REPORT on the 2012-2013 traces conducted on Bridge Creek

Houston County, Mn

Minnesota Department of Natural Resources

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Introduction

In 2012 and 2013, dye traces were conducted on Bridge Creek in Yucatan Township, Minnesota. Yucatan Township is located in western Houston County roughly 7 miles to the southwest of the City of Houston. Dye traces have been completed in this general vicinity on two trout streams. Dye tracing occurred on Daley Creek, located roughly 1.5 miles to the north of Bridge Creek, in 2009. A synchronous December 2013 dye trace also occurred on Girl Scout Camp Creek, located roughly 1.5 miles to the south of Bridge Creek. Reports of each of those traces are available as separate documents. In addition, an ephemeral sinking stream has been identified on Hallum Creek, located roughly 1.5 miles to the southeast of Girl Scout Camp Creek, via GIS reconnaissance. Subsequent discussion with the landowner verified the existence of the Hallum Creek stream sink.

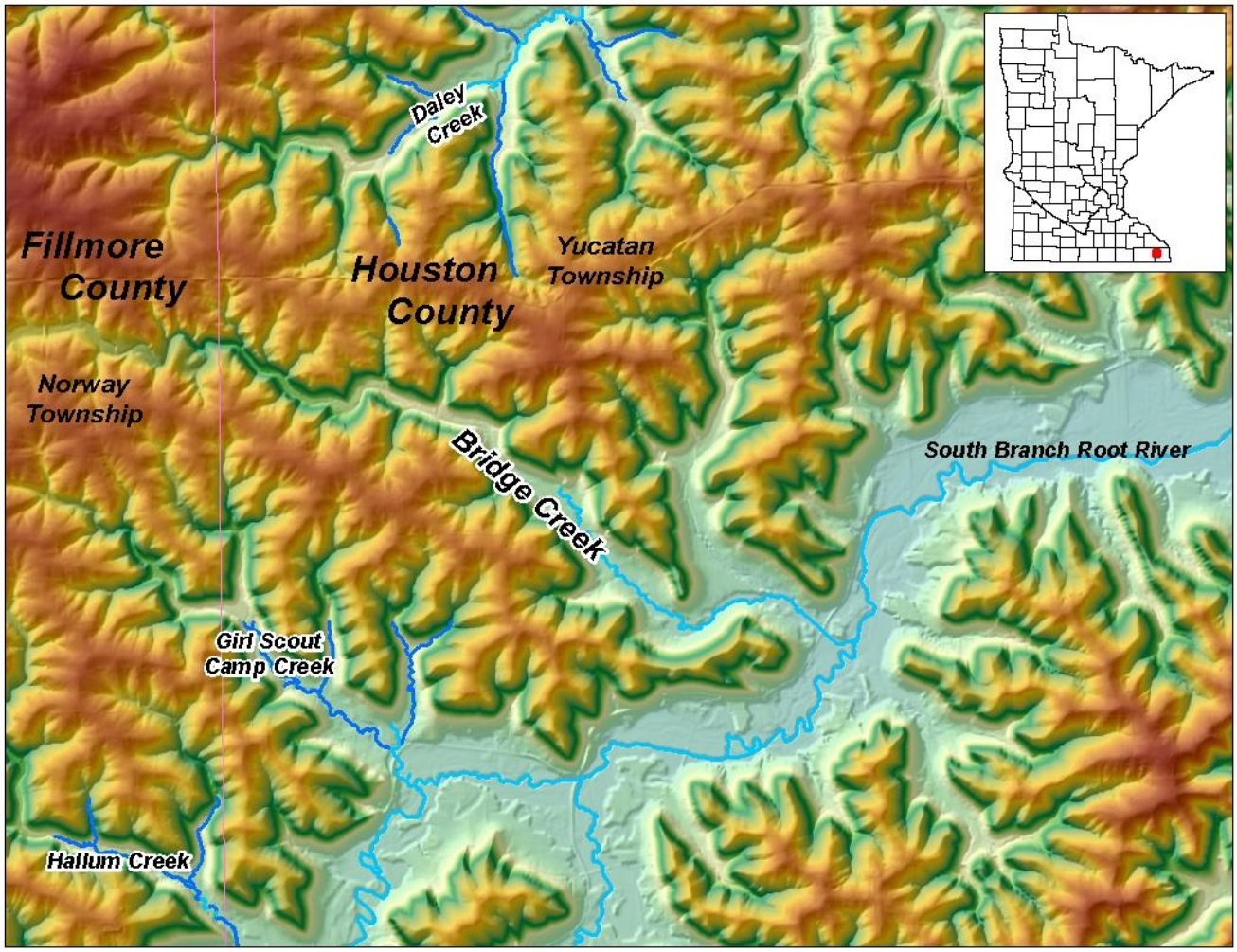


Figure 1. *Yucatan, Township Minnesota is located in western Houston County, Minnesota. Bridge Creek is located in close proximity to the Houston County/Fillmore County border. Streams identified as trout streams are shown with dark blue lines.*

All of these traces were conducted to further delineate springsheds in the area, characterize sinking streams in the Cambrian St. Lawrence Formation, and characterize surface-groundwater interactions in the county. Characterizing sinking streams and their connection to cold water springs is important as numerous trout streams are located in southeastern Minnesota.

Dye tracing entails using fluorescent dyes to track groundwater flow directions and travel times. The dye is poured into a sinking stream or sinkhole; from there it flows through a conduit system until it re-emerges at a spring. For the Bridge Creek project, the dye Eosin was used during the December 2012 trace and the dye Uranine C (fluorescein) was used during the September 2013 trace. Table 1 identifies input locations and dye quantities used for each trace. Dye recovery was accomplished using both direct water "grab" samples and passive dye detectors (packets of coconut charcoal also known as "bugs") for the December 2012 trace. The September 2013 trace used both direct water samples and passive dye detectors. The majority of direct water samples collected for the 2013 trace, samples collected during the first 70 days of the trace, were collected using Isco automatic water sampling devices set to sample three times per day. Additional direct water grab samples were collected for the 2013 trace as well. All direct water samples and charcoal detectors were returned to the University of Minnesota Geology & Geophysics Department Hydrochemistry Laboratory for analysis. There, the charcoal detectors were opened, the charcoal was removed, and the fluorescent materials were extracted using an eluent solution of 70% isopropyl alcohol, 30% deionized water, and 10g/L NaOH. The eluent solution was then run through the Shimadzu RF5000U scanning spectrofluorometer to detect and record the spectra. Direct water samples were also analyzed using the Shimadzu RF5000U scanning spectrofluorometer. Spectral components, including the background spectral components, were quantified using PeakFit software as described in Alexander (2005).

Table 1. *Bridge Creek dye trace input locations, dye types, trace dates, and estimated stream flow.*

Bridge Creek 2012 Dye Input			
Dye Input Point	Dye (type, quantity, color index #)	Date & Time	Stream Volumetric Flow (Est.)
Sinking Stream 28:B00006	Eosin 1.104 kg. 33%wt, Chromatint 040711B	19 Dec 2012 1140 hrs.	0.3-0.5 CFS
Bridge Creek 2013 Dye Input			
Dye Input Point	Dye (type, quantity, color index #)	Date & Time	Stream Volumetric Flow (Est.)
Sinking Stream 28:B00005	Uranine C 35%wt, 1.073 kg. Chromatint 041808C	12 Sep. 2013 1640 hrs.	0.1 CFS

The 2012 trace was designed and executed by Jeff Green of the Minnesota Department of Natural Resources (DNR). The 2013 trace was designed and executed by John Barry and Jeff Green of the DNR. E. Calvin Alexander, Jr. of the University of Minnesota Earth Sciences Department performed the sample analysis and interpretation.

2012 Approach and Results

Prior to the 2012 trace, Kevin Kuehner of the Department of Agriculture led a targeted watershed project in the Bridge Creek watershed. Discussion between the MDA and watershed landowners elucidated a sinking stream in the watershed and initiated the investigation. Jeff Green of the DNR established contact with landowners who owned property with relevant sinking stream points, stream access points, and springs. After gaining permission for property access, "background" bugs were placed at advantageous points throughout the investigation area. Background bugs are passive charcoal detectors that establish the level of dye, if any, that is present in a stream prior to the introduction of the trace dye. The dye trace was initiated on December 19, 2012 with the introduction of 1.104 kilograms of Eosin dye into a discrete sinking stream point on Bridge Creek (MN28:B00006). Jeff Green of the DNR, Kevin Kuehner of the Minnesota Department of Agriculture, and Joe Magee of the Fillmore SWCD were present for the trace. Stream discharge at the time was estimated to be 0.3 to 0.5 cubic feet per second. Table 1 summarizes the dye input information.

Passive charcoal detectors were in place at sampling locations from introduction of the dye on December 19, 2012 until June 18, 2013. Eosin dye was detected at levels high enough for positive identification at a number of sampling sites; Appendix 1 summarizes the 2012 trace dye analysis and highlights sites where dye was detected. Bold italicized cells in Appendix 1 emphasize the sites where either trace amounts or quantifiable amounts of Eosin were detected. The eosin dye input point and receptor locations are shown in Figure 2. The dye, Eosine, was detected in a charcoal detector at Rostvold Spring 20 – 28 days later. Assuming a straight line distance from the stream sink (28:B00006) to Rostvold Spring, this translates to a peak groundwater velocity ranging from roughly 146 to 205 meters/day (480 ft./day to 670 ft./day). This is consistent with previous traces in the St. Lawrence where peak rates range from 35 to 600 meters/day (Appendix 2). Dye was also detected in charcoal detectors at the Bridge Creek Station, the Frauenkron Crossing, the Frauenkron well (toilet tank), and the Bolster spring pond. Detection dates for these detectors are listed in Appendix 1.

