct remediation efforts.This may be attempted in the 2019 report.

Appendix A. Quality Assurance Measures for phosphorus, chloride, and turbidity sampling in 2018.

RPD Analysis			
Date	Location	Test	RPD (%)
07/10/18	Munroe 20	Chloride (mg/L)	0.00
		TP(ug P/L)	17.52
		Turbidity (NTU)	7.92
	Muddy 10	Chloride (mg/L)	0.59
		TP(ug P/L)	4.96
		Turbidity (NTU)	3.79
	Engelsby 10	Chloride (mg/L)	1.61
		TP(ug P/L)	71.28
		Turbidity (NTU)	1.00
07/24/18	Potash 20	Chloride (mg/L)	0.48
		TP(ug P/L)	0.00
		Turbidity (NTU)	18.62
	Muddy 30	Chloride (mg/L)	1.20
		TP(ug P/L)	0.98
		Turbidity (NTU)	2.96
	Indian 10	Chloride (mg/L)	3.28
		TP(ug P/L)	0.78
		Turbidity (NTU)	2.57
08/07/18	Potash 30	Chloride (mg/L)	0.00
		TP(ug P/L)	0.91
		Turbidity (NTU)	7.76
	Munroe 10	Chloride (mg/L)	0.87
		TP(ug P/L)	10.23
		Turbidity (NTU)	20.16
	Indian 20	Chloride (mg/L)	0.49
		TP(ug P/L)	4.08
		Turbidity (NTU)	20.61
08/21/18	Potash 40	Chloride (mg/L)	0.70
		TP(ug P/L)	2.81
		Turbidity (NTU)	52.12
	Malletts 10	Chloride (mg/L)	1.94
		TP(ug P/L)	0.60
		Turbidity (NTU)	4.62
	Bartlett 10	Chloride (mg/L)	0.78
		TP(ug P/L)	1.69
		Turbidity (NTU)	5.22
09/04/18	Sunderland 10	Chloride (mg/L)	1.00
		TP(ug P/L)	9.52
		Turbidity (NTU)	33.93
	Morehouse 10	Chloride (mg/L)	2.80
		TP(ug P/L)	12.66
		Turbidity (NTU)	89.69
	Centennial 20	Chloride (mg/L)	0.81
		TP(ug P/L)	24.39
		Turbidity (NTU)	38.43

Mean RPD	Parameter	Actual	Target
	Chloride (mg/L)	1.10	≤5
	TP(ug P/L)	10.83	≤30
	Turbidity (NTU)	20.63	≤15

Appendix B. Project Completeness
Project proposal anticipated 5 dates for baseflow sampling across 23 sites (115 samples per parameter) as well as 2 rain dates sampling across 5 sites (10 samples per parameter). This is a total of 125 samples per parameter not including duplicates and blanks.

Parameter	Number of Samples Anticipated (not including blanks and Dupes) = 23 sites*5 sampling dates	Number of Valid Samples* Collected and Analyzed	Percent Complete
Chloride	125	121	97%
Total Phosphorus	125	116	93%
Turbidity	125	117	94%

*"Valid sample" includes all samples not flagged by issues that arose from blank or dupe results

Appendix C. Individual Sample Results. Boxes highlighted in yellow indicate issue flagged by inconsistent blank result. Boxes highlighted in red indicate sample whose duplicate is notably different in value. All values included in graphing and statistical analyses of 2018 report.

Sample Number	Location	Date	Chloride (mg/L)	TP(ug P/L)	Turbidity (NTU)
181280-01	Alder 10	7/10/2018	12	152	35.3
181398-01	Alder 10	7/24/2018	13.4	97.8	24.3
181538-01	Alder 10	8/7/2018	9.73	86.7	30
181652-01	Alder 10	8/21/2018	7.82	80.1	34.2
181809-01	Alder 10	9/4/2018	11.7	93.7	30.7
181280-02	Alder 10 Blank	7/10/2018	< 2	5.48	< 0.2
181280-03	Bartlett 10	7/10/2018	229	57.8	11.6
181398-02	Bartlett 10	7/24/2018	322	56.8	10.3
181538-02	Bartlett 10	8/7/2018	288	65.7	14.4

181652-02	Bartlett 10	8/21/2018	254	46.9	11.8
181809-02	Bartlett 10	9/4/2018	187	57.9	8.91
181652-03	Bartlett 10 Field Dup	8/21/2018	256	47.7	11.2
181398-04	Centannial 10 Blank	7/24/2018	< 2	< 5	< 0.2
181280-04	Centennial 10	7/10/2018	915	46.4	3.79
181398-03	Centennial 10	7/24/2018	976	57.7	7.39
181538-03	Centennial 10	8/7/2018	775	40.9	3.2
181629-01	Centennial 10	8/18/2018	248	88.9	18.2
181652-04	Centennial 10	8/21/2018	430	47.7	6.08
181809-03	Centennial 10	9/4/2018	544	62	5.53
181280-05	Centennial 10 Blank	7/10/2018	< 2	< 5	< 0.2
181280-06	Centennial 20	7/10/2018	234	74.1	2.88
181398-05	Centennial 20	7/24/2018	202	62.3	3.7
181538-04	Centennial 20	8/7/2018	207	51.6	2.43
181652-05	Centennial 20	8/21/2018	114	66.6	3.74
181809-05	Centennial 20	9/4/2018	124	57.6	4.56
181538-05	Centennial 20 Blank	8/7/2018	< 2	9.17	0.5
181809-04	Centennial 20 Dup	9/4/2018	123	73.6	3.09
181280-07	Engelsby 10	7/10/2018	492	102	6.05
181398-06	Engelsby 10	7/24/2018	544	44.4	5.94
181538-06	Engelsby 10	8/7/2018	480	51.9	4.36
181652-06	Engelsby 10	8/21/2018	296	117	14.1

181809-06	Engelsby 10	9/4/2018	197	95.3	4.15
181398-07	Engelsby 10 Blank	7/24/2018	< 2	< 5	< 0.2
181280-08	Engelsby 10 Field Dup	7/10/2018	500	48.4	5.99
181280-09	Engelsby 20	7/10/2018	1030	103	3.12
181398-08	Engelsby 20	7/24/2018	1195	121	2.56
181538-07	Engelsby 20	8/7/2018	642	129	1.58
181652-07	Engelsby 20	8/21/2018	370	74.2	2.25
181809-07	Engelsby 20	9/4/2018	322	65.6	1.7
181538-08	Engelsby 20 Blank	8/7/2018	< 2	< 5	< 0.2
181280-10	Indian 10	7/10/2018	288	38.9	14.5
181398-09	Indian 10	7/24/2018	300	38.5	3.94
181538-09	Indian 10	8/7/2018	326	37.8	5.46
181629-02	Indian 10	8/18/2018	41.55	180	64.9
181652-08	Indian 10	8/21/2018	140	43.2	4.96
181809-08	Indian 10	9/4/2018	234	49.9	9.83
181652-09	Indian 10 Blank	8/21/2018	< 2	< 5	< 0.2
181398-10	Indian 10 Field Dup	7/24/2018	310	38.8	3.84
181280-11	Indian 20	7/10/2018	131	115	13.6
181398-11	Indian 20	7/24/2018	322	110	6.63
181538-10	Indian 20	8/7/2018	206	120	5.92
181652-10	Indian 20	8/21/2018	55.5	68.3	11.8
181809-09	Indian 20	9/4/2018	188	74.1	7.57

181809-10	Indian 20 Blank	9/4/2018	< 2	< 5	0.23
181538-11	Indian 20 Field Dup	8/7/2018	205	125	7.28
181809-11	Mallets 10	9/4/2018	54.5	44.4	4.61
181280-12	Malletts 10	7/10/2018	48.15	41.2	6.25
181398-12	Malletts 10	7/24/2018	57	36.7	3.22
181538-12	Malletts 10	8/7/2018	47.35	42.6	4.28
181652-11	Malletts 10	8/21/2018	43.45	33.5	5.5
181652-12	Malletts 10 Field Dup	8/21/2018	44.3	33.7	5.76
181280-13	Morehouse 10	7/10/2018	136	32.9	10.2
181398-13	Morehouse 10	7/24/2018	185	26.2	6.18
181538-13	Morehouse 10	8/7/2018	150	26	2.18
181629-03	Morehouse 10	8/18/2018	38.65	48.8	8.52
181652-13	Morehouse 10	8/21/2018	49.85	32.4	3.59
181809-12	Morehouse 10	9/4/2018	145	37	7.54
181280-14	Morehouse 10 Blank	7/10/2018	< 2	< 5	< 0.2
181809-13	Morehouse 10 Dup	9/4/2018	141	42	19.8
181280-15	Morehouse 20	7/10/2018	537.5	27.1	5.99
181398-14	Morehouse 20	7/24/2018	684	24.4	1.23
181538-14	Morehouse 20	8/7/2018	486	65.3	2.48
181629-04	Morehouse 20	8/18/2018	111	76.5	21.3
181652-14	Morehouse 20	8/21/2018	223	28.5	2.18
181809-14	Morehouse 20	9/4/2018	520	34	2.2