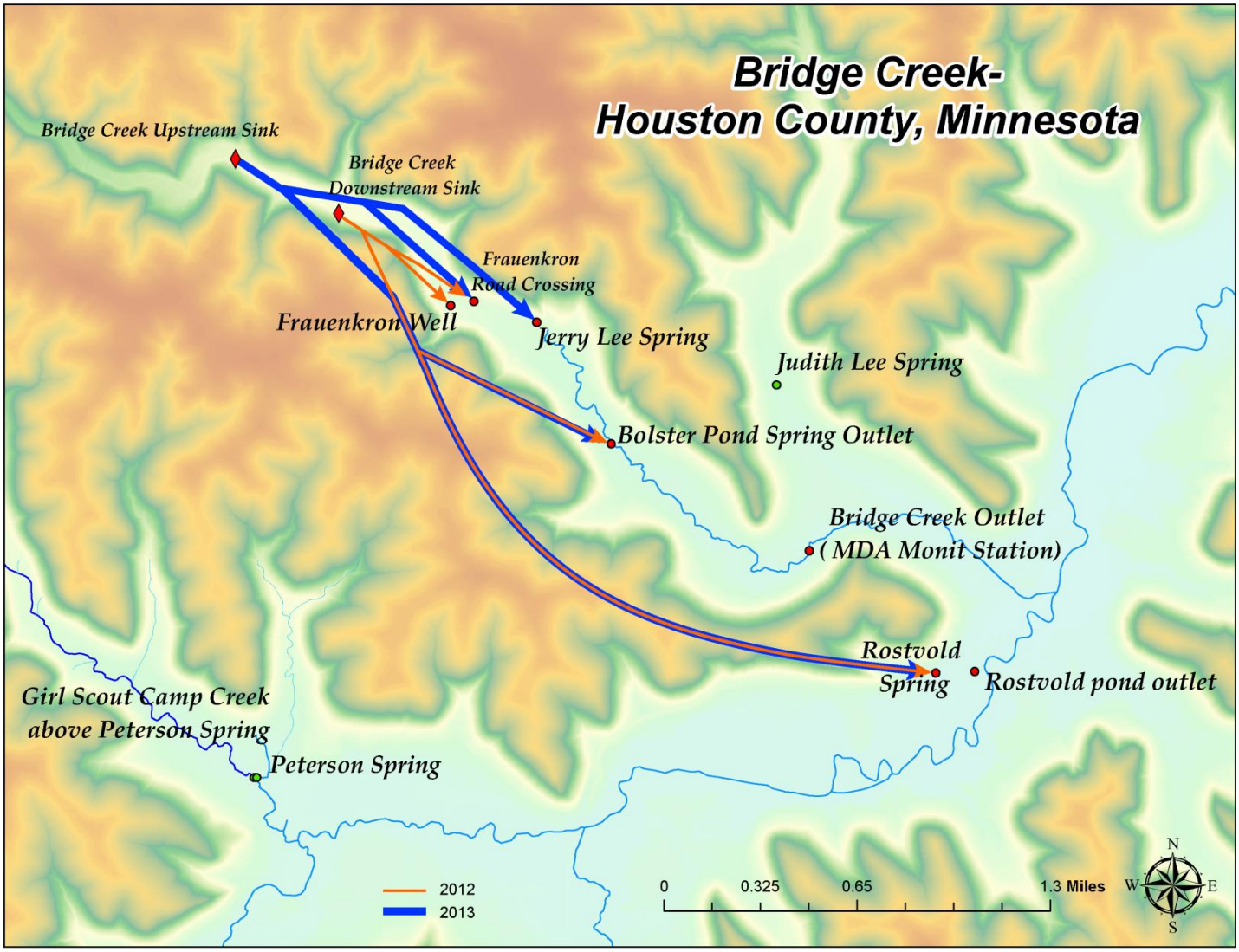


Figure 2. *2012-2013 Bridge Creek site sampling locations and dye flow vectors. Dye flow vectors for the 2012 trace are shown in orange.*

2013 Trace- Background, Approach, and Results

Following the 2012 Bridge Creek trace, a multi-day rain event from June 21-25, 2013 dumped roughly 9.5 inches of rain in the Bridge Creek watershed area. Overland stream flow during this event heavily altered the geomorphology of Bridge Creek, causing large shifts in the streams thalweg. Following the precipitation event, a site visit determined that surface water was no longer making it down the valley. The stream channel had shifted to the north and no longer provided surface water to stream sink 28:B00006. Reconnaissance was conducted to determine where the stream was losing water. Surface water was found to be sinking in a location roughly 2000 feet upstream from 28:B00006. A stream sink had previously been speculated to be in this general vicinity based on black and white aerial imagery from 1991.

Due to a dramatic shift in the sinking stream location and site access from a willing landowner, an additional trace was planned for Bridge Creek. This second trace was also conducted to delineate springsheds in the region, but also to more robustly characterize groundwater velocity through the St. Lawrence and Upper Tunnel City. To further characterize peak velocity and groundwater flow, multiple autosamplers were placed at the furthest known spring with an assumed hydrologic connection to the system: Rostvold Spring. The second dye trace was initiated on September 12, 2013 with the introduction of 1.073 kilograms of 35% weight Uranine dye into a sinking pool and discrete sinking stream point on Bridge Creek (MN28:B00005). John Barry and Jeff Green of the MNDNR and Calvin Alexander of the University of Minnesota were present for the trace. Stream discharge at the time was estimated to be 0.1 cubic feet per second. Table 1 summarizes the dye input information.

Three Isco automatic sampling devices were programmed to sample at eight hour intervals for the first seventy days of the 2013 trace (Figure 3). Automatic samplers were utilized as they are ideal for characterizing dye breakthrough curves. Trace results from the automatic samplers are shown in Figure 4. Passive charcoal detectors were additionally in place at sampling locations from introduction of the dye on September 12, 2013 until December 27, 2013. Uranine dye was detected at levels high enough for positive identification at both the passive and active sampling sites. Appendix 3 summarizes the 2013 trace dye analysis and highlights sites where dye was detected. Bold italicized cells in Appendix 3 emphasize the sites where either trace amounts or quantifiable amounts of Uranine were detected.

Figure 3. *Continuous monitoring using Isco water samplers at the Rostvold spring location*

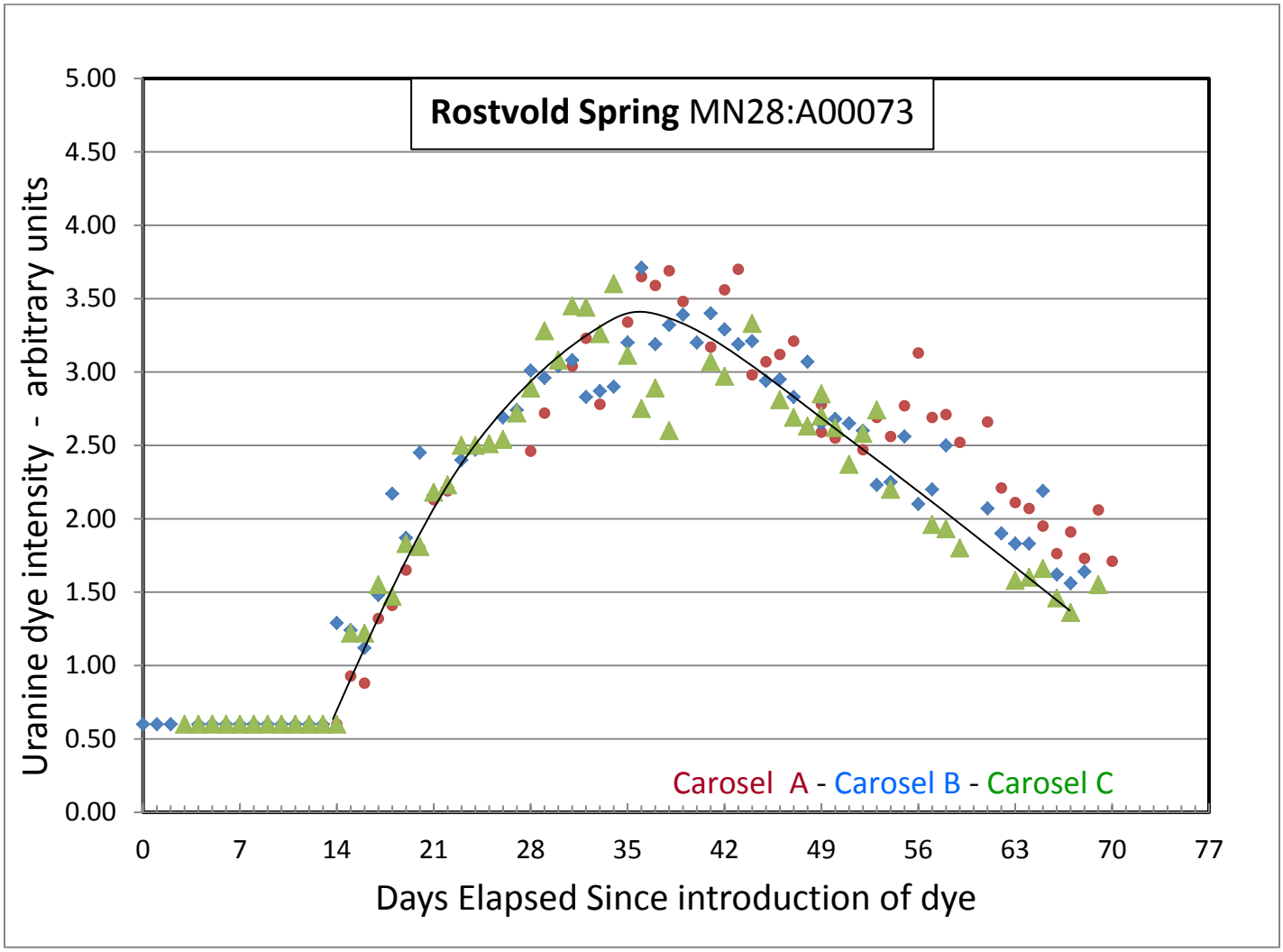


Figure 4. *Break through curve for the 2013 dye trace on Bridge Creek, Houston County, Minnesota. Dye input occurred at stream sink (28:B00005) located roughly 4,716 meters (15,469 ft) in a straight line distance from Rostvold Spring. Dye arrived at the spring 15 days after input.*

The Uranine dye input point and receptor locations are shown in Figure 4. Uranine dye was detected in the automatic samplers at Rostvold Spring 15 days later. Assuming a straight line distance from the stream sink (28:B00005) to Rostvold Spring, this translates to a peak groundwater velocity of roughly 314 meters/day (1,031 ft./day). This velocity is consistent with previous traces in the St. Lawrence where peak rates range from 35 to 600 meters/day. Dye was also detected in charcoal detectors at Frauenkron Road Crossing, Jerry Lee Spring, and Bolster Pond Spring Outlet. Detection dates for these detectors are listed in Appendix 3. Eosine dye used in the 2012 trace was additionally detected at Rostvold Spring, Daley Creek, Bridge Creek Outlet, Jerry Lee Spring, and Frauenkron Crossing Bridge during the 2013 trace suggesting that there is a long tail on dye recovery in these systems.

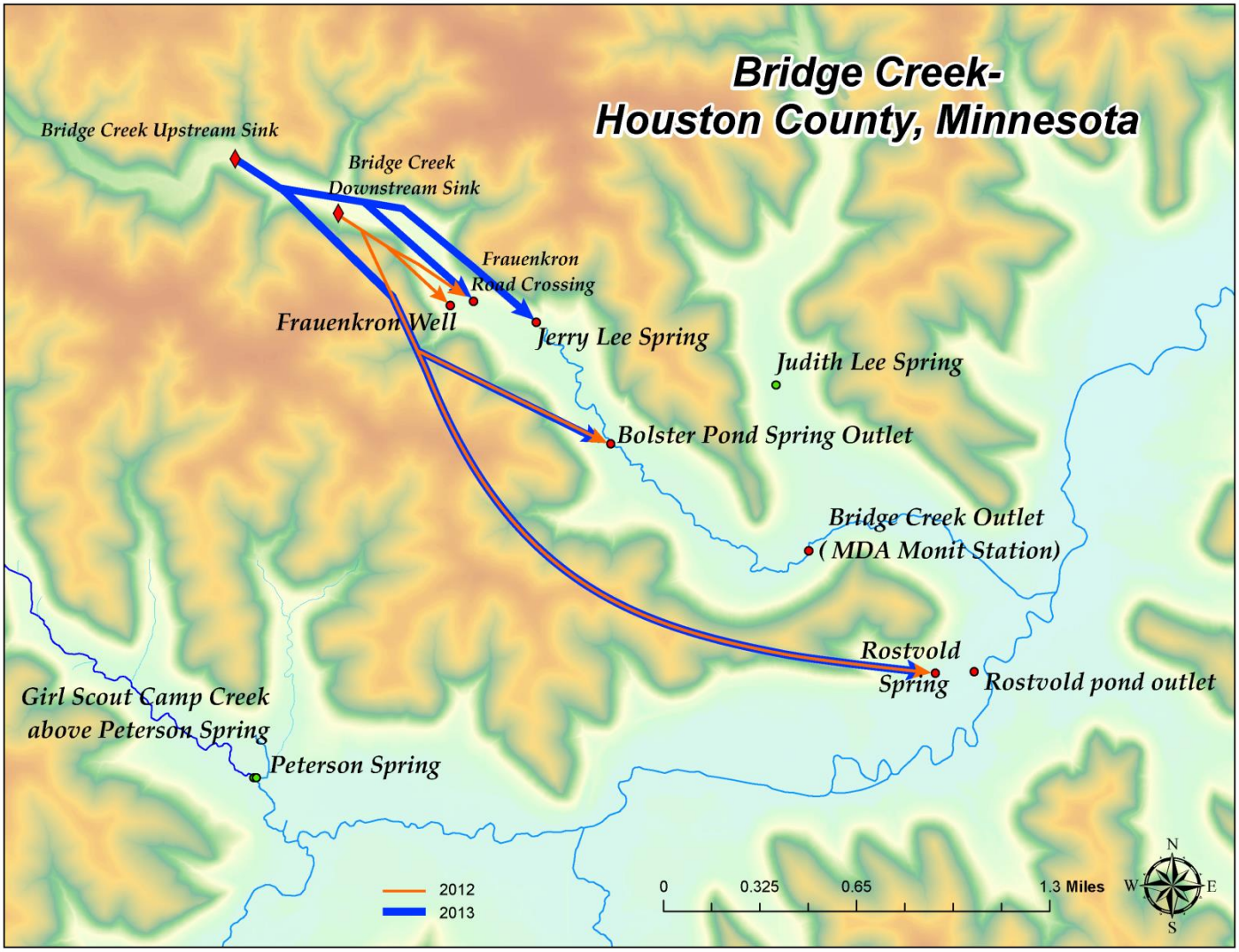


Figure 4. *2012-2013 Bridge Creek site sampling locations and dye flow vectors. Dye flow vectors for the 2013 trace are shown in blue.*

Discussion

The 2012 and 2013 traces on Bridge Creek both determined that surface water that sinks in the upper reaches of Bridge Creek ultimately resurges as groundwater at Rostvold Spring (MN28:A00076). However the traces also showed that dye recovery in springs higher up the valley was dependent upon which stream sink the dye was poured into. This suggests that these stream sinks have preferential flow paths to discharge points lower in the watershed. Dye recovery from the 2012 trace, only occurred at discharge locations located on the south side of the valley. In contrast, dye recovery from the 2013 trace occurred at discharge locations located on the south side of the valley and at Jerry Lee Spring located on the north side of the valley. Figure 5 graphically represents the stratigraphy of the Bridge Creek area

and schematically represents dye trace vectors in cross section view. Both stream sinks on Bridge Creek occur in the St. Lawrence Formation and each of the springs that were positively traced to occur in the Tunnel City Group.

Elevated levels of chloride and nitrate can be used as geochemical indicators of recent human influences on groundwater. Elevated concentrations of these species can be attributed to the application of road salts, the use of water softeners, and fertilizer application. Nitrate concentrations greater than 1 part per million are greater than background conditions and possibly indicate that an aquifer has been impacted by activities on the land surface (Minn. Dept. of Health, 1998 and Wilson, 2012). Nitrate concentrations greater than 3 ppm indicate that an aquifer has been impacted by activities on the land surface (Minn. Dept. of Health, 1998). Chloride concentrations of greater than 5 ppm can also be used to indicate that an aquifer has been impacted by activities on the land surface. Multiple investigators have used Cl/Br ratios to identify chloride sources to groundwater (Davis and others, 1998; Panno and others, 2006). In general, samples with chloride to bromide ratios above 300 are waters that have been elevated by human activity.

Anion chemistry collected during the Bridge Creek investigation suggests that springs located stratigraphically lower than the St. Lawrence Formation are discharging groundwater with a regional flow component. This is evident as springs that are located in the Lone Rock Formation have lower nitrate values than surface water and spring water located stratigraphically higher in the local flow system (Appendix 5). This observed pattern of high nitrate levels in surface water and upper bedrock aquifers and nitrate poor water in lower units is a regional phenomenon recently observed by Runkel (Runkel and others, 2014).

Peak groundwater velocity calculated for the 2013 trace was between 1.5 and 2 times greater than calculated for the 2012 trace. The greater velocity could be a function of flow accessing larger conduits, a steeper gradient, or due to the sampling frequency and sample locations used during the first dye trace. The first dye trace sampled Rostvold Spring (MN28:A0073) at a point several hundred meters downstream of the spring. The water had to pass through a large pond at Rostvolds, affecting the travel time to the sample location. The dye concentration could also have been impacted by photo-degradation of the dye as it traveled through the pond at Rostvolds.

Volumetric flow at Rostvold Spring was calculated for the duration of the dye trace. Flow was determined using a continuous level logger and Manning's Equation. Volumetric flow was additionally determined for a discrete time period using constant rate tracer dilution to verify a Manning's equation value. In general, flow at Rostvold Spring is roughly 0.5 cubic feet per second. Discharge calculated for Rostvold Spring is presented in Appendix 4.

Dye from the 2012 Eosine trace on Bridge Creek continues to move through the hydrologic system. This suggests that break through curves in this system will have long tails. Dye

intensity recovered in direct water samples collected from the autosamplers during the 2013 trace suggests that the mass of dye could have been increased to produce a stronger signal. We suggest that a mass of dye three to four times greater than what was used on the Bridge trace be used in future traces in a similar geologic terrain.

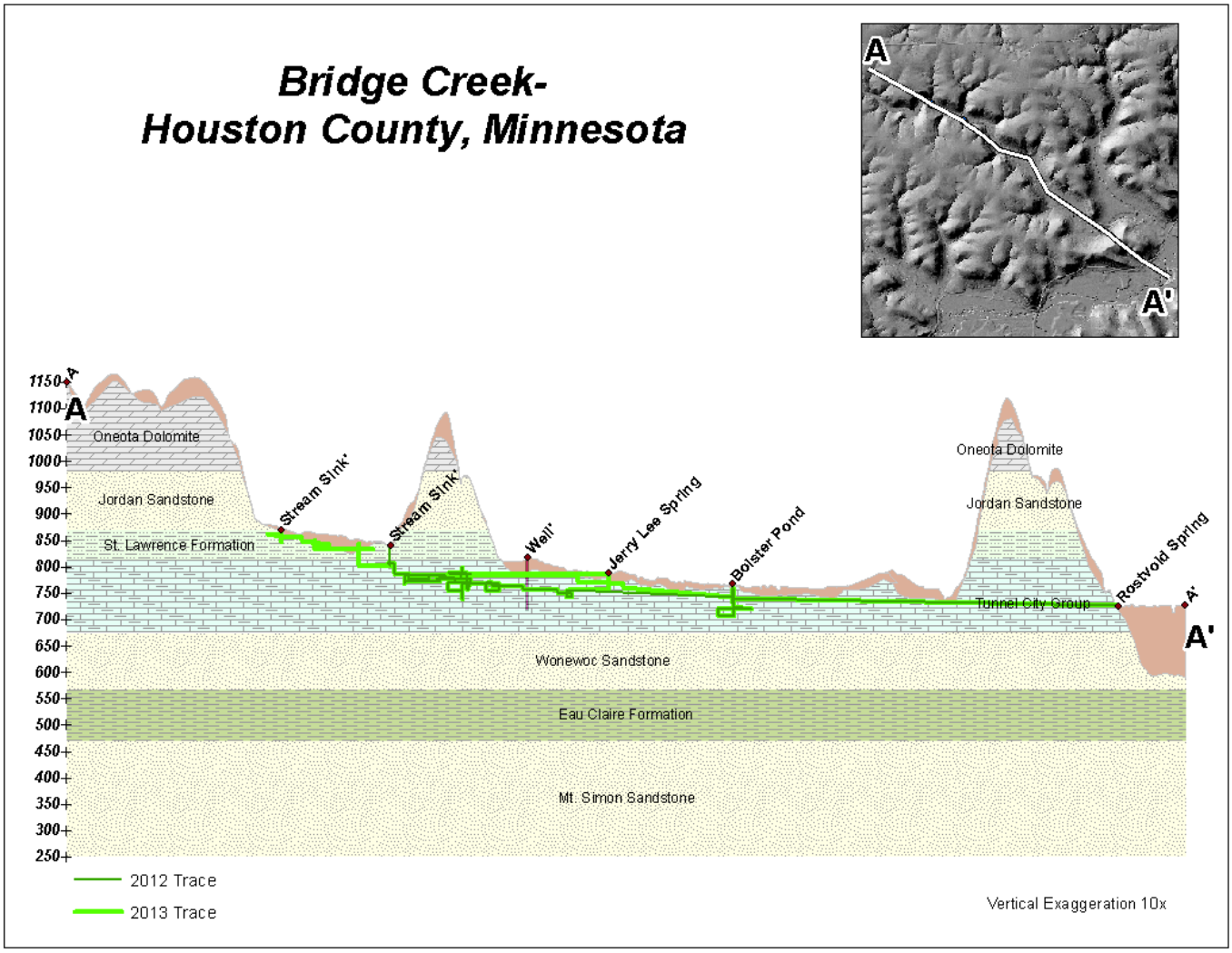


Figure 5. *Hydrogeologic cross section of Bridge Creek showing the position of stream sinks, major spring locations, and hypothetical dye flow vectors.*

Acknowledgements

The work presented in this report could not have occurred without the permission of landowners who graciously allowed access to their property. Special thanks are given to Roland Rodghers who gave us permission to explore and pour from his property and to Diane Rostvold who permitted us to set up an automatic sampler station next to the spring on her property. Additional thanks are given to the Frauenkrons, the Rodghers, the Lees, Duane Peterson, and the Girl Scouts of America who own the Girl Scout Camp Creek property. This work is the result of collaboration between a numbers of professionals

including John Barry and Jeff Green of the Minnesota Department of Natural Resources, E. Calvin Alexander, Sophie M. Kasahara, and Betty J. Wheeler of the University of Minnesota, Kevin Kuehner of the Department of Agriculture, Joe Magee of the Fillmore Soil Water Conservation District, and Anthony Runkel and Julia Anderson of the Minnesota Geological Survey.