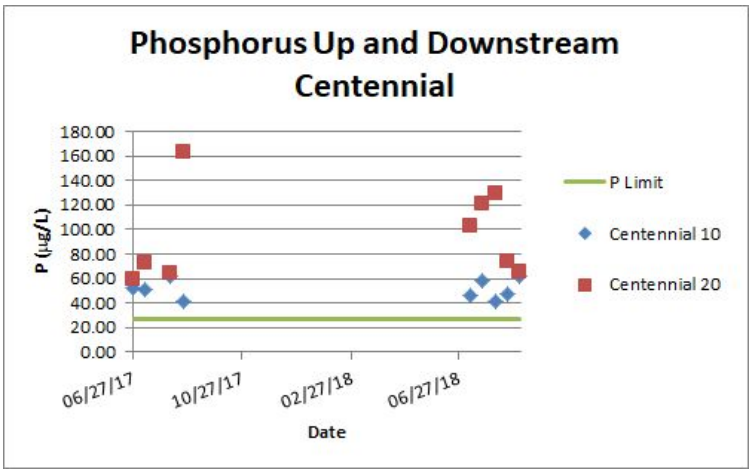
181629-05	Morehouse 20 Blank	8/18/2018	< 2	< 5	0.22
181280-16	Muddy 10	7/10/2018	170	55.1	7.5
181398-15	Muddy 10	7/24/2018	220	51.8	6.87
181538-15	Muddy 10	8/7/2018	228	43.1	4.11
181652-15	Muddy 10	8/21/2018	254	49.8	6.31
181809-15	Muddy 10	9/4/2018	284	52.2	6.47
181398-16	Muddy 10 Blank	7/24/2018	< 2	< 5	0.23
181280-17	Muddy 10 Field Dup	7/10/2018	171	57.9	7.79
181280-18	Muddy 20	7/10/2018	645	34.5	4.97
181398-17	Muddy 20	7/24/2018	620	36.9	4.77
181538-16	Muddy 20	8/7/2018	600	41.8	5.9
181652-16	Muddy 20	8/21/2018	510	50.2	7.72
181809-16	Muddy 20	9/4/2018	605	44.6	6.28
181538-17	Muddy 20 Blank	8/7/2018	< 2	< 5	< 0.2
181280-19	Muddy 30	7/10/2018	31.2	107	21.1
181398-18	Muddy 30	7/24/2018	33.4	102	13.3
181538-18	Muddy 30	8/7/2018	34	114	13.9
181629-06	Muddy 30	8/18/2018	35.7	92.3	11.5
181652-17	Muddy 30	8/21/2018	38.25	84.3	16.5
181809-17	Muddy 30	9/4/2018	34.15	175	23.6
181652-18	Muddy 30 Blank	8/21/2018	< 2	< 5	< 0.2
181398-19	Muddy 30 Field Dup	7/24/2018	33	103	13.7

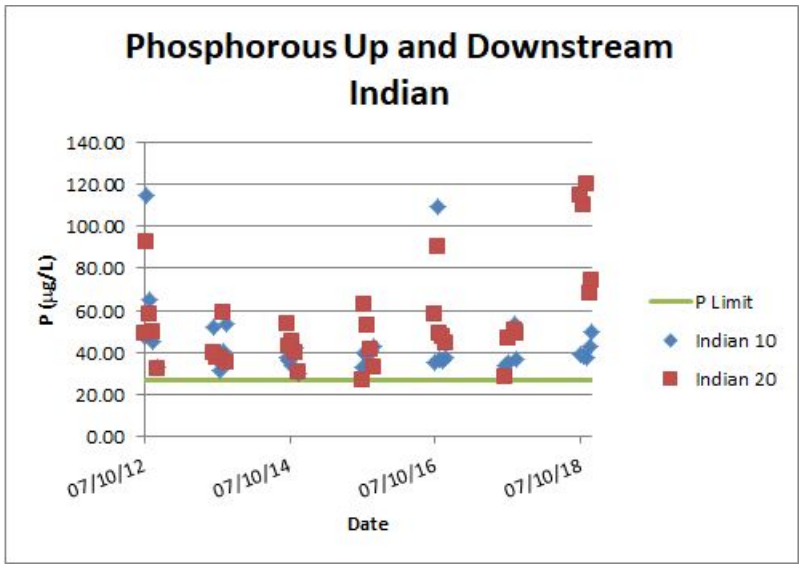
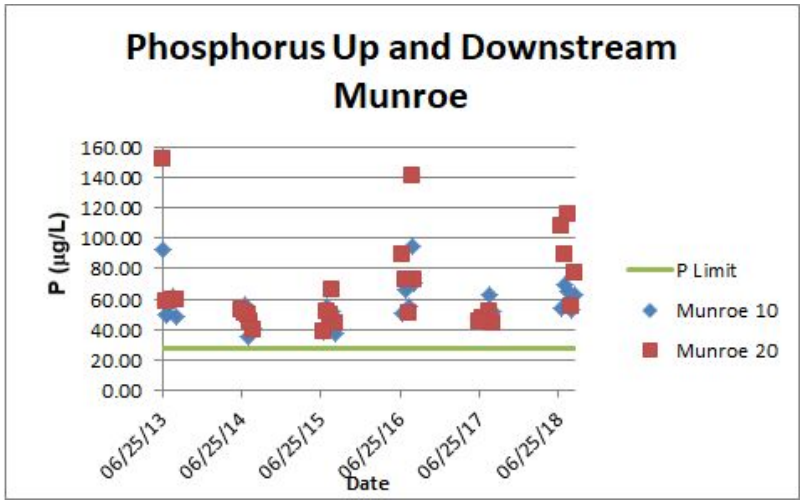
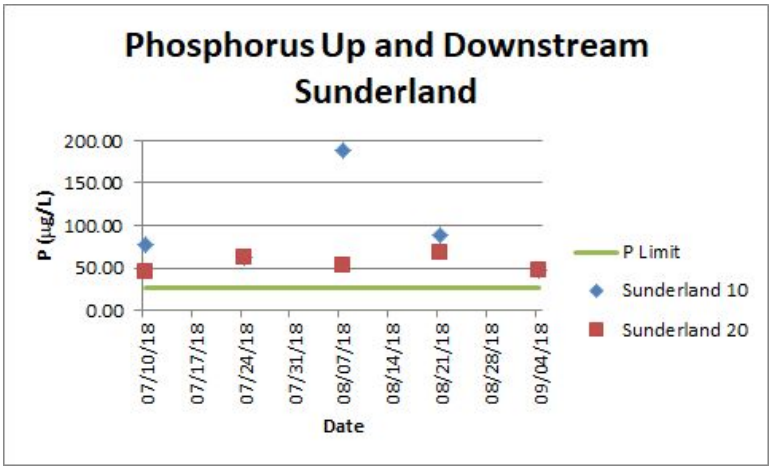
181280-20	Munroe 10	7/10/2018	230	54.4	5.25
181398-20	Munroe 10	7/24/2018	596	69.5	8.69
181538-19	Munroe 10	8/7/2018	575	64.9	8.25
181652-19	Munroe 10	8/21/2018	152	52.6	5.28
181809-18	Munroe 10	9/4/2018	154	62.9	6.15
181809-19	Munroe 10 Blank	9/4/2018	< 2	7.58	< 0.2
181538-20	Munroe 10 Field Dup	8/7/2018	570	71.9	10.1
181280-21	Munroe 20	7/10/2018	92.9	108	30.2
181398-21	Munroe 20	7/24/2018	466	88.8	33.9
181538-21	Munroe 20	8/7/2018	132	116	9.2
181652-20	Munroe 20	8/21/2018	63	55.2	6.7
181809-20	Munroe 20	9/4/2018	93.8	76.8	14.5
181280-22	Munroe 20 Field Dup	7/10/2018	92.9	90.6	27.9
181280-23	Potash 10	7/10/2018	490	32	2.84
181398-22	Potash 10	7/24/2018	872	31.6	2.39
181538-22	Potash 10	8/7/2018	484	41.4	4.09
181652-21	Potash 10	8/21/2018	416	74.3	12.1
181809-21	Potash 10	9/4/2018	590	44	2.92
181280-24	Potash 20	7/10/2018	470	31.7	0.98
181398-23	Potash 20	7/24/2018	832	30.3	1.12
181538-23	Potash 20	8/7/2018	416	33.8	1.02
181629-07	Potash 20	8/18/2018	187	74	8.71

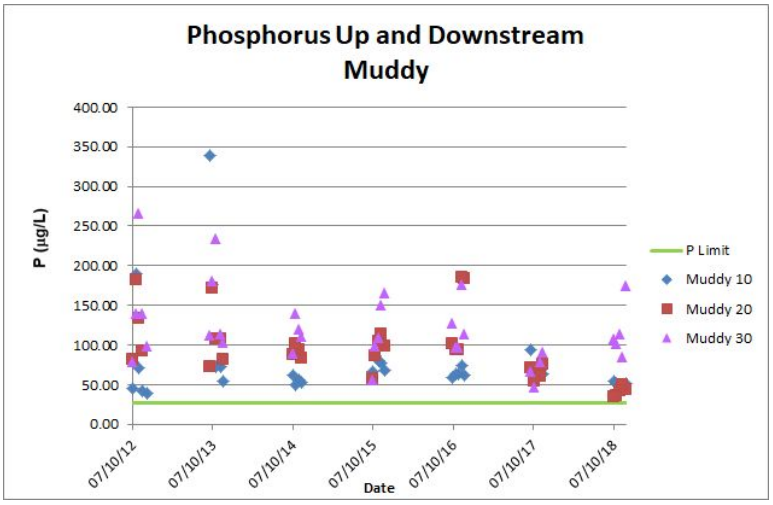
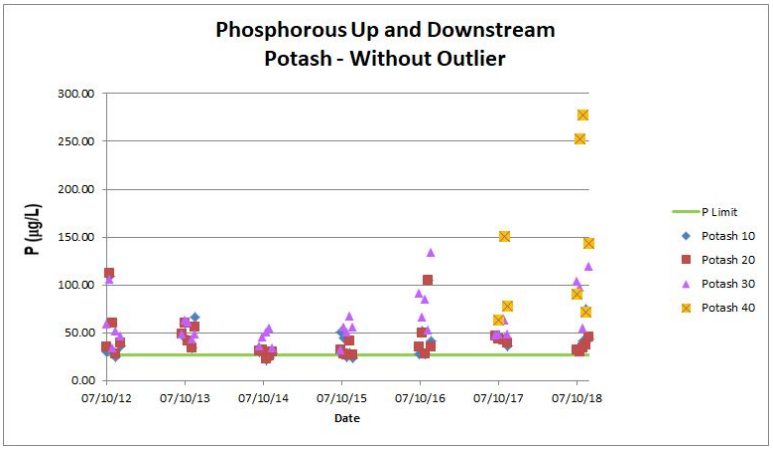
181652-22	Potash 20	8/21/2018	460	37.8	1.39
181809-22	Potash 20	9/4/2018	823	45.5	2.93
181398-24	Potash 20 Field Dup	7/24/2018	828	30.3	1.35
181280-25	Potash 30	7/10/2018	338	104	3.13
181398-25	Potash 30	7/24/2018	332	98	3.39
181538-24	Potash 30	8/7/2018	416	55.1	4.09
181652-23	Potash 30	8/21/2018	348	71.8	32
181809-23	Potash 30	9/4/2018	216	119	11.3
181538-25	Potash 30 Field Dup	8/7/2018	416	54.6	4.42
181280-26	Potash 40	7/10/2018	607.5	252	50.2
181398-26	Potash 40	7/24/2018	736	277.8	39
181538-26	Potash 40	8/7/2018	855	847.8	23.3
181652-24	Potash 40	8/21/2018	720	72.1	20.8
181809-24	Potash 40	9/4/2018	767	143	63.3
181652-25	Potash 40 Field Dup	8/21/2018	715	70.1	12.2
181280-27	Sunderland 10	7/10/2018	176	77.8	11.2
181398-27	Sunderland 10	7/24/2018	185	62.7	5.41
181538-27	Sunderland 10	8/7/2018	186	188	16
181652-26	Sunderland 10	8/21/2018	187	89.2	2.24
181809-25	Sunderland 10	9/4/2018	202	47	5.31
181652-27	Sunderland 10 Blank	8/21/2018	< 2	< 5	< 0.2
181809-26	Sunderland 10 Dup	9/4/2018	200	51.7	7.48