This effort was conducted as part of the Innovative Springshed Mapping for Trout Stream Management-Phase II as funded by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative and Citizen Commission on Minnesota Resources.

References

Alexander, Scott C. (2005) "Spectral Deconvolution of Natural Organics and Man-Made Fluorescent Dyes." *Tenth Multidisciplinary Conference on Sinkholes and the Engineering and Environmental Impacts of Karst*, San Antonio, 441-448.

Appendix 1- 2012 Trace Summary

Bridge Creek 2012 Dye Receptor Points					
Karst Feature Database Number (KFDB)	Site Name(s)	Receptor In Date	Receptor Out Date	Peak	Comments
See Comments	See Comments	11-Dec-12	19-Dec-12	n/a	No Eosin detected at background "bug" sites. Sites included Bridge Creek Station, Judith Lee Spring, Jerry Lee Spring (MN28:A0029)
See Comments	See Comments	19-Dec-12	26-Dec-12	n/a	No Eosin detected at any sites. Sites included Bridge Creek Station, Judith Lee Spring, Jerry Lee Spring (MN28:A0029), Frauenkron Crossing, Girl Scout Camp Ck, Peterson Spring (MN:A0028), Bolster Spring, Daley Ck (MN28:X0009)
See Comments	See Comments	26-Dec-12	2-Jan-13	n/a	No Eosin detected at any sites. Sites included Bridge Creek Station, Judith Lee Spring, Jerry Lee Spring (MN28:A0029), Frauenkron Crossing, Girl Scout Camp Ck, Peterson Spring (MN:A0028), Bolster Spring, Daley Ck (MN28:X0009), Rostvold Spring Stream (MN28:A0073)
See Comments	See Comments	2-Jan-13	8-Jan-13	n/a	No Eosin detected at any sites. Sites included Bridge Creek Station, Judith Lee Spring, Jerry Lee Spring (MN28:A0029), Frauenkron Crossing, Girl Scout Camp Ck, Peterson Spring (MN:A0028), Bolster Spring, Daley Ck (MN28:X0009), Rostvold Spring Stream (MN28:A0073)
See Comments	See Comments	2-Jan-13	8-Jan-13	n/a	No Eosin detected at any sites. Sites included Bridge Creek Station, Judith Lee Spring, Jerry Lee Spring (MN28:A0029), Frauenkron Crossing, Girl Scout Camp Ck, Peterson Spring (MN:A0028), Bolster Spring, Daley Ck (MN28:X0009), Rostvold Spring Stream (MN28:A0073)
MN28:A0073	***Rostvold Spring Stream***	***8-Jan-13***	***16-Jan-13***	***Trace Eosin***	Not quantifiable (between 3 and 10 sigma)
See Comments	See Comments	8-Jan-13	16-Jan-13	n/a	No Eosin detected at Bridge Creek Station, Judith Lee Spring, Jerry Lee Spring (MN28:A0029), Frauenkron Crossing, Girl Scout Camp Ck, Peterson Spring (MN:A0028), Bolster Spring, Daley Ck (MN28:X0009)
n/a	***Bridge Creek Station***	***16-Jan-13***	***31-Jan-13***	***Trace Eosin***	Not quantifiable (between 3 and 10 sigma)
n/a	***Frauenkron Crossing***	***16-Jan-13***	***31-Jan-13***	***Trace Eosin***	Not quantifiable (between 3 and 10 sigma)
MN28:A0073	***Rostvold Spring Stream***	***16-Jan-13***	***31-Jan-13***	***Trace Eosin***	Not quantifiable (between 3 and 10 sigma)
See Comments	See Comments	16-Jan-13	31-Jan-13	n/a	No Eosin detected at Judith Lee Spring, Jerry Lee Spring (MN28:A0029), Girl Scout Camp Ck, Peterson Spring (MN:A0028), Bolster Spring, Daley Ck (MN28:X0009)
n/a	Bolster Toilet Tank	11-Dec-12	6-Feb-13	n/a	n/a
n/a	Roghers Toilet Tank	19-Dec-12	6-Feb-13	n/a	n/a
n/a	***Bridge Creek Station***	***31-Jan-13***	***20-Feb-13***	***Trace Eosin***	Not quantifiable (between 3 and 10 sigma)
n/a	***Frauenkron Crossing***	***31-Jan-13***	***20-Feb-13***	***Trace Eosin***	Not quantifiable (between 3 and 10 sigma)
MN28:A0073	***Rostvold Spring Stream***	***31-Jan-13***	***20-Feb-13***	***Trace Eosin***	Not quantifiable (between 3 and 10 sigma)
See Comments	See Comments	31-Jan-13	20-Feb-13	n/a	No Eosin detected at Judith Lee Spring, Jerry Lee Spring (MN28:A0029), Girl Scout Camp Ck, Peterson Spring (MN:A0028),Daley Ck (MN28:X0009)
n/a	Frauenkron Crossing	20-Feb-13	6-Mar-13	Trace Eosin	Not quantifiable (between 3 and 10 sigma)
MN28:A0073	Rostvold Spring Stream	20-Feb-13	6-Mar-13	Trace Eosin	Not quantifiable (between 3 and 10 sigma)
See Comments	See Comments	20-Feb-13	6-Mar-13	n/a	No Eosin detected at Bridge Ck Station, Judith Lee Spring, Jerry Lee Spring (MN28:A0029), Girl Scout Camp Ck, Peterson Spring (MN:A0028),Daley Ck (MN28:X0009)
n/a	***Frauenkron Toilet Tank***	***19-Dec-13***	***6-Mar-13***	***Eosin***	-

Appendix 2 - Southeast Minnesota Dye Trace Velocities of the St. Lawrence Formation and Tunnel City Group

Site	Unit	Peak Velocity	Peak Velocity	Sample Type
Ahrensfeld 1	CSTL	150-300 m/day	492-984 ft/day	Charcoal detector
Ahrensfeld 2	CSTL	400-600 m/day	1,312-1,968 ft/day	Direct Water Samples
Borson Northeast	CSTL	75-110 m/day	246-361 ft/day	Charcoal detector
Bridge Creek 1 (downstream)	CSTL-CTCG	146-205 m/day	480-670 ft/day	Charcoal detector
Bridge Creek 2 (upstream)	CSTL-CTCG	314 m/day	1,031 ft/day	Direct Water Samples
Campbell Valley	CSTL-CTCG	82-124 m/day	270-405 ft/day	Charcoal detector
Daley Creek	CSTL	180-360 m/day	590-1,181 ft/day	Charcoal detector
Gilbert Creek	CSTL	137-198 m/day	450-650 ft/day	Charcoal detector
Girl Scout Creek	CSTL-CTCG	> 88-154 m/day	> 290-504 ft/day	Charcoal detector
Indian Springs	CSTL	80-285 m/day	262-935 ft/day	Charcoal detector
Kiefer Valley	CSTL	260-580 m/day	853-1,902 ft/day	Charcoal detector
Sullivan Creek	CSTL	35-240 m/day	115-787 ft/day	Charcoal detector

CSTL - Cambriam St. Lawrence Formation

CTCG - Cambrian Tunnel City Group

Appendix 3 - 2013 Trace Result Tables

Rostvold Spring, MN28:A00073 (4,839,001N, 607,555E)