181280-28	Sunderland 20	7/10/2018	208	45.1	6.07
181398-28	Sunderland 20	7/24/2018	156	62.4	11.4
181538-28	Sunderland 20	8/7/2018	178	53.3	8.57
181652-28	Sunderland 20	8/21/2018	131	68.9	17.6
181809-27	Sunderland 20	9/4/2018	168	46.6	6.89
181809-28	Sunderland 20 Blank	9/4/2018	< 2	< 5	< 0.2
181280-29	Sunnyside 10	7/10/2018	900	21.5	4.91
181398-29	Sunnyside 10	7/24/2018	875	22.3	8.07
181538-29	Sunnyside 10	8/7/2018	775	13	4.37
181652-29	Sunnyside 10	8/21/2018	560	13.9	7.77
181809-29	Sunnyside 10	9/4/2018	755	66.1	30.1

Appendix D. Statistically Different Phosphorus Up and Downstream

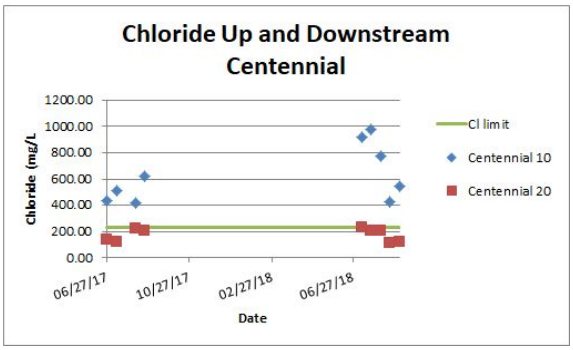
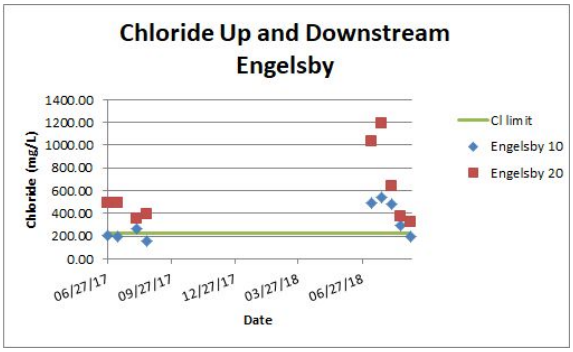
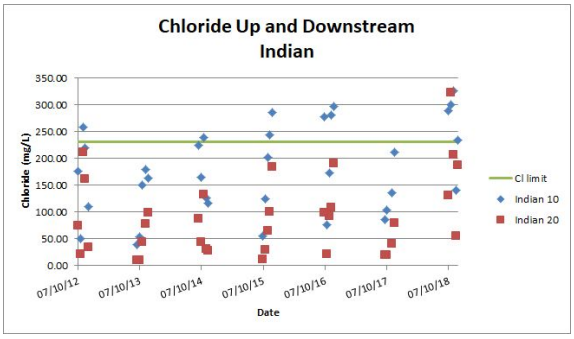
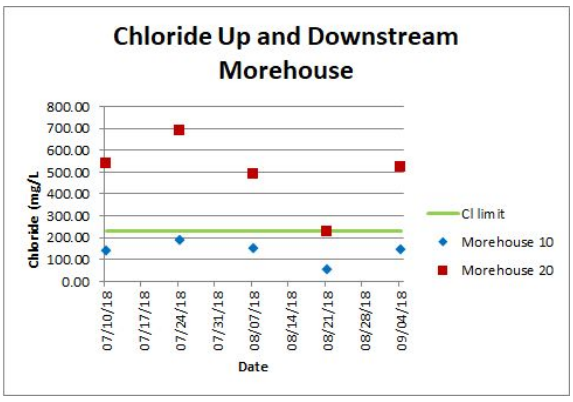
Stream	Test statistic, Critical Value, Two-tailed Alpha Value	Visualization
Centennial	0,6,0.05	

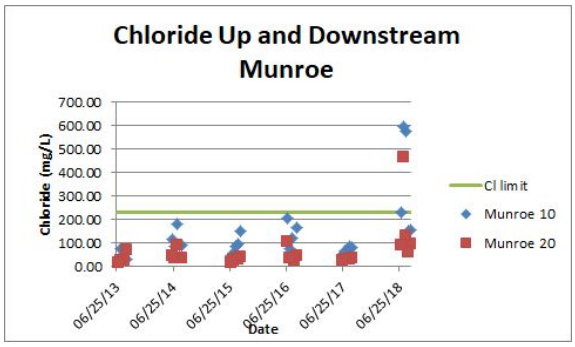
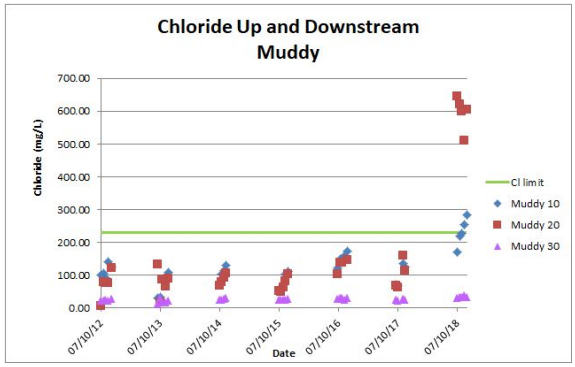
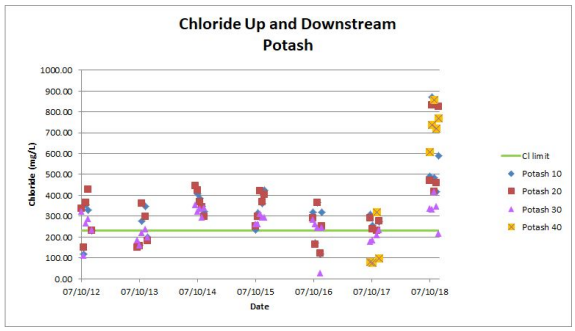
Indian	159, 187, 0.05	
Munroe	90,127,0.05	
Sunderland	0,1, 0.1	

Site	K, Critical Value, Two tailed Alpha Value	Visualization
Muddy	26.85, 5.99, 0.05	
Potash	43.94, 7.81, 0.05	

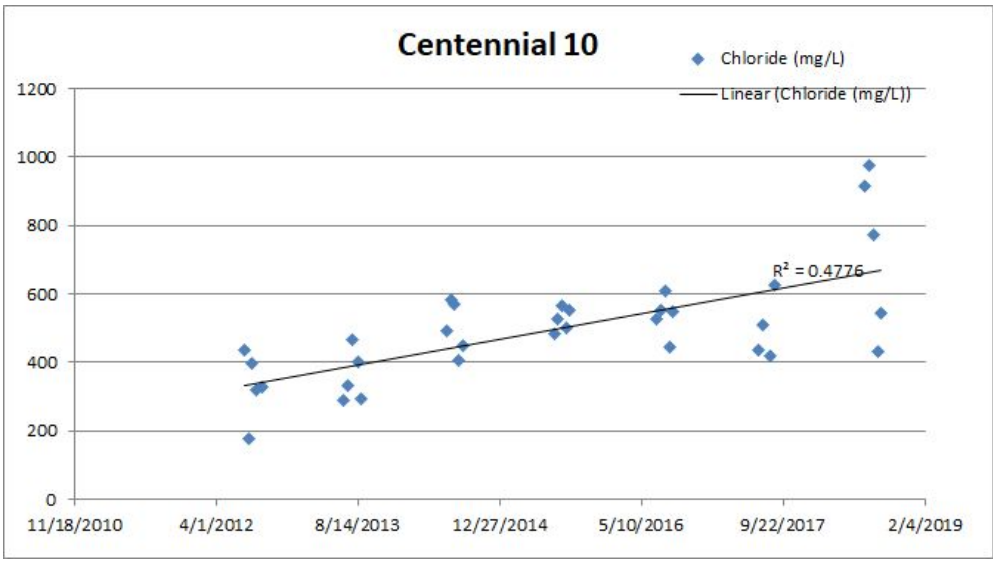
Appendix E. Statistically Different Chloride Up and Downstream

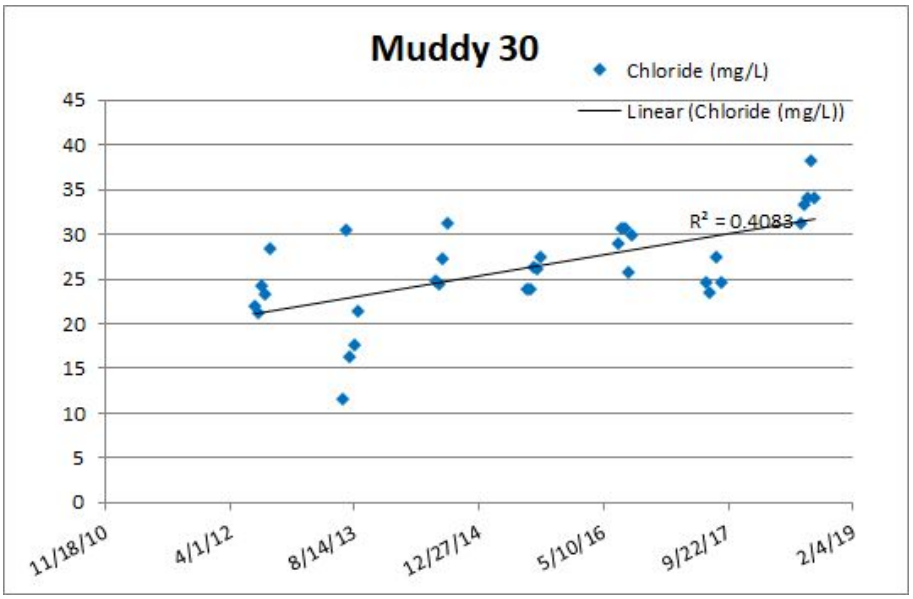
Stream	Test statistic, Critical Value, Two-tailed Alpha Value	Visualization

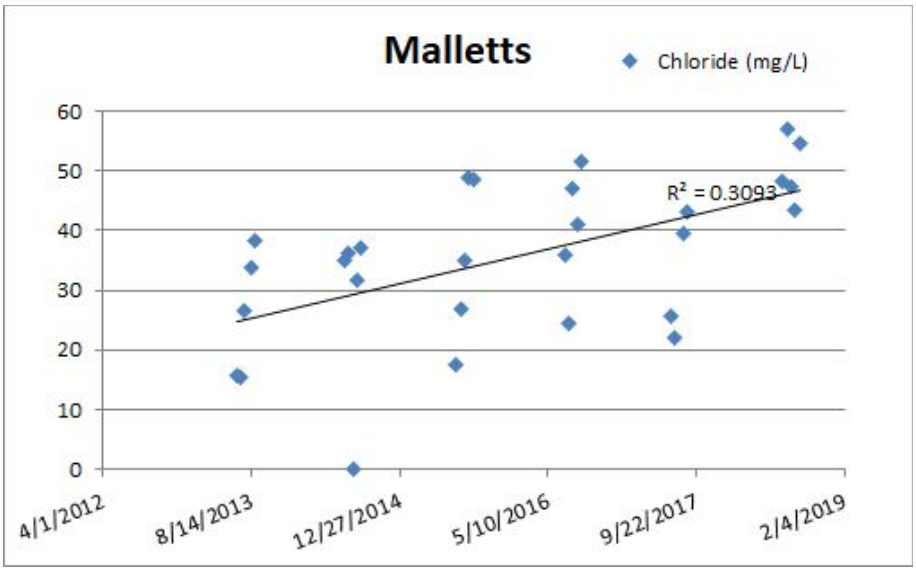
Centennial	0, 6, 0.05	
Engelsby	0, 6, 0.05	
Indian	1, 187, 0.05	
Morehouse	0, 1, 0.1	

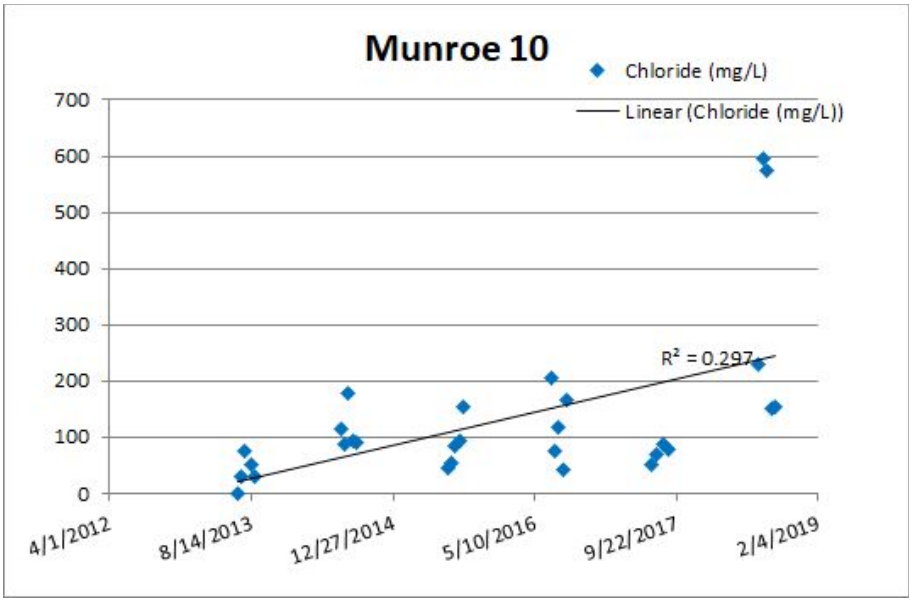
Munroe	9, 117, 0.05	
Site	**K, Critical Value, Two tailed Alpha Value**	**Visualization**
Muddy	57.23, 5.99, 0.05	
Potash	8.33, 7.81, 0.05	

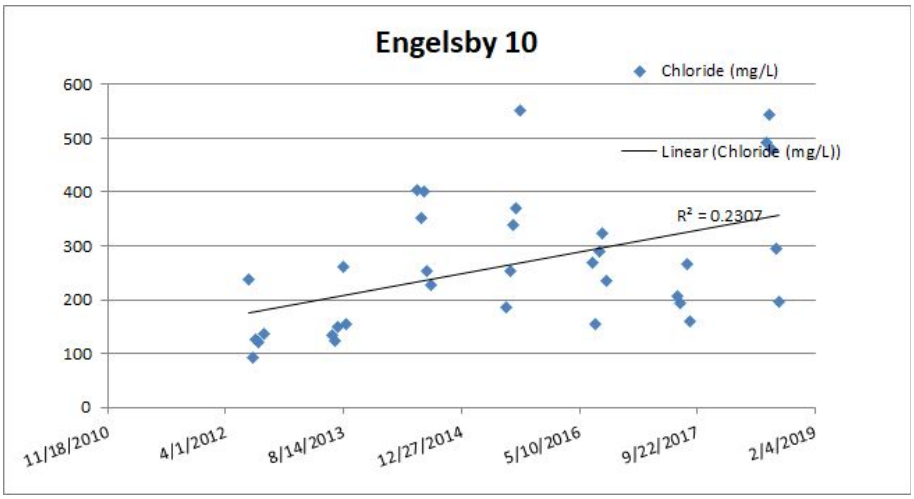
Appendix F. Notable Trends in Chloride Increases Over Time By Site. Sorted in descending order by R2 values.

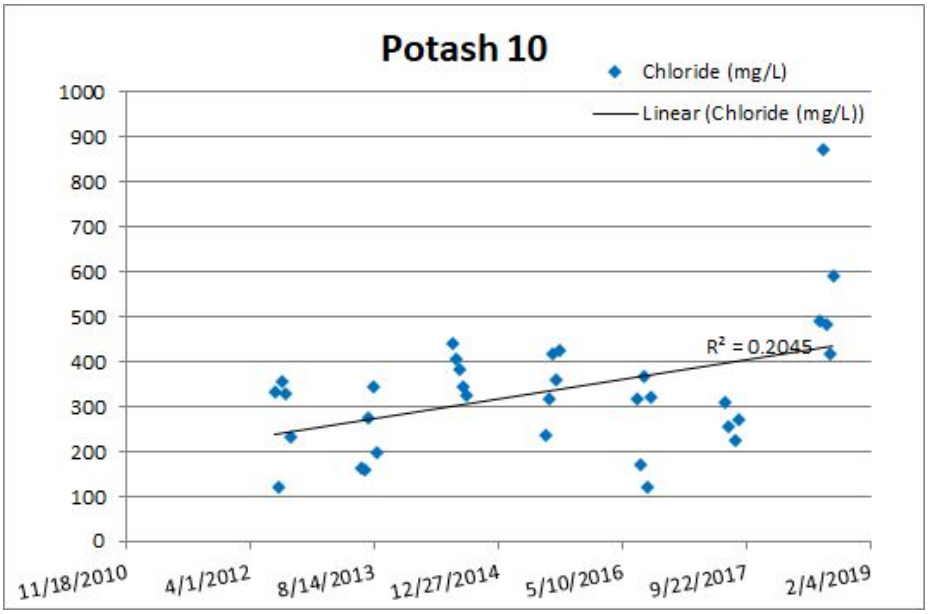

Centennial 10
Chloride (mg/L)
Linear (Chloride (mg/L))
R² = 0.4776
1200
1000
800
600
400
200
0
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
2/4/2019

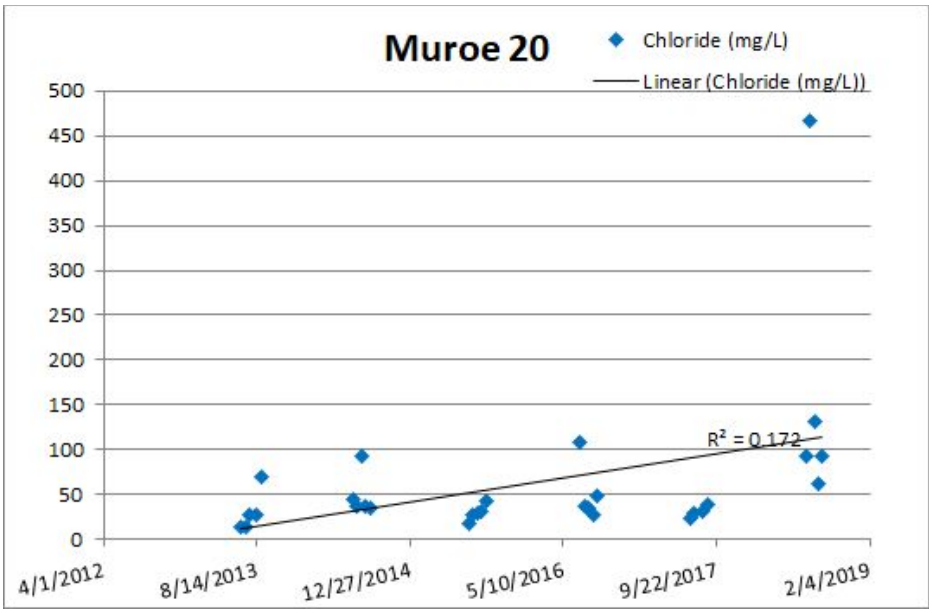

Muddy 30
Chloride (mg/L)
Linear (Chloride (mg/L))
R² = 0.4083
45
40
35
30
25
20
15
10
5
0
11/18/10
4/1/12
8/14/13
12/27/14
5/10/16
9/22/17
2/4/19