Sample	Date	Time		Uranine/Fluorescein				Rhodamine WT				Eosin			
				Peak Height	PH/σ	Peak Center	FWHM	Peak Height	PH/σ	Peak Center	FWHM	Peak Height	PH/σ	Peak Center	FWHM
				I.U.		*nm*	*nm*	*I.U.*		*nm*	*nm*	*I.U.*		*nm*	*nm*
Water Samples															
Car. A	12-Sep-2013	12:15	9/12/13 12:15	0.60	---	---	---	---	---	---	---	---	---	---	---
Car. A	13-Sep-2013	12:15	9/13/13 12:15	0.60	---	---	---	---	---	---	---	---	---	---	---
Car. A	14-Sep-2013	12:15	9/14/13 12:15	0.60	---	---	---	---	---	---	---	---	---	---	---
Car. A	15-Sep-2013	12:15	9/15/13 12:15	0.60	---	---	---	---	---	---	---	---	---	---	---
Car. A	16-Sep-2013	12:15	9/16/13 12:15	0.60	---	---	---	---	---	---	---	---	---	---	---
Car. A	17-Sep-2013	12:15	9/17/13 12:15	0.60	---	---	---	---	---	---	---	---	---	---	---
Car. A	18-Sep-2013	12:15	9/18/13 12:15	0.60	---	---	---	---	---	---	---	---	---	---	---
Car. A	19-Sep-2013	12:15	9/19/13 12:15	0.60	---	---	---	---	---	---	---	---	---	---	---
Car. A	20-Sep-2013	12:15	9/20/13 12:15	0.60	---	---	---	---	---	---	---	---	---	---	---
Car. A	21-Sep-2013	12:15	9/21/13 12:15	0.60	---	---	---	---	---	---	---	---	---	---	---
Car. A	22-Sep-2013	12:15	9/22/13 12:15	0.60	---	---	---	---	---	---	---	---	---	---	---
Car. A	23-Sep-2013	12:15	9/23/13 12:15	0.60	---	---	---	---	---	---	---	---	---	---	---
Car. A	24-Sep-2013	12:15	9/24/13 12:15	0.60	---	---	---	---	---	---	---	---	---	---	---
Car. A	25-Sep-2013	12:15	9/25/13 12:15	0.60	---	---	---	---	---	---	---	---	---	---	---
Car. A	26-Sep-2013	12:15	9/26/13 12:15	0.60	---	---	---	---	---	---	---	---	---	---	---
Car. A	27-Sep-2013	12:15	9/27/13 12:15	0.93	*4.4*	509.5	35.0	---	---	---	---	---	---	---	---
Car. A	28-Sep-2013	12:15	9/28/13 12:15	0.88	*4.0*	507.4	30.5	1.42	*6.5*	586.4	21.7	---	---	---	---
Car. A	29-Sep-2013	12:15	9/29/13 12:15	1.32	*6.0*	507.7	31.0	---	---	---	---	---	---	---	---
Car. A	30-Sep-2013	12:15	9/30/13 12:15	1.41	*6.5*	507.9	30.1	---	---	---	---	---	---	---	---
Car. A	1-Oct-2013	12:15	10/1/13 12:15	1.65	*7.9*	506.4	29.2	---	---	---	---	---	---	---	---
Car. A	2-Oct-2013	12:15	10/2/13 12:15	1.80	*8.5*	506.0	29.0	---	---	---	---	---	---	---	---
Car. A	3-Oct-2013	12:15	10/3/13 12:15	2.13	**10.6**	506.9	26.3	1.56	*7.8*	584.7	21.3	---	---	---	---
Car. A	4-Oct-2013	12:15	10/4/13 12:15	2.19	**11.4**	506.8	29.4	0.52	*2.7*	585.3	13.0	---	---	---	---
Car. A	5-Oct-2013	12:15	10/5/13 12:15	2.46	**11.3**	507.3	23.6	1.13	*5.2*	587.3	25.0				
Car. A	10-Oct-2013	15:15	10/10/13 15:15	2.46	**11.3**	507.3	23.6	1.13	*5.2*	587.3	25.0	---	---	---	---
Car. A	11-Oct-2013	12:15	10/11/13 12:15	2.72	**13.3**	506.4	25.1	---	---	---	---	---	---	---	---
Car. A	12-Oct-2013	12:15	10/12/13 12:15	3.05	**12.2**	506.9	25.5	---	---	---	---	---	---	---	---
Car. A	13-Oct-2013	12:15	10/13/13 12:15	3.04	**13.0**	506.9	28.1	---	---	---	---	---	---	---	---
Car. A	14-Oct-2013	12:15	10/14/13 12:15	3.23	**15.7**	506.5	26.8	0.74	*3.6*	592.8	16.3	---	---	---	---
Car. A	15-Oct-2013	12:15	10/15/13 12:15	2.78	**13.1**	506.9	24.7	---	---	---	---	---	---	---	---
Car. A	17-Oct-2013	12:15	10/17/13 12:15	3.34	**17.3**	507.4	24.2	---	---	---	---	---	---	---	---
Car. A	18-Oct-2013	12:15	10/18/13 12:15	3.65	**17.1**	507.0	26.7	0.78	*3.6*	590.1	25.0	---	---	---	---
Car. A	19-Oct-2013	12:15	10/19/13 12:15	3.59	**16.0**	506.7	27.6	---	---	---	---	---	---	---	---
Car. A	20-Oct-2013	12:15	10/20/13 12:15	3.69	**17.5**	506.8	27.9	0.79	*3.7*	593.6	42.4	---	---	---	---
Car. A	21-Oct-2013	12:15	10/21/13 12:15	3.48	**17.2**	507.1	26.5	0.77	*3.8*	581.2	23.5	---	---	---	---
Car. A	22-Oct-2013	12:15	10/22/13 12:15	3.20	**16.2**	506.8	26.8	---	---	---	---	---	---	---	---
Car. A	23-Oct-2013	12:15	10/23/13 12:15	3.17	**17.0**	506.9	24.6	---	---	---	---	---	---	---	---
Car. A	24-Oct-2013	12:15	10/24/13 12:15	3.56	**15.5**	507.1	25.2	---	---	---	---	---	---	---	---
Car. A	25-Oct-2013	12:15	10/25/13 12:15	3.70	**19.6**	507.1	27.2	---	---	---	---	---	---	---	---
Car. A	26-Oct-2013	12:15	10/26/13 12:15	2.98	**15.5**	506.7	25.8	---	---	---	---	---	---	---	---
Car. A	27-Oct-2013	12:15	10/27/13 12:15	3.07	**13.0**	506.5	25.8	---	---	---	---	---	---	---	---
Car. A	28-Oct-2013	12:15	10/28/13 12:15	3.12	**14.0**	506.6	26.2	---	---	---	---	---	---	---	---
Car. A	29-Oct-2013	12:15	10/29/13 12:15	3.21	**13.2**	507.9	31.4	---	---	---	---	---	---	---	---
Car. A	30-Oct-2013	12:15	10/30/13 12:15	2.62	**12.7**	506.8	28.7	---	---	---	---	---	---	---	---
Car. A	31-Oct-2013	12:15	10/31/13 12:15	2.59	**12.3**	506.4	25.6	---	---	---	---	*hint of eosin - PH/σ = 1.8*			
Car. A	1-Nov-2013	12:15	11/1/13 12:15	2.78	**10.9**	507.1	25.4	---	---	---	---	---	---	---	---
Car. A	2-Nov-2013	12:15	11/2/13 12:15	2.55	**12.1**	506.8	24.9	*hint of RhWT - PH/σ = 2.9*				---	---	---	---
Car. A	3-Nov-2013	12:15	11/3/13 12:15	2.38	**10.0**	506.8	28.1	---	---	---	---	---	---	---	---
Car. A	4-Nov-2013	12:15	11/4/13 12:15	2.47	9.3	506.9	28.0	---	---	---	---	---	---	---	---
Car. A	5-Nov-2013	12:15	11/5/13 12:15	2.69	**11.8**	507.5	30.9	---	---	---	---	---	---	---	---
Car. A	6-Nov-2013	12:15	11/6/13 12:15	2.56	**12.2**	505.9	28.2	0.64	*3.1*	583.7	39.50	*hint of eosin - PH/σ = 1.5*			
Car. A	7-Nov-2013	12:15	11/7/13 12:15	2.77	**12.7**	505.3	29.0	1.05	*4.8*	582.6	40.0	*hint of eosin - PH/σ = 1.9*			
Car. A	8-Nov-2013	12:15	11/8/13 12:15	3.13	**12.8**	505.3	33.3	1.07	*4.4*	583.6	38.7	---	---	---	---
Car. A	9-Nov-2013	12:15	11/9/13 12:15	2.69	**13.8**	505.3	28.3	0.82	*4.2*	581.7	37.5	*hint of eosin - PH/σ = 1.9*			
Car. A	10-Nov-2013	12:15	11/10/13 12:15	2.71	**11.9**	504.9	30.0	0.79	*3.5*	578.1	33.7	*hint of eosin - PH/σ = 2.2*			
Car. A	11-Nov-2013	12:15	11/11/13 12:15	2.52	**12.9**	506.1	30.4	0.77	*3.9*	580.9	21.4	---	---	---	---
Car. A	13-Nov-2013	12:15	11/13/13 12:15	2.66	**11.4**	505.1	29.6	---	---	---	---	*hint of eosin - PH/σ = 2.2*			
Car. A	14-Nov-2013	12:15	11/14/13 12:15	2.21	**10.9**	504.8	30.8	---	---	---	---	*hint of eosin - PH/σ = 2.2*			
Car. A	15-Nov-2013	12:15	11/15/13 12:15	2.11	**11.5**	505.3	29.0	0.66	*3.5*	580.1	38.6	*hint of eosin - PH/σ = 2.8*			
Car. A	16-Nov-2013	12:15	11/16/13 12:15	2.07	**10.4**	504.3	30.3	0.80	*4.1*	580.6	33.1	*hint of eosin - PH/σ = 2.3*			
Car. A	17-Nov-2013	12:15	11/17/13 12:15	1.95	**10.4**	505.0	30.2	0.86	*4.6*	578.1	26.7	*hint of eosin - PH/σ = 1.8*			
Car. A	18-Nov-2013	12:15	11/18/13 12:15	1.76	**10.0**	504.4	30.6	0.85	*4.8*	582.5	32.2	*hint of eosin - PH/σ = 2.1*			
Car. A	19-Nov-2013	12:15	11/19/13 12:15	1.91	*9.2*	504.4	29.8	0.66	*3.2*	580.0	41.4	*hint of eosin - PH/σ = 2.6*			
Car. A	20-Nov-2013	12:15	11/20/13 12:15	1.73	*8.1*	505.3	29.6	---	---	---	---	*hint of eosin - PH/σ = 1.8*			
Car. A	21-Nov-2013	12:15	11/21/13 12:15	2.06	*9.3*	505.9	40.9	0.83	*3.7*	580.8	24.7	---	---	---	---
Car. A	22-Nov-2013	12:15	11/22/13 12:15	1.71	*8.9*	505.9	35.4	0.68	*3.5*	581.6	27.7	---	---	---	---