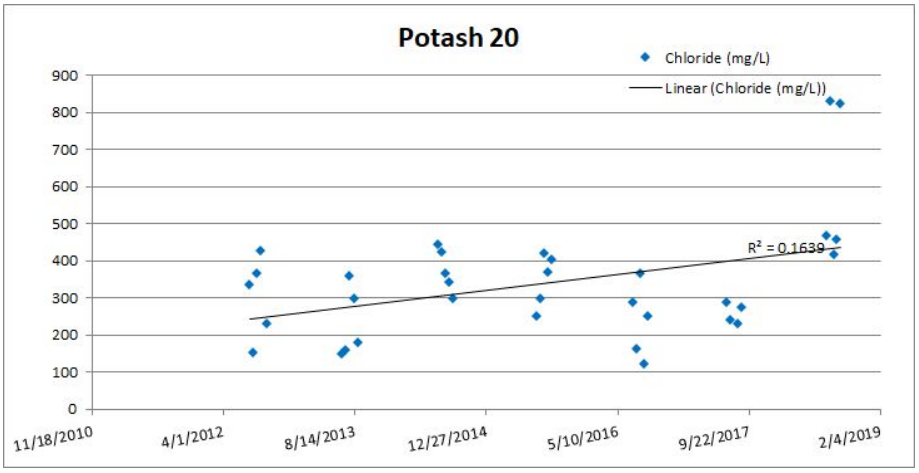

Malletts
Chloride (mg/L)
60
50
40
30
20
10
0
R² = 0.3093
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
2/4/2019

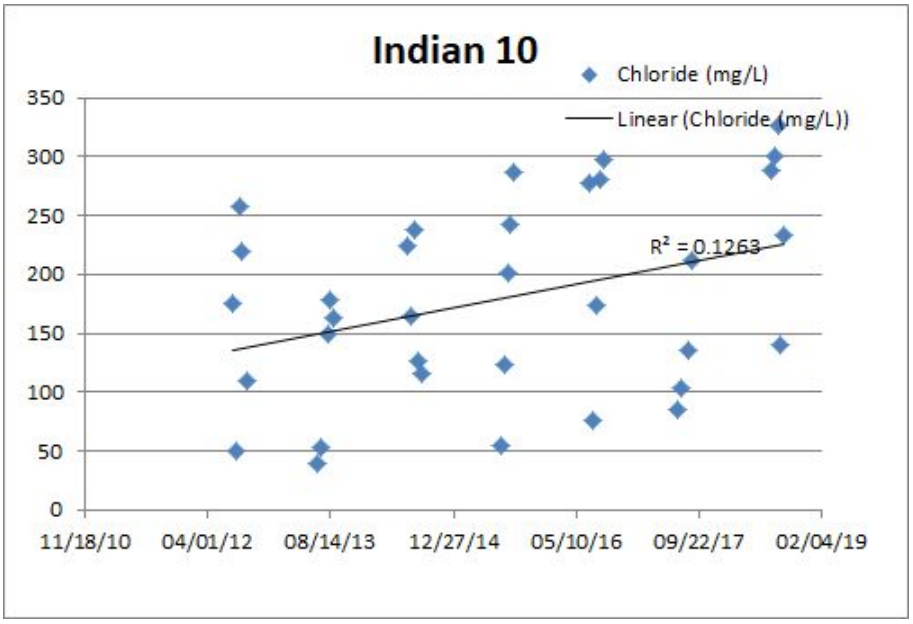

Munroe 10
Chloride (mg/L)
Linear (Chloride (mg/L))
700
600
500
400
300
200
100
0
R² = 0.297
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
2/4/2019

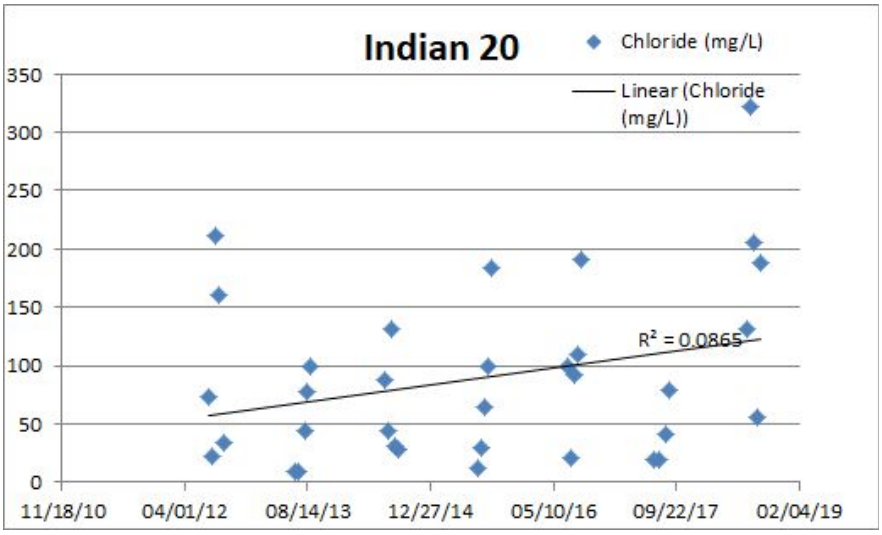

Engelsby 10
Chloride (mg/L)
Linear (Chloride (mg/L))
R² = 0.2307
600
500
400
300
200
100
0
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
2/4/2019


Potash 10
Chloride (mg/L)
Linear (Chloride (mg/L))
R² = 0.2045
1000
900
800
700
600
500
400
300
200
100
0
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
2/4/2019


Muroe 20
Chloride (mg/L)
Linear (Chloride (mg/L))
500
450
400
350
300
250
200
150
100
50
0
R² = 0.172
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
2/4/2019


Potash 20
Chloride (mg/L)
Linear (Chloride (mg/L))
900
800
700
600
500
400
300
200
100
0
R² = 0.1639
11/18/2010
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
2/4/2019


Indian 10
Chloride (mg/L)
Linear (Chloride (mg/L))
R² = 0.1263
350
300
250
200
150
100
50
0
11/18/10
04/01/12
08/14/13
12/27/14
05/10/16
09/22/17
02/04/19


Indian 20
Chloride (mg/L)
Linear (Chloride (mg/L))
R² = 0.0865
350
300
250
200
150
100
50
0
11/18/10
04/01/12
08/14/13
12/27/14
05/10/16
09/22/17
02/04/19

STORMWATER MANAGEMENT PROGRAM

GENERAL PERMIT 3-9018

FOR STORMWATER DISCHARGES FROM SMALL MUNICIPAL SEPARATE STORM SEWER SYSTEMS

Prepared by:
Krebs & Lansing
Consulting Engineers, Inc.
164 Main Street
Colchester, Vermont 05446
(802) 878-0375

January 23, 2019

Table of Contents

Introduction

The University of Vermont (UVM) is designated a non-traditional Municipal Separate Storm Sewer System (MS4) by the State of Vermont and is therefore subject to the Vermont Pollutant Discharge Elimination System (VPDES) General Permit 3-9014 (2018). Through this Stormwater Management Program (SWMP), the University of Vermont is establishing a framework to implement practices and procedures to manage stormwater runoff and improve water quality.

Permit Coverage

The University of Vermont first applied for coverage under General Permit #3-9014 on March 10, 2003 for the first 5-year term (2003-2007). The Application was revised and resubmitted on May 9, 2003 after receiving comments from the State of Vermont Agency of Natural Resources. On September 11, 2003 the State of Vermont acknowledged, by letter, the University's Stormwater Management Program complies with the terms and conditions of the General Permit. They further indicated that the University's MS4 discharges are eligible for continued coverage under the terms and conditions of the General Permit.

On February 22, 2008, the University of Vermont prepared an application for coverage under General Permit #3-9014 for the second 5-year term (2008-2012). Additional information was provided on March 3, 2008 as requested by the State of Vermont.

On June 3, 2013, the University of Vermont prepared an application for coverage under General Permit #3-9014 for a third 5-year term (2013-2017). The application was deemed complete and effective on October 1, 2013.

Stormwater System

The University of Vermont's Main Campus is approximately 459 acres and is located in two different municipalities and in four different stream watersheds. The campus is in both Burlington and South Burlington, and is split between the Centennial Brook, Englesby Brook, Potash Brook and Winooski River watersheds. Ultimately, these four watersheds discharge to Lake Champlain. The University of Vermont also owns properties outside of Main Campus that also have stormwater collection systems. Both Fort Ethan Allen and Colchester Business Park discharge to Sunderland Brook and then to Lake Champlain. The Bioresearch Facility and Forestry Service Complex both drain to Potash Brook. Campus watershed maps are provided in Appendix B for each portion of UVM's Campus.

The University is in a unique position as a non-traditional MS4 within the Phase II General Permit. The majority of the University is located in the City of Burlington, which is an MS4 permittee, and the remaining portion of campus is located in South Burlington, which is also an MS4 permittee. The University has been and will continue to coordinate with both municipalities regarding project development and Phase II General Permit conditions.

Since Lake Champlain is the source of water for both the Champlain Water District and the City of Burlington, the University must review and coordinate the General Permit requirements to minimize conflicts. The goals of this MS4 with regards to preventing or controlling stormwater runoff are consistent with the general principles of the Champlain Water District and City of Burlington (Water Supply Division of Public Works) Source Water Protection Plans. By establishing stormwater facilities at

major outfalls, the University is treating and detaining the majority of its urbanized Main Campus. The treatment component of the facilities reduce sediment and nutrient loading of downstream water bodies, and detention of post-development flows help reduce stream bank erosion.

Stormwater Best Management Practices

The University of Vermont has five large stormwater detention facilities to treat and detain stormwater:

- North Campus (87.3-acre watershed)
- East Campus (82.6-acre watershed)
- Southwest Campus (53.4-acre watershed)
- Main Street Facility (26.9-acre watershed)
- Colchester Business Park (16 acres)

a. The North Campus Facility drains lands of the UVM Medical Center, City of Burlington (East Avenue), private properties along East Avenue and the University of Vermont. In 2001 the North Campus Facility was upgraded to comply with what came to be the "2002 Vermont Stormwater Manual". By complying with the design standards in the manual, it is presumed the structural BMP is achieving an 80% suspended solids removal and 40% phosphorus removal.

b. The East Campus Facility drains lands of the UVM Medical Center, the Double Tree by Hilton (Formerly Sheraton Hotel), private properties along East Avenue and the University of Vermont. The original detention facility was originally designed under the 1987 procedures (10-year, 24-hour storm event). On April 11, 2002 the University retrofitted the outlet structure on the detention facility to more closely comply to the 1997 procedures (2-year, 24-hour storm event).