Car. B	12-Sep-2013	20:15	9/12/13 20:15	0.60	---	---	---		1.66	*7.0*	587.0	23.0		---	---	---	---
Car. B	13-Sep-2013	20:15	9/13/13 20:15	0.60	---	---	---		---	---	---	---		---	---	---	---
Car. B	14-Sep-2013	20:15	9/14/13 20:15	0.60	---	---	---		---	---	---	---		---	---	---	---
Car. B	15-Sep-2013	20:15	9/15/13 20:15	0.60	---	---	---		---	---	---	---		---	---	---	---
Car. B	16-Sep-2013	20:15	9/16/13 20:15	0.60	---	---	---		---	---	---	---		---	---	---	---
Car. B	17-Sep-2013	20:15	9/17/13 20:15	0.60	---	---	---		---	---	---	---		---	---	---	---
Car. B	18-Sep-2013	20:15	9/18/13 20:15	0.60	---	---	---		---	---	---	---		---	---	---	---
Car. B	19-Sep-2013	20:15	9/19/13 20:15	0.60	---	---	---		---	---	---	---		---	---	---	---
Car. B	20-Sep-2013	20:15	9/20/13 20:15	0.60	---	---	---		---	---	---	---		---	---	---	---
Car. B	21-Sep-2013	20:15	9/21/13 20:15	0.60	---	---	---		---	---	---	---		---	---	---	---
Car. B	22-Sep-2013	20:15	9/22/13 20:15	0.60	---	---	---		0.96	*5.1*	586.9	24.1		---	---	---	---
Car. B	23-Sep-2013	20:15	9/23/13 20:15	0.60	---	---	---		---	---	---	---		---	---	---	---
Car. B	24-Sep-2013	20:15	9/24/13 20:15	0.60	---	---	---		0.83	*3.7*	585.1	22.3		---	---	---	---
Car. B	25-Sep-2013	20:15	9/25/13 20:15	0.60	---	---	---		0.79	*3.2*	586.2	20.5		---	---	---	---
Car. B	26-Sep-2013	20:15	9/26/13 20:15	1.29	*5.6*	505.4	37.2		1.41	*6.1*	584.3	20.1		---	---	---	---
Car. B	27-Sep-2013	20:15	9/27/13 20:15	1.24	*5.5*	508.1	37.3		1.04	*4.6*	585.6	21.2		---	---	---	---
Car. B	28-Sep-2013	20:15	9/28/13 20:15	1.12	*5.7*	507.4	32.5		1.13	*5.7*	585.7	22.1		---	---	---	---
Car. B	29-Sep-2013	20:15	9/29/13 20:15	1.48	*7.4*	506.6	32.9		0.72	*3.6*	586.1	16.5		---	---	---	---
Car. B	30-Sep-2013	20:15	9/30/13 20:15	2.17	**10.1**	506.6	35.8		---	---	---	---		---	---	---	---
Car. B	1-Oct-2013	20:15	10/1/13 20:15	1.87	*8.6*	506.1	27.2		1.39	*6.4*	585.0	19.8		---	---	---	---
Car. B	2-Oct-2013	20:15	10/2/13 20:15	2.45	**12.1**	508.1	30.0		---	---	---	---		---	---	---	---
Car. B	3-Oct-2013	20:15	10/3/13 20:15	2.16	*9.8*	506.3	27.3		1.18	*5.3*	585.1	23.3		---	---	---	---
Car. B	4-Oct-2013	20:15	10/4/13 20:15	2.21	*9.7*	507.4	27.6		1.90	*8.3*	586.1	21.6		---	---	---	---
Car. B	5-Oct-2013	20:15	10/5/13 20:15	2.40	**10.7**	507.2	27.6		---	---	---	---		---	---	---	---
Car. B	6-Oct-2013	20:15	10/6/13 20:15	2.47	**11.8**	506.6	25.8		---	---	---	---		---	---	---	---
Car. B	8-Oct-2013	20:15	10/8/13 20:15	2.69	**12.9**	506.9	24.7		1.51	*7.2*	586.2	20.6		---	---	---	---
Car. B	9-Oct-2013	20:15	10/9/13 20:15	2.74	**14.3**	507.4	23.2		0.91	*4.8*	582.3	11.5		---	---	---	---
Car. B	10-Oct-2013	20:15	10/10/13 20:15	3.01	**11.5**	506.8	25.5		1.00	*3.8*	586.6	22.3		---	---	---	---
Car. B	11-Oct-2013	20:15	10/11/13 20:15	2.96	**14.7**	507.2	24.3		1.20	*6.0*	586.3	19.0		---	---	---	---
Car. B	12-Oct-2013	20:15	10/12/13 20:15	3.04	**12.7**	507.6	25.0		0.87	*3.6*	591.1	27.4		---	---	---	---
Car. B	13-Oct-2013	20:15	10/13/13 20:15	3.08	**14.7**	507.0	24.9		---	---	---	---		---	---	---	---
Car. B	14-Oct-2013	20:15	10/14/13 20:15	2.83	**13.8**	506.7	24.9		---	---	---	---		---	---	---	---
Car. B	15-Oct-2013	20:15	10/15/13 20:15	2.87	**12.2**	507.2	24.9		---	---	---	---		---	---	---	---
Car. B	16-Oct-2013	20:15	10/16/13 20:15	2.90	**12.7**	507.1	25.7		---	---	---	---		---	---	---	---
Car. B	17-Oct-2013	20:15	10/17/13 20:15	3.20	**16.0**	507.0	25.2		---	---	---	---		---	---	---	---
Car. B	18-Oct-2013	20:15	10/18/13 20:15	3.71	**15.3**	506.8	26.6		---	---	---	---		---	---	---	---
Car. B	19-Oct-2013	20:15	10/19/13 20:15	3.19	**14.0**	506.6	23.7		---	---	---	---		---	---	---	---
Car. B	20-Oct-2013	20:15	10/20/13 20:15	3.32	**13.3**	506.7	24.1		---	---	---	---		---	---	---	---
Car. B	21-Oct-2013	20:15	10/21/13 20:15	3.39	**16.2**	506.8	27.1		---	---	---	---		---	---	---	---
Car. B	22-Oct-2013	20:15	10/22/13 20:15	3.20	**16.9**	507.3	25.1		0.84	*4.4*	584.1	19.0		---	---	---	---
Car. B	23-Oct-2013	20:15	10/23/13 20:15	3.40	**13.9**	507.0	25.7		0.88	*3.6*	584.9	27.9		---	---	---	---
Car. B	24-Oct-2013	20:15	10/24/13 20:15	3.29	**14.0**	506.8	26.4		---	---	---	---		---	---	---	---
Car. B	25-Oct-2013	20:15	10/25/13 20:15	3.19	**13.8**	506.6	26.3		---	---	---	---		---	---	---	---
Car. B	26-Oct-2013	20:15	10/26/13 20:15	3.21	**14.4**	506.9	25.5		0.88	*3.9*	582.5	21.8		---	---	---	---
Car. B	27-Oct-2013	20:15	10/27/13 20:15	2.94	**14.2**	507.1	26.3		0.62	*3.0*	582.9	21.4		---	---	---	---
Car. B	28-Oct-2013	20:15	10/28/13 20:15	2.95	**14.9**	506.9	25.0		---	---	---	---		---	---	---	---
Car. B	29-Oct-2013	20:15	10/29/13 20:15	2.83	**14.0**	506.8	26.3		0.97	*4.8*	581.7	25.9		---	---	---	---
Car. B	30-Oct-2013	20:15	10/30/13 20:15	3.07	**13.2**	507.0	27.5		---	---	---	---		---	---	---	---
Car. B	31-Oct-2013	20:15	10/31/13 20:15	2.82	**13.9**	507.2	27.7		---	---	---	---		---	---	---	---
Car. B	1-Nov-2013	20:15	11/1/13 20:15	2.65	**10.3**	507.1	26.3		---	---	---	---		---	---	---	---
Car. B	2-Nov-2013	20:15	11/2/13 20:15	2.68	**12.3**	507.0	26.5		---	---	---	---		---	---	---	---
Car. B	3-Nov-2013	20:15	11/3/13 20:15	2.65	**12.8**	506.9	27.7		0.78	*3.8*	583.9	13.6		---	---	---	---
Car. B	4-Nov-2013	20:15	11/4/13 20:15	2.60	**11.0**	506.6	27.8		---	---	---	---		---	---	---	---
Car. B	5-Nov-2013	20:15	11/5/13 20:15	2.23	**11.4**	506.0	25.7		0.63	*3.2*	584.6	28.1		---	---	---	---
Car. B	6-Nov-2013	20:15	11/6/13 20:15	2.25	**11.1**	506.3	26.0		---	---	---	---		---	---	---	---
Car. B	7-Nov-2013	20:15	11/7/13 20:15	2.56	**12.0**	505.7	28.3		---	---	---	---		---	---	---	---
Car. B	8-Nov-2013	20:15	11/8/13 20:15	2.10	**11.1**	506.4	25.6		---	---	---	---		---	---	---	---
Car. B	9-Nov-2013	20:15	11/9/13 20:15	2.20	**11.8**	505.2	27.2		---	---	---	---		---	---	---	---
Car. B	10-Nov-2013	20:15	11/10/13 20:15	2.50	**11.2**	505.8	27.5		---	---	---	---		---	---	---	---
Car. B	13-Nov-2013	20:15	11/13/13 20:15	2.07	**10.2**	506.2	27.9		---	---	---	---		---	---	---	---
Car. B	14-Nov-2013	20:15	11/14/13 20:15	1.90	*9.9*	505.0	25.2		0.65	*3.4*	588.2	24.9		---	---	---	---
Car. B	15-Nov-2013	20:15	11/15/13 20:15	1.83	*8.6*	505.0	25.7		0.64	*3.0*	584.0	20.5		---	---	---	---
Car. B	16-Nov-2013	20:15	11/16/13 20:15	1.83	*8.9*	505.7	27.5		0.64	*3.1*	584.0	24.4		---	---	---	---
Car. B	17-Nov-2013	20:15	11/17/13 20:15	2.19	**10.1**	504.3	29.4		---	---	---	---		---	---	---	---
Car. B	18-Nov-2013	20:15	11/18/13 20:15	1.62	*7.6*	505.7	30.2		---	---	---	---		---	---	---	---
Car. B	19-Nov-2013	20:15	11/19/13 20:15	1.56	*8.3*	505.8	30.0		---	---	---	---		---	---	---	---
Car. B	20-Nov-2013	20:15	11/20/13 20:15	1.64	*8.5*	506.2	30.3		---	---	---	---		---	---	---	---