   In 2004, the University, through its stormwater consultant, Krebs & Lansing Consulting Engineers, redesigned and reconstructed the East Campus Stormwater Facility to comply with the 2002 State of Vermont Stormwater Manual.

c. The Southwest Campus Stormwater Facility drains lands of the City of Burlington (South Prospect Street), Burlington Country Club and the University of Vermont. The original detention basins were designed and constructed in 1991 in accordance with the 1987 procedures (10-year, 24-hour storm event). In May of 1999 the University modified the outlet structure to more closely comply to the 1997 procedures (2-year, 24-hour storm).

   In 2006, the University designed and constructed an upgrade to the Southwest Campus Stormwater Facilities to comply with the 2002 State Stormwater Manual. Manual.

d. The Main Street Facility was constructed by VTrans to mitigate impacts from the Main Street Project. The University has not only accepted this facility on its land but has agreed to maintain the stormwater basin. The basin was designed by the engineering firm of Dufresne-Henry Consulting Engineers (now Stantec).

e. The Colchester Business Park Facility is a pre-existing stormwater pond constructed with the Colchester Business Park in the 1980's. The University owns Lot #1, and Lots #3 and #4. The stormwater system was originally designed by Hamlin Engineers. Refer to General Operational Stormwater Discharge Permit 3307-9010.

The University has acknowledged that the proper design and construction of these BMPs is only part of the solution. For these facilities to properly operate, they must be frequently inspected and maintained. The University's Physical Plant Department (PPD) has previously done an admirable job of maintaining these facilities by completing trash rack cleanouts and comprehensive sediment removal operations on forebays and/or micropools.

Minimum Control Measures

UVM, as a designated non-traditional MS4, must develop, implement, and enforce the six minimum control measures (MM) identified below. These measures provide guidance for reducing the discharge of pollutants to the maximum extent practicable (MEP) in order to protect water quality.

1. Public Education and Outreach on Stormwater Impacts
2. Public Involvement and Participation
3. Illicit Discharge Detection and Elimination
4. Construction Site Stormwater Runoff Control
5. Post-Construction Stormwater Management for New Development and Redevelopment
6. Pollution Prevention and Good Housekeeping for Operations

Annual reporting of these Minimum Control Measures will be tracked and update in Appendix C.

MM#1: Public Education and Outreach on Stormwater Impacts

In order to comply with Minimum Measure 1, Public Education and Outreach on Stormwater Impacts, the University of Vermont must implement a public education program that distributes educational materials to the community. In order to meet this requirement, UVM will take the following steps:

- Maintain a website with locally relevant stormwater information.
    - *Rationale:* Permittee websites are often the place where residents/users first go to obtain information on stormwater issues. Provision of basic information on such websites will help form a strong initial form of engagement to site visitors.
    - *Measurable Goal:* UVM will maintain basic information about stormwater on a dedicated page within its website which describes its stormwater related programming and includes links for visitors to learn more. The permittee will track the annual number of visits to this page.
- Maintain a program to identify opportunities and provide technical assistance on Low Impact BMPs.
    - *Rationale:* There are several organizations and agencies operating in the Chittenden County MS4 region. By providing such links, the visitor can figure out which entity is best suited to provide technical assistance.
    - *Measurable Goal:* UVM will provide links on a dedicated stormwater page within its website with links to relevant non-profits and government resource sites which can provide technical assistance.
- Participate in a regional stormwater education strategy or develop an MS4 specific program.
    - *Rationale:* Support of the campaign will educate the general public in the MS4 area about key storm water quality issues by using TV, radio, online media placements/advertising to drive viewers to the www.rethinkrunoff.org website
    - *Measurable Goal:* UVM will participate in and provide financial support for operation of the regional Rethink Runoff campaign consisting generally of periodic advertising

throughout each year supplemented by a survey of residents every 5 years to track reported behavior with regards to residential stormwater BMPs. Via an annual report provided by the Chittenden County RPC's subcontractor, MS4s will document the annual number of site visits to www.rethinkrunoff.org as well as provide other metrics.

MM#2: Public Involvement and Participation

- Participate in a regional stormwater public involvement and participation strategy or develop an MS4 specific program.
    - *Rationale:* Through support of the Stream Team, the regional campaign's "action arm", UVM will support the engagement of local residents in the MS4 area via outreach events and via hands-on participation events.
    - *Measurable Goal:* UVM will participate in and provide financial support for operation of the Rethink Runoff Stream Team consisting generally of both outreach and hands-on participation events in various MS4 towns on a rotating annual basis. Via an annual report provided by the Chittenden County RPC's subcontractor, MS4s will document on an annual basis the number of participants and/or persons contacted by outreach events and hands-on activities through the Rethink Runoff Stream Team.

MM#3: Illicit Discharge Detection and Elimination

- Develop and maintain a GIS or AutoCAD map of the storm sewers in the regulated MS4 showing all outfalls. Document how the storm sewer map will be maintained and improved, the source of the information, and the plan to verify the outfall locations with field surveys.
    - *Rationale:* A campus wide storm sewer map will help to identify the extent of the stormwater collection system for annual maintenance tracking. The mapping will also highlight the stormwater outfalls for dry weather illicit detection and any potential building sources.
    - *Measurable Goal:* UVM previously created a comprehensive AutoCAD based Utility Master Plan map. The mapping shows the stormwater outfalls, stormwater collection structures, piping and building services. The mapping continues to be updated as new projects are completed and refined as existing utilities are discovered either during construction or during site specific topographic survey work.
        - Versions of the mapping may be available, in pdf format, upon request through UVM Campus Planning Services.
- Develop ordinance or policy prohibiting non-stormwater discharges and implement enforcement procedures.
    - *Rationale:* Section 2.2 of the 2018 MS4 General Permit outlines a list of eligible discharges. Creating a policy that includes this list will educate users as to what may be discharged to the stormwater collection system. It will also highlight that any non-stormwater discharge is illegal and subject to enforcement.
    - *Measurable Goal:* The list of Eligible Discharges will be included as part of the VOSHA 10-hour training for new UVM Physical Plant Department staff. The number of newly trained staff members will be tracked and reported annually.
    - *Measurable Goal*: The University will document and report the number of illicit discharges each year and will provide a report identifying the nature and corrective action taken for each.

- Develop and implement a plan to detect and address non-stormwater discharges.
    - *Rationale:* Existing illicit discharges, which can be difficult to identify, may exist within the stormwater collection system. Identification, and ultimately, elimination of any illicit building connection is an important goal for water quality improvement and protection.
    - *Measurable Goal:* The University has previously conducted dry weather stormwater outfall and system inspections within the North, East, Southwest, and Trinity Campus Watersheds. Dry weather illicit discharge monitoring will continue to be evaluated, in a rotating basis annually, between the following UVM watersheds: Trinity Campus, North Campus Watershed, East Campus Watershed, Southwest Campus Watershed, Main Street Watershed, the Colchester Business Park, and the Potash Brook Watershed properties.
        - All records of illicit discharge monitoring information shall include:
            - The date, exact place, and time of sampling or measurements;
            - The names(s) of the individual(s) who performed the sampling or measurements;
            - The date(s) analyses were performed;
            - The names of the individuals who performed the analyses;
            - The analytical techniques or methods used; and
            - The results of such analyses
- Inform the public on the dangers of illegal discharges. Coordinate with MM#1 and MM#6.
    - *Rationale:* Educating the public about the dangers of illicit discharges will hopefully prevent the unnecessary spilling or discharging of chemicals or pollutants into streams and waterways. The Regional Stormwater Education Program has many stakeholders and combines resources to expand public education and outreach.
    - *Measurable Goal:* The Regional Stormwater Education Program efforts will continually promote public awareness and reduce ignorant illicit discharges.
    - *Measurable Goal:* Continue to install "No Dumping" tags on new catch basin grates as they are installed by new construction projects. The UVM standard catch basin detail will be updated to require that the tags be installed on the catch basins as a project requirement. The number of installed tags will be identified annually.
- Maintain a log to monitor the status of illicit discharge activities.
    - *Rationale:* A log will help to track what portions of the existing stormwater collection system have been monitored, what issues, if any, have been discovered, and the corrective actions taken to remedy any deficiencies.
    - *Measurable Goal:* As part of the annual dry weather monitoring, the following actions shall be measured and logged:
        - Number of outfalls inspected
        - Number of dry-weather samples taken
        - Feet of stormwater collection system measured
        - Discharges detected
        - Discharges corrected

MM#4: Construction Site Stormwater Runoff Control

- Develop and implement procedures to ensure that construction activities undertaken by the MS4 are properly permitted.
    - *Rationale:* There are often many construction projects taking place across campus, especially during the summer. All earth disturbing projects need to consider erosion prevention and sediment control designs to ensure that the potential for off-site sediment transport is minimized. Project Managers need to be aware of the local and state permitting requirements for construction activities.
    - *Measurable Goal:* UVM Campus Planning Services will continue to have an annual meeting, typically in January, with all project managers from Facilities Design and Construction and the Physical Plant Department to outline construction projects planned for the current year. Project Managers will be made aware of the permitting responsibilities for each construction activity.
- Review existing policies to determine effectiveness, consistency with state standards; Amend for consistency with state standards.
    - *Rationale:* Continued monitoring of State and local standards and practices not only ensures standards are met but also promotes the education of new strategies and better construction site stormwater designs.
    - *Measurable Goal:* By following the State and/or local municipality Construction Stormwater Permit Standards, UVM must evaluate all disturbances across UVM's Main Campus as part of the "Risk" evaluation. Almost every project on campus, large and small, is subject to either a General or Individual State Permit or a City of Burlington or South Burlington local permit. This ensures that site specific erosion prevention and sediment control plans are developed for each construction project and minimizes the potential for sediment transport to the stormwater system.
- Develop and implement ordinance that regulates earth disturbance <1ac.
    - *Rationale:* A large number of projects do not reach the 1-acre Construction General Permit trigger. The location of projects and the aggregate disturbance from a number of non-jurisdictional projects can have an adverse impact on the State's waterways.
    - *Measurable Goal:* Either due to its jurisdiction as a Common Plan of Development, or due to the local municipality MS4 requirements, almost every earth disturbing project is subject to erosion prevention and sediment control regulation. One area that can be addressed is related to building projects that do not specifically require earth disturbance but involve the use of lift trucks to access the building exterior. UVM will include, in the front end of their bid documents, stabilization and sediment control best management practice specifications that must be implemented if inadvertent earth disturbance is generated by construction vehicle movements or activities. The number of earth disturbing projects will be identified annually.

MM#5: Post Construction Stormwater Management for New Development and Redevelopment

- Review existing policies to determine effectiveness, consistency with state standards, opportunities for LID, and opportunities for changes to street and parking requirements; Amend for consistency with state standards.
    - *Rationale:* Stormwater treatment and the effectiveness of accepted practices is constantly being studied at the federal, state and local levels. The goal is to increase pollutant removal efficiencies as well as the number of available stormwater Best Management Practice options through monitoring, studies, and with advances in technology. The EPA, in conjunction with the State of Vermont Watershed Management Division, is continually developing standards and approved BMPs that will ultimately improve water quality. Continued review and education of state standards ensures that regulations are met, and treatment designs are consistent with current practices.
    - *Measurable Goal:* UVM regularly meets with the City of Burlington Stormwater Program staff and attends the Chittenden County Regional Planning Commission's Clean Water Advisory Committee (CWAC) meetings and MS4 Subcommittee Meetings to discuss stormwater projects, regulations, goals, education, outreach, etc. For many years UVM has also contracted with a stormwater consultant for project permitting, guidance, and to follow the development of stormwater regulations and policies. UVM will continue to follow these avenues to remain educated and informed about stormwater standards, practices, and regulations.
- Develop and implement procedures to identify projects that disturb >1ac but do not require a state post-construction permit.
    - *Rationale:* This will ensure that stormwater treatment and runoff reduction opportunities are captured even for projects that may not otherwise meet jurisdictional requirements.
    - *Measurable Goal:* Either due to its jurisdiction as a Common Plan of Development, or due to the local municipality MS4 requirements, almost every project that expands impervious is subject to a State post-construction stormwater permit or a local stormwater permit dictated by their MS4 ordinances or policies. UVM will continue to obtain state or local post-construction stormwater permits for all jurisdictional projects. The number of new projects that disturb greater than 1 acre but do not require a state post-construction permit will be reported annually.
- Adopt an ordinance or policy that requires projects that disturb >1ac to utilize a combination of structural, non-structural, and low impact BMPs and ensure long-term maintenance.
    - *Rationale:* State of Vermont post construction stormwater permit jurisdiction is based solely on impervious area. Therefore, potential low impact BMPs or other runoff reduction opportunities may be missed with non-jurisdictional projects.
    - *Measurable Goal:* Either due to its jurisdiction as a Common Plan of Development, or due to the local municipality MS4 requirements, almost every project that expands impervious is subject to a State post-construction stormwater permit or a local stormwater permit governed by their MS4 ordinances or policies. UVM will continue to comply with state or local post-construction stormwater permits for all jurisdictional projects. UVM Physical Plant Department has a standard specification for ground restoration. Update the UVM Grounds Restoration specification to align with the State of

Vermont's Post Construction Soil Depth and Quality Standard outlined in the 2017 Stormwater Management Manual.

- Develop and implement procedures for inspecting projects subject to the MS4's ordinance.
    - *Rationale:* An important aspect of a Storm Water Management Program is the inspection and maintenance of existing stormwater practices. Pollutant removal efficiencies decrease if stormwater systems and treatment practices are not maintained and allowed to degrade.
    - *Measurable Goal:* Create a list of stormwater treatment practices (STP) located on UVM MS4 properties. This list will be included in Appendix H of this document and will be updated annually.
    - *Measurable Goal:* Each spring, after snow melt, and prior to June 15th, every UVM stormwater treatment practice shall be inspected and an annual report shall be maintained. This includes observation of eroded areas and areas of poor vegetative growth.
    - *Measurable Goal:* UVM will continue to contract with Hartigan, P&P Septic or equivalent, to clean the sumps of at least 50% of the existing catch basins, storm manholes, and detention tanks annually. A report will be maintained identifying which catch basins are cleaned each year. Storm structure shall be cleaned when the sediment level reaches half the depth of the available sump.
    - *Measurable Goal:* Stormwater ponds are inspected frequently throughout the year. They will continue to be inspected annually in the spring, prior to June 15th. Forebays and micropools will be observed to determine the depth of sediment accumulation. Sediment will be removed when the level reaches half the design depth of the permanent pool.
- Develop and implement procedures to ensure that development activities undertaken by the MS4 are properly permitted.
    - *Rationale:* Projects that are not properly permitted are a violation of water quality standards and can be subject to fines and potentially costly remediation efforts.
    - *Measurable Goal:* For many years UVM has also contracted with a stormwater consultant for project permitting, guidance, and to ensure that development activities are properly permitted. UVM will continue this consulting approach throughout the year. UVM Campus Planning Services will also continue to organize and lead an annual meeting, typically in January, with the consultant and all project managers from Facilities Design and Construction and the Physical Plant Department. The meeting will outline current and future planned development projects to discuss stormwater permitting requirements.
- Provide plans, policies, and procedures as part of SWMP.
    - *Rationale:* A well prepared Stormwater Management Program identifies the stormwater collection system, all stormwater treatment practice, outfalls, impervious areas, watersheds, specific policies, and inspection and maintenance procedures. This information, when documented in one location, helps to ensure that the goals of the plan are identifiable and therefore successfully followed even if the responsible staff members change.
    - *Measurable Goal:* UVM will continue to update this Stormwater Management Program documentation as part of the annual MS4 report that is due April 1st each year.

MM#6: Pollution Prevention and Good Housekeeping for Municipal Operations

- List the operations covered by the program, including park and open space maintenance, fleet and building maintenance, new construction land disturbances, and stormwater system maintenance.
    - *Rationale:* It is important to identify what daily University related operations have the potential to impact stormwater and water quality. Maintenance responsibilities and budgeting requirements can then be clearly designated by campus department.
    - *Measurable Goal:* The UVM Physical Plant Department is responsible for all campus operations. We will create a document that identifies specific Physical Plant Department divisions responsible for maintenance of stormwater treatment practices, stormwater collection systems, grounds, salt management, illicit discharge monitoring, stormwater inspections, and stormwater permitting. This document will be incorporated in Appendix D of this Program.
- Conduct stormwater training for staff.
    - *Rationale:* Relevant staff members need to be trained so that Non-Stormwater discharges can be identified, inspections are completed regularly, deficiencies are correctly identified, and the design and operation of the stormwater system needs to be understood so that maintenance is completed properly.
    - *Measurable Goal:* UVM has been operating and maintaining the stormwater system for many years and the existing staff that address stormwater are trained. New Physical Plant Department staff members who are assigned to address components of the stormwater collection system will be trained by existing trained staff. New and existing staff members who are assigned responsibilities related to inspection of the stormwater treatment practices shall conduct a site walk around campus with the UVM Stormwater Consultant for education and training of the stormwater practices around campus. The number of employees that are trained each year will be tracked as part of the annual report.
- Implement controls for reducing or eliminating the discharge of pollutants from the MS4.
    - *Rationale:* Ultimately, one of the main goals of a Stormwater Management Program is to reduce discharge of pollutants and improve water quality.
    - *Measurable Goal:* UVM has constructed a number of stormwater treatment practices and as new projects are developed new treatment practices will be designed and constructed. Below is a list of measurable goals that will be included in the annual report:
        - Number of new standard treatment practices (STP) constructed
        - Number of existing STPs retrofitted
        - Number of INDS permits transferred to the MS4 Permit
        - Number of STPs inspected
        - Number of inspections performed on maintenance facilities, paint shops, salt sheds and storage facilities
        - Number of catch basins, storm manholes, and underground detention tanks cleaned or lbs. of sediment removed
        - Street sweeping documentation
        - Frequency of leaf litter/organic waste collection

- Develop and implement procedures for proper disposal of wastes.
    - *Rationale:* Properly operating STPs collect sediment which needs to be disposed of during maintenance. It is important that a disposal procedure is in place so that the high concentration of sediment and pollutants are removed and do not reach the streams and waterways.
    - *Measurable Goal:* UVM currently contracts with Hartigan Wastewater Services to clean the sumps of catch basins and storm manholes. As part of the contract Hartigan is responsible for the proper disposal of the waste material. Hartigan provides a report identifying the catch basins that are cleaned. The results of this report will be included in the Annual Reporting Spreadsheet found in Appendix C.
    - *Measurable Goal:* When cleaning of stormwater ponds are required, UVM contracts with a site excavation contractor. The contract requires the Contractor to remove the material from campus and dispose of it in a State approved off-site disposal area. The Annual Report (Appendix C) will be updated when stormwater treatment ponds are cleaned.
- Prohibit use of phosphorus containing fertilizers on facility operations unless warranted by a soil test; submit copy of test.
    - *Rationale:* Phosphorus content can be present in the soil. If the phosphorus content is already optimum, or even excessive, for promoting vegetative growth, additional phosphorus in fertilizer can runoff and adversely affect water quality. Lake Champlain is already phosphorus impaired.
    - *Measurable Goal:* UVM's use of fertilizers are in alignment with State regulations. The Physical Plant Soil & Seeding Specifications will be updated to specify that only phosphorus free fertilizers be used unless a soil test identifies that fertilizer containing phosphorus is warranted for optimum vegetative growth.
- Participate in the Agency's Municipal Compliance Assistance Program (or other audit program) for municipal garages.
    - *Rationale:* UVM is a Non-Traditional MS4 and does not have any municipal garages on campus.
    - *Measurable Goal:* This goal does not apply.
- List town owned or operated industrial facilities that are subject to the MSGP.
    - *Rationale:* Facilities that are subject to a Multi-Sector General Permit have specific stormwater regulations and reporting requirements that must be followed. These facilities are operated differently than typical stormwater treatment practices.
    - *Measurable Goal:* Review UVM properties to identify if any Multi Sector General Permits exist and identify them in the Stormwater Management Program documentation.
- Provide a copy of the operation and maintenance program.
    - *Rationale:* A stormwater operation and maintenance program ensures that both short-term and long-term stormwater requirements and objectives are identified and followed. This ensures that maintenance requirements are followed, permit dates are met, stormwater infrastructure costs are planned and budgeted, and system users are properly educated.
    - *Measurable Goal:* Annual updates to this Stormwater Management Program will be submitted to identify stormwater improvements and maintenance measures completed throughout the previous year.