Car. C	15-Sep-2013	4:15	9/15/13 4:15	0.60	---	---	---		1.4	*5.8*	583.8	21.3		---	---	---	---
Car. C	16-Sep-2013	4:15	9/16/13 4:15	0.6	---	---	---		1.90	*8.9*	584.5	21.9		---	---	---	---
Car. C	17-Sep-2013	4:15	9/17/13 4:15	0.60	---	---	---		1.79	*7.1*	584.4	19.9		---	---	---	---
Car. C	18-Sep-2013	4:15	9/18/13 4:15	0.6	---	---	---		---	---	---	---		---	---	---	---
Car. C	19-Sep-2013	4:15	9/19/13 4:15	0.60	---	---	---		---	---	---	---		---	---	---	---
Car. C	20-Sep-2013	4:15	9/20/13 4:15	0.6	---	---	---		1.30	*5.4*	586.1	19.3		---	---	---	---
Car. C	21-Sep-2013	4:15	9/21/13 4:15	0.60	---	---	---		---	---	---	---		---	---	---	---
Car. C	22-Sep-2013	4:15	9/22/13 4:15	0.6	---	---	---		0.68	*3.1*	585.0	26.8		---	---	---	---
Car. C	23-Sep-2013	4:15	9/23/13 4:15	0.60	---	---	---		---	---	---	---		---	---	---	---
Car. C	24-Sep-2013	4:15	9/24/13 4:15	0.6	---	---	---		---	---	---	---		---	---	---	---
Car. C	25-Sep-2013	4:15	9/25/13 4:15	0.60	---	---	---		---	---	---	---		---	---	---	---
Car. C	26-Sep-2013	4:15	9/26/13 4:15	0.6	---	---	---		---	---	---	---		---	---	---	---
Car. C	27-Sep-2013	4:15	9/27/13 4:15	1.22	*4.7*	508.9	32.2		---	---	---	---		---	---	---	---
Car. C	28-Sep-2013	4:15	9/28/13 4:15	1.22	*6.0*	507.5	36.5		1.26	*6.2*	583.6	14.1		---	---	---	---
Car. C	29-Sep-2013	4:15	9/29/13 4:15	1.55	*6.8*	507.2	32.5		---	---	---	---		---	---	---	---
Car. C	30-Sep-2013	4:15	9/30/13 4:15	1.47	*6.6*	507.4	31.4		1.01	*4.5*	582.3	18.0		---	---	---	---
Car. C	1-Oct-2013	4:15	10/1/13 4:15	1.83	*7.2*	508.1	34.7		1.07	*4.2*	582.8	20.5		---	---	---	---
Car. C	2-Oct-2013	4:15	10/2/13 4:15	1.81	*7.3*	506.8	26.9		---	---	---	---		---	---	---	---
Car. C	3-Oct-2013	4:15	10/3/13 4:15	2.18	*9.5*	506.8	29.1		1.03	*4.5*	585.5	20.1		---	---	---	---
Car. C	4-Oct-2013	4:15	10/4/13 4:15	2.23	**10.2**	506.9	25.9		---	---	---	---		---	---	---	---
Car. C	5-Oct-2013	4:15	10/5/13 4:15	2.50	*9.8*	507.2	26.7		---	---	---	---		---	---	---	---
Car. C	6-Oct-2013	4:15	10/6/13 4:15	2.50	**10.1**	507.2	25.7		---	---	---	---		---	---	---	---
Car. C	7-Oct-2013	4:15	10/7/13 4:15	2.51	**11.5**	506.7	25.0		---	---	---	---		---	---	---	---
Car. C	8-Oct-2013	4:15	10/8/13 4:15	2.54	**11.6**	507.3	25.7		---	---	---	---		---	---	---	---
Car. C	9-Oct-2013	4:15	10/9/13 4:15	2.72	**12.1**	507.0	24.8		---	---	---	---		---	---	---	---
Car. C	10-Oct-2013	4:15	10/10/13 4:15	2.89	**11.8**	506.8	25.8		---	---	---	---		---	---	---	---
Car. C	11-Oct-2013	4:15	10/11/13 4:15	3.28	**14.2**	506.8	27.5		---	---	---	---		---	---	---	---
Car. C	12-Oct-2013	4:15	10/12/13 4:15	3.08	**13.5**	506.5	24.5		---	---	---	---		---	---	---	---
Car. C	13-Oct-2013	4:15	10/13/13 4:15	3.45	**14.3**	506.8	27.1		1.92	*6.8*	591.6	29.6		---	---	---	---
Car. C	14-Oct-2013	4:15	10/14/13 4:15	3.44	**12.3**	507.7	28.8		---	---	---	---		---	---	---	---
Car. C	15-Oct-2013	4:15	10/15/13 4:15	3.26	**14.7**	506.9	25.7		---	---	---	---		---	---	---	---
Car. C	16-Oct-2013	4:15	10/16/13 4:15	3.60	**16.5**	507.1	26.3		---	---	---	---		---	---	---	---
Car. C	17-Oct-2013	4:15	10/17/13 4:15	3.11	**16.2**	506.8	25.3		---	---	---	---		---	---	---	---
Car. C	18-Oct-2013	4:15	10/18/13 4:15	2.75	**12.9**	506.6	25.4		---	---	---	---		---	---	---	---
Car. C	19-Oct-2013	4:15	10/19/13 4:15	2.89	**13.5**	506.9	26.0		0.67	*3.1*	583.2	19.3		---	---	---	---
Car. C	20-Oct-2013	4:15	10/20/13 4:15	2.60	**11.5**	507.2	27.8		1.19	*5.3*	585.3	19.9		---	---	---	---
Car. C	23-Oct-2013	4:15	10/23/13 4:15	3.07	**12.9**	506.2	24.8		1.29	*5.4*	585.8	19.7		---	---	---	---
Car. C	24-Oct-2013	4:15	10/24/13 4:15	2.97	**13.8**	507.0	26.2		---	---	---	---		---	---	---	---
Car. C	26-Oct-2013	4:15	10/26/13 4:15	3.33	**10.1**	507.6	29.8		---	---	---	---		---	---	---	---
Car. C	28-Oct-2013	4:15	10/28/13 4:15	2.81	*9.9*	507.1	29.0		---	---	---	---		---	---	---	---
Car. C	29-Oct-2013	4:15	10/29/13 4:15	2.69	**11.3**	506.8	25.3		---	---	---	---		---	---	---	---
Car. C	30-Oct-2013	4:15	10/30/13 4:15	2.63	**11.0**	506.1	25.4		---	---	---	---		---	---	---	---
Car. C	31-Oct-2013	4:15	10/31/13 4:15	2.85	**12.3**	507.1	25.3		---	---	---	---		---	---	---	---
Car. C	1-Nov-2013	4:15	11/1/13 4:15	2.70	**11.0**	507.1	25.8		---	---	---	---		---	---	---	---
Car. C	2-Nov-2013	4:15	11/2/13 4:15	2.62	*9.6*	506.8	25.9		---	---	---	---		---	---	---	---
Car. C	3-Nov-2013	4:15	11/3/13 4:15	2.37	*9.5*	506.5	25.4		1.50	*6.0*	587.9	24.5		---	---	---	---
Car. C	4-Nov-2013	4:15	11/4/13 4:15	2.58	*8.6*	506.4	26.7		---	---	---	---		---	---	---	---
Car. C	5-Nov-2013	4:15	11/5/13 4:15	2.74	**11.7**	507.3	25.4		---	---	---	---		---	---	---	---
Car. C	6-Nov-2013	4:15	11/6/13 4:15	2.20	*9.8*	505.9	28.5		0.69	*3.1*	583.0	20.5		---	---	---	---
Car. C	9-Nov-2013	4:15	11/9/13 4:15	1.96	*8.7*	506.5	28.6		1.00	*4.4*	584.6	19.6		---	---	---	---
Car. C	10-Nov-2013	4:15	11/10/13 4:15	1.93	*8.8*	506.6	24.2		0.75	*3.4*	583.5	22.6		---	---	---	---
Car. C	11-Nov-2013	4:15	11/11/13 4:15	1.80	*8.5*	506.2	24.6		---	---	---	---		---	---	---	---
Car. C	15-Nov-2013	4:15	11/15/13 4:15	1.58	*5.3*	504.6	25.8		---	---	---	---		---	---	---	---
Car. C	16-Nov-2013	4:15	11/16/13 4:15	1.60	*7.9*	505.7	26.1		0.97	*4.8*	584.9	17.8		---	---	---	---
Car. C	17-Nov-2013	4:15	11/17/13 4:15	1.66	*8.4*	506.0	28.0		1.17	*5.9*	586.1	18.5		---	---	---	---
Car. C	18-Nov-2013	4:15	11/18/13 4:15	1.46	*7.0*	505.4	25.7		0.71	*3.4*	584.8	16.0		---	---	---	---
Car. C	19-Nov-2013	4:15	11/19/13 4:15	1.36	*5.4*	504.8	26.1		3.08	**12.1**	585.6	26.3		---	---	---	---
Car. C	21-Nov-2013	4:15	11/21/13 4:15	1.55	*7.3*	504.7	25.9		0.91	*4.3*	582.7	23.9		---	---	---	---
bank	13-Dec-2013			---	---	---	---		---	---	---	---		---	---	---	---
boil	13-Dec-2013			---	---	---	---		---	---	---	---		---	---	---	---

Rostvold Spring, MN28:A00073 (4,839,001N, 607,555E)

Sample	Date	Time	Uranine/Fluorescein				Rhodamine WT				Eosin			
			Peak Height	PH/σ	Peak Center	FWHM	Peak Height	PH/σ	Peak Center	FWHM	Peak Height	PH/σ	Peak Center	FWHM
			I.U.		*nm*	*nm*	*I.U.*		*nm*	*nm*	*I.U.*		*nm*	*nm*
							Bugs							
in	7-May-2013													
out	10-Jun-2013		---	---	---	---	---	---	---	---	17.6	**45.9**	538.4	18.6
in	23-Jul-2013													
out	16-Aug-2012		---	---	---	---	---	---	---	---	11.9	**28.6**	538.3	
in	16-Aug-2012													
out	11-Sep-2013		---	---	---	---	---	---	---	---	11.0	**13.8**	535.2	34.2
in	11-Sep-2013													
out	26-Sep-2013	2X	---	---	---	---	---	---	---	---	1.2	*5.0*	533.5	31.6
in	12-Sep-2013	bank												
out	17-Oct-2013		74.50	**140.7**	514.8	20.9	---	---	---	---	34.3	**64.8**	538.8	20.3
in	12-Sep-2013	boil												
out	17-Oct-2013		326.50	**244.6**	514.7	20.1	---	---	---	---	101.9	**76.3**	538.4	20.6
in	26-Sep-2013	?												
out	10-Oct-2013		19.47	**58.2**	514.7	20.7	---	---	---	---	3.3	*9.9*	538.1	23.9
in	10-Oct-2013	?												
out	24-Oct-2013		48.50	**67.4**	514.7	23.2	---	---	---	---	4.8	*6.7*	541.7	17.4
in	24-Oct-2013	?												
out	12-Nov-2013		47.48	**110.6**	514.6	21.3	---	---	---	---	4.8	**11.2**	540.3	19.4
in	17-Oct-2013	bank												
out	5-Nov-2013		185.12	**277.5**	514.9	20.2	---	---	---	---	18.0	**26.9**	538.2	21.7
in	17-Oct-2013	boil												
out	5-Nov-2013		1313.00	**---**	515.2	20.7	---	---	---	---	124.0		540.0	18.2
in	5-Nov-2013	bank												
out	21-Nov-2013		3.50		514.8	20.3	---	---	---	---	0.3		538.1	13.9
in	5-Nov-2013	boil												
out	21-Nov-2013		894.20		515.1	20.6	---	---	---	---	109.5		539.3	19.5
in	12-Nov-2013	?												
out	27-Nov-2013		8.11	**29.3**	514.5	21.5	---	---	---	---	2.3	*8.4*	537.6	23.7
in	21-Nov-2013	bank												
out	2-Dec-2013		59.34	**135.7**	514.9	20.5	---	---	---	---	14.8	**33.8**	538.0	21.1
in	21-Nov-2013	boil												
out	2-Dec-2013		225.10	**161.8**	514.7	20.6	---	---	---	---	61.7	**44.4**	538.1	21.7
in	27-Nov-2013	?												
out	11-Dec-2013		3.42	**11.1**	514.2	29.0	---	---	---	---	2.0	*6.6*	539.0	25.2
in	11-Dec-2013	?												
out	27-Dec-2013		4.24	**16.3**	514.6	24.7	---	---	---	---	3.0	**11.5**	538.6	20.6

Daley Creek Bug Set, MN28:X00009, (4,845,408 N, 605,589 E)

							Bugs							
in	7-May-2013													
out	10-Jun-2013		---	---	---	---	---	---	---	---	---	---	---	---
in	12-Jul-2013													
out	23-Jul-2013		---	---	---	---	---	---	---	---	1.2	*3.9*	537.0	23.0
in	23-Jul-2013													
out	16-Aug-2013		---	---	---	---	---	---	---	---	2.4	*6.9*	534.2	27.3
in	16-Aug-2013													
out	11-Sep-2013		1.60	*3.4*	515.5	12.5	---	---	---	---	9.7	**20.3**	535.0	30.7
in	11-Sep-2013													
out	26-Sep-2013		---	---	---	---	---	---	---	---	---	---	---	---
in	26-Sep-2013													
out	10-Oct-2013		---	---	---	---	---	---	---	---	---	---	---	---
in	10-Oct-2013													
out	24-Oct-2013		---	---	---	---	2.80	*4.7*	586.1	19.5	---	---	---	---
in	24-Oct-2013													
out	12-Nov-2013		---	---	---	---	---	---	---	---	1.9	*6.7*	533.0	34.1
in	12-Nov-2013													
out	27-Nov-2013		---	---	---	---	---	---	---	---	---	---	---	---
in	27-Nov-2013													
out	11-Dec-2013		---	---	---	---	---	---	---	---	---	---	---	---
in	11-Dec-2013													
out	27-Dec-2013		---	---	---	---	---	---	---	---	---	---	---	---

Bridge Creek Outlet/BCO Bug Set, MN28:X00022, (4,839,663 N, 606,858 E)