Promotion of Riparian Buffers and Setbacks

- UVM will abide by applicable zoning regulations in South Burlington and Burlington on Centennial Brook and Potash Brook. There are two UVM Natural Areas: East Woods and Centennial Woods that are located on the above two streams. Management of the Natural Areas is consistent with providing a protected stream buffer for these lands.

Total Maximum Daily Load (TMDL) Implementation

Flow Restoration Plans

The University of Vermont has been collaborating with the City of Burlington, City of South Burlington, Town of Essex and VTrans on the Flow Restoration Plans (FRP). The University of Vermont participated in the following flow restoration plans: Centennial Brook, Englesby Brook, Potash Brook, Bartlett Brook and Sunderland Brook.

The traditional MS4s have gathered and submitted the FRP narrative including model runs and possible best management practices. This document supplements and clarifies the University's involvement and financial commitments in the Flow Restoration Plans.

The MS4 General Permit (3-9014), subpart IV.C.1 required that a Flow Restoration Plan be submitted to the Agency of Natural Resources by October 1, 2016. The FRP serves all MS4s as a planning tool in the respective impaired waterways.

Centennial Brook (See Appendix E)

Since the University of Vermont has been proactive in establishing Best Management Practices (BMP), their future obligation for capturing untreated/undetained runoff is limited. UVM currently treats/detains over 95% of its impervious surfaces in the Centennial Brook Watershed. With the BMPs proposed in the FRP, this increases to 97.4%. It is commendable that 97.4% of UVM's impervious would be fully treated and detained in accordance with the current State Stormwater Regulations.

The University is participating in three improvements through the Centennial Brook FRP; The North Campus Stormwater Treatment Facility Upgrade, the Main Street Stormwater Treatment Upgrade and a small drainage improvement at the UVM Physical Plant recycling area located behind Centennial Baseball Field.

i) North Campus Stormwater Treatment Facility (see attached schematic plan - sheet SP-1 dated 9/20/2016 in Appendix B South Burlington ID CB0019. Construction estimated to be completed between 2021 and 2026.

   The North Campus watershed drains approximately 84 acres of University of Vermont and the City of Burlington. The University had offered the use of the North Campus Stormwater Facility under two conditions;

   1) There is sufficient capacity for UVM to expand the pond to facilitate full build out of UVM Campus.

   2) The entity using the UVM pond (City of Burlington) would have financial obligations toward the construction and maintenance. The City and University will negotiate the

terms for use of the pond at a later date. The University of Vermont will have complete discretion regarding all terms of any agreement.

ii) Main Street Stormwater Treatment Facility (see attached schematic plan - sheet SP-2 dated 9/27/2016 in Appendix B). Retrofit M5A (Retrofit 24 on Sheraton/UVM property not accepted). Construction estimated to be completed between 2021 and 2026.

The Main Street Stormwater Treatment Facility currently drains approximately 27 acres of land owned by the University of Vermont, the City of South Burlington and the City of Burlington. The University had offered the use of the Main Street Stormwater Facility under two conditions;

1) There is sufficient capacity for UVM to expand the pond to facilitate full build out of UVM Campus.

2) The entity(s) using the UVM pond (City of South Burlington and City of Burlington) would have financial obligations toward the construction and maintenance. The City of South Burlington, the City of Burlington and UVM will negotiate the terms for use of the pond at a later date. The University of Vermont will have complete discretion regarding all terms of any agreement.

iii) UVM Physical Plant recycling area drainage improvements (Completed April 2017)
(See sheet SP-2 dated 9/19/2016 in Appendix B)
Approximate ¼ acre gravel recycling yard that previously drained untreated to Centennial Brook. UVM extended the stormwater collection infrastructure to capture the flows from this area and direct them to the North Campus Stormwater Treatment Facility.

The initial model runs prepared by Horsley Whitten for the Centennial FRP included four other BMPs on UVM properties. These were located in future building land banks or other areas that were not acceptable to UVM. Many of these BMPs were established to treat non-UVM properties. The proposed retrofits include:

- Retrofit 24 Sheraton.
- Retrofit 17 Jug-Handle.
- Retrofit M1A (CB 0005) Centennial Court.
- Retrofit M7B Case Parkway (on UVM property).

The above listed items are not included in the FRP. In the Memo from Emily Schelley (Stormwater Management Program, VTDEC) dated August 23, 2017 in Appendix E, DEC removed the four BMPs from the Centennial Brook BMPDSS model. The revised flow restoration plan model run for Centennial Brook achieved a 51.9% reduction in high flow when compared to the base period. This represents a slightly higher reduction in flow even with the removal of the four practices on UVM property when other watershed changes are considered.

Potash Brook (See Appendix F)

The University of Vermont has limited properties subject to MS4 in the Potash Brook watershed. Most of the properties are agricultural in nature. The two non-agricultural properties include Bio-Research Facility at 720 Spear Street and Aiken Forestry Research Center at 705 Spear Street. There are just over five acres of impervious on these properties. The FRP proposed specific upgrades at both of these

facilities, and while UVM is committed to providing stormwater improvements, the BMPs proposed would impact future building sites.

The University anticipates designing, permitting and constructing improvements in 2019 and 2020 for both the Aiken Forestry Research Center (PB0084 and PB0085 in Appendix F) and Bio-Research (PB0083 in Appendix F) properties.

Englesby Brook

The southern end of the main UVM Campus drains to Englesby Brook. The University proactively constructed two stormwater ponds in full compliance with the state stormwater regulations. The combined watershed is approx. 53 acres. See sheet WS-1 dated 12/07/2018 in Appendix B for existing UVM watersheds.

The stormwater computer model runs completed for the Englesby FRP indicate the University stormwater ponds *exceed* the required detention for compliance with the FRP goals. There are no changes required to the ponds or UVM financial obligations in Englesby watershed.

Sunderland Brook

The University participated in the Sunderland Brook FRP with the Town of Essex. The University sold the student housing complex (County Apartments) and currently only owns some commercial buildings at the east end of the Fort Ethan Allen Complex.

The FRP did not identify UVM as a jurisdictional MS4 within the Sunderland Brook watershed and UVM is not included as a contributing MS4 to the Sunderland Brook TMDL.

Financial Statement

Under the current budgeting process, the University would establish project funds to fulfill the University's obligation. We would endeavor to pursue federal and state stormwater grant opportunities.

In summary, the University's Stormwater Management Program is in conformance with the recommendations of the Lake Champlain TMDL. Not only are they currently implementing Best Management Practices to reduce phosphorus loading of the lake but the implementation of this Stormwater Management Program will further reduce phosphorus.

Lake Champlain Phosphorus TMDL

Phosphorus Control Plan

- The University will develop and implement a Phosphorus Control Plan (PCP), that will achieve the level of phosphorus reduction equivalent to the target for developed land consistent with the Lake Champlain TMDLs. The percent reduction targets for UVM properties in each Lake Segment are as follows:
    - Main Lake - 20.2% (Winooski River (Trinity Campus & Colchester Avenue WS)), Centennial Brook (North Campus, East Campus and Main Street Watersheds)
    - Shelburne Bay 20.2% (Potash Brook Watershed)
    - Burlington Bay 24.2% (Englesby Brook (Southwest Campus Watershed))

- The Phosphorus Control Plan may include reductions calculated based on:
    - Street sweeping and catch basin cleaning practices
    - Implementation of stormwater treatment practice upgrades or retrofits to treat existing impervious after the adoption of the 2002 Vermont State Stormwater Manual
    - Implementation of stormwater treatment practices after July 1, 2010, on developed lands that are not subject to the state's operational stormwater permit

- The following conditions apply when calculating phosphorus reductions for application towards the PCP targets:

  a) Where the PCP includes phosphorus reductions from UVM developed lands that are otherwise subject to an operational stormwater permit that requires an upgrade of the stormwater treatment system pursuant to the Department's regulations, including 3-acre sites, the PCP will be designed to achieve, in aggregate, a level of phosphorus reduction equivalent to the lake segment target as applied to the UVM owned developed land.

  b) Where a PCP includes non-municipally-owned developed lands that are subject to an operational stormwater permit that does not otherwise require an upgrade of the stormwater system pursuant to the Department's regulations, the management of stormwater from these lands is creditable towards the phosphorus reduction target.

  c) The PCP may include a component to address a reduction of future growth discharges of phosphorus from developed lands. The future growth component shall track the amount of development, and the level of stormwater management achieved by local ordinances or regulations, on future development. Future development is any development after July 1, 2010 that is not subject to a state operational permit.

- Schedule of Compliance
    - April 1, 2019 - Submit the first Annual PCP Report
    - April 1, 2020 - Submit the Annual PCP Report
    - April 1, 2021 - Complete the Phosphorus Control Plan (PCP) and submit it to the Secretary - Submit the Annual PCP Report
    - April 1, 2022 and every year thereafter - Submit Annual PCP Report
    - No later than June 17, 2036 - Complete full implementation of the approved PCP

- Pursuant to the compliance schedule, UVM will submit a report every April 1st on the development and implementation of the PCP. The reports will address actions taken to implement all PCP components, including:
    - Extent of street sweeping and catch basin cleaning;
    - Extent of stormwater BMP implementation;
    - An estimate of the extent of remaining items requiring completion,
    - An assessment of the ability to meet outstanding schedule items; and
    - A written statement, signed by a designer acceptable to the Secretary, that any structural BMP built or implemented within the preceding six-month period was constructed in compliance with the approved plans.

Annual Reporting

On, or prior to, April 1st each year, UVM will submit a report to the Vermont Agency of Natural Resources Watershed Management Division with an update of the University's stormwater efforts. The report will identify the following:

- Measurable outcome reporting (Refer to Appendix C);
- Status of compliance with permit conditions;
- A summary of stormwater activities planned during the next reporting cycle; and
- Proposed changes to the Stormwater Management Program.