Bugs

in	7-May-2013															
out	10-Jun-2013			---	---	---	---		---	---	---	---	---	---	---	---
in	12-Jul-2013															
out	23-Jul-2013			---	---	---	---		---	---	---	---	5.2	**14.9**	536.7	26.0
in	23-Jul-2013															
out	16-Aug-2013			---	---	---	---		---	---	---	---	---	---	---	---
in	16-Aug-2013															
out	11-Sep-2013			---	---	---	---		---	---	---	---	---	---	---	---
in	11-Sep-2013															
out	26-Sep-2013			17.60	**30.5**	515.6	23.8		---	---	---	---	8.5	**14.7**	539.1	24.6
in	10-Oct-2013															
out	24-Oct-2013	3X		43.70	**49.1**	514.6	24.6		---	---	---	---	---	---	---	---
in	24-Oct-2013															
out	12-Nov-2013			16.06	**34.5**	514.9	20.1		---	---	---	---	4.5	*9.6*	536.4	22.7
in	12-Nov-2013															
out	27-Nov-2013			25.60	**59.7**	515.0	20.6		---	---	---	---	5.5	**12.9**	537.5	24.0
in	27-Nov-2013															
out	11-Dec-2013			13.96	**22.4**	515.2	21.3		---	---	---	---	5.6	*8.9*	534.6	27.6
in	11-Dec-2013															
out	27-Dec-2013			19.46	**37.7**	515.0	18.8		---	---	---	---	7.2	**14.9**	535.4	25.7

Jerry Lee Spring Run Bug Set, MN28:A00029, (4,840,903N, 605,389E)

Bugs

in	7-May-2013															
out	10-Jun-2013			---	---	---	---		---	---	---	---	---	---	---	---
in	10-Jun-2013															
out	12-Jul-2013			---	---	---	---		---	---	---	---	---	---	---	---
in	12-Jul-2013															
out	23-Jul-2013			---	---	---	---		---	---	---	---	---	---	---	---
in	23-Jul-2013															
out	16-Aug-2013			---	---	---	---		---	---	---	---	---	---	---	---
in	16-Aug-2013															
out	26-Sep-2013	8X		72.65	**182.4**	514.6	20.1		---	---	---	---	---	---	---	---
in	26-Sep-2013															
out	10-Oct-2013			61.30	**169.6**	514.6	20.1		---	---	---	---	---	---	---	---
in	10-Oct-2013															
out	24-Oct-2013			56.00	**133.7**	514.7	20.3		---	---	---	---	1.7	*4.0*	542.9	29.3
in	24-Oct-2013															
out	12-Nov-2013			49.20	**119.8**	514.5	20.3		---	---	---	---	1.5	*3.6*	540.8	30.0
in	12-Nov-2013															
out	27-Nov-2013	2X		40.17	**129.5**	514.7	20.4		---	---	---	---	1.4	*4.4*	539.7	25.8
in	27-Nov-2013															
out	11-Dec-2013			41.86	**123.0**	514.7	20.9		---	---	---	---	---	---	---	---
in	11-Dec-2013															
out	27-Dec-2013			53.06	**150.4**	514.4	21.1						2.4	*5.4*	539.5	33.6

Frauenkron Crossing Bridge Creek Bug Set, MN28:X00023, (4,841,122 N, 604,863 E)

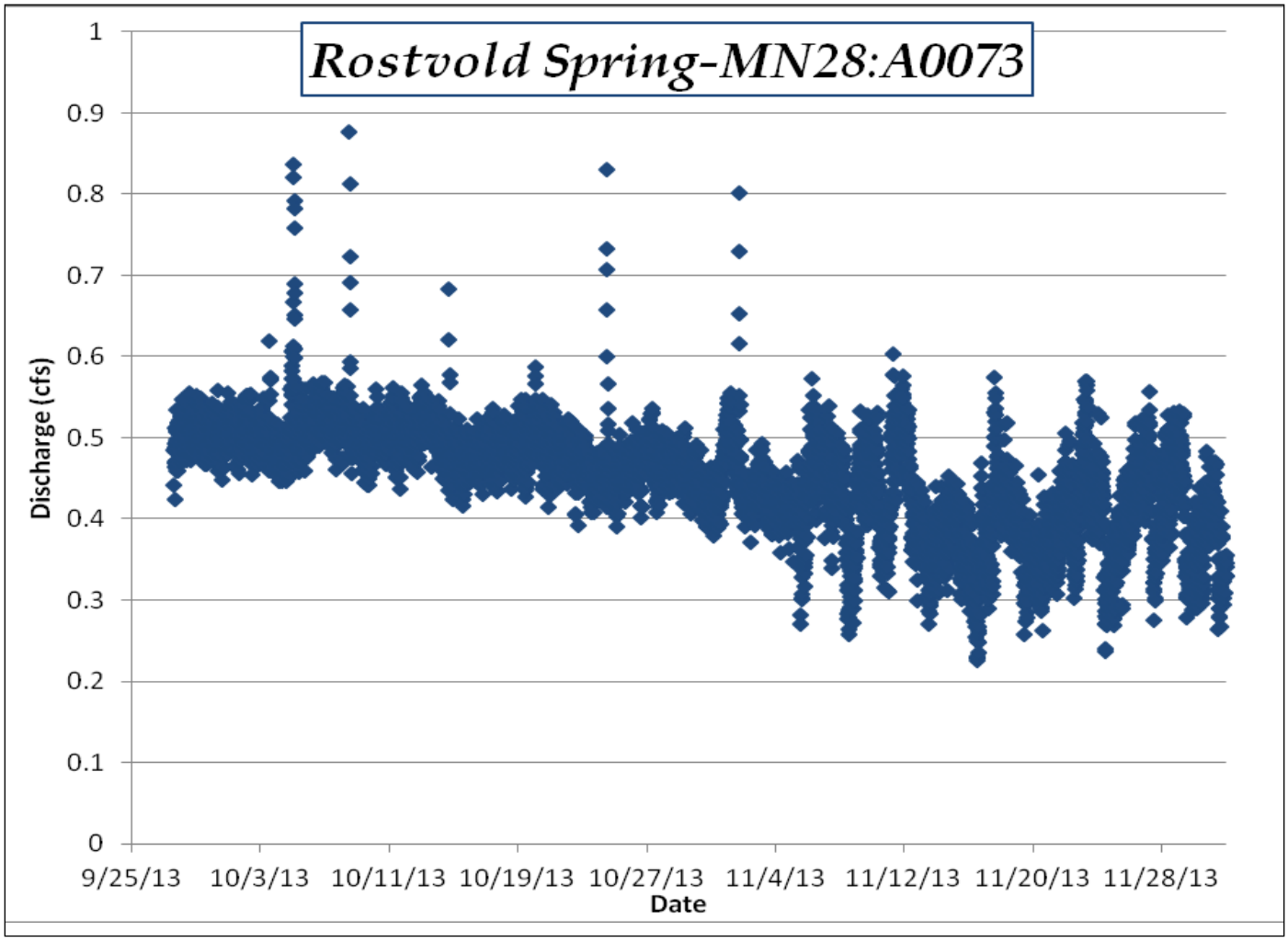
Bugs

in	7-May-2013														
out	10-Jun-2013			---	---	---	---	---	---	---	---	---	---	---	---
in	12-Jul-2013														
out	23-Jul-2013			---	---	---	---	---	---	---	---	3.5	**12.4**	537.1	23.5
in	16-Aug-2013														
out	11-Sep-2013			3.76	*9.5*	515.8	25.8	---	---	---	---	8.3	**20.8**	536.8	30.8
in	11-Sep-2013														
out	26-Sep-2013	2X		47.79	***40.0***	515.2	30.9	---	---	---	---	---	---	---	---
in	26-Sep-2013														
out	10-Oct-2013			56.60	**86.7**	515.0	22.7	---	---	---	---	4.3	*6.6*	542.6	26.7
in	10-Oct-2013														
out	24-Oct-2013			36.10	**80.5**	515.2	21.9	---	---	---	---	6.5	**14.6**	539.3	18.6
in	10-Oct-2013														
out	24-Oct-2013			9.85	**18.7**	515.7	21.5	---	---	---	---	5.6	**10.5**	538.0	22.3
in	12-Nov-2013														
out	27-Nov-2013			8.98	**19.3**	514.3	21.6	---	---	---	---	11.0	**23.6**	537.0	25.9
in	27-Nov-2013														
out	11-Dec-2013			5.27	**11.1**	515.0	24.2	---	---	---	---	6.0	**12.6**	537.3	25.9
in	11-Dec-2013														
out	27-Dec-2013			8.71	**17.2**	514.8	24.2	---	---	---	---	11.4	**22.5**	537.5	23.3

Bolster Spring Pond Bug, MN23:A00093, (4,840,259 N, 605,761 E)

Sample	Date	Time or Dil.	Uranine/Fluorescein				Rhodamine WT				Eosin			
			Peak Height	PH/σ	Peak Center	FWHM	Peak Height	PH/σ	Peak Center	FWHM	Peak Height	PH/σ	Peak Center	FWHM
			I.U.		*nm*	*nm*	*I.U.*		*nm*	*nm*	*I.U.*		*nm*	*nm*
Bugs														
in	11-Sep-2013													
out	26-Sep-2013	4X	---	---	---	---	---	---	---	---	---	---	---	---
in	26-Sep-2013													
out	10-Oct-2013		---	---	---	---	---	---	---	---	---	---	---	---
in	10-Oct-2013													
out	24-Oct-2013		12.00	**25.3**	517.5	45.5	---	---	---	---	---	---	---	---
in	24-Oct-2013													
out	12-Nov-2013		3.89	**11.1**	517.0	41.3	---	---	---	---	---	---	---	---
in	12-Nov-2013													
out	27-Nov-2013		13.33	**21.2**	514.8	50.3	---	---	---	---	---	---	---	---
in	27-Nov-2013													
out	11-Dec-2013		8.20	**21.4**	514.5	40.3	---	---	---	---	---	---	---	---
in	11-Dec-2013													
out	27-Dec-2013		32.99	**44.3**	515.1	31.3	---	---	---	---	---	---	---	---

Appendix 4 – Volumetric Flow measured at Rostvold Spring (MN28:A00076)



Appendix 5 –Anion Chemistry of the Bridge Creek Watershed

			Fluoride	Chloride	Nitrite - N	Bromide	Nitrate - N	Sulfate	Phosphate - P	Cl/Br
	Concentration Units =>		ug/g	ug/g	ug/g	ug/g	ug/g	ug/g	ug/g	
	Detection Limits for 1x Dilution (<)		0.005	0.010	0.002	0.005	0.001	0.020	0.005	
	Sample Name	Sample Date								
Bridge Creek	Bridge Creek Surface Water	9/12/2013	**0.089**	**7.594**	**0.005**	**0.013**	**5.278**	**8.082**	**0.081**	**608**
	Rolland Rogers Well	9/12/2013	**0.075**	**7.218**	**0.002**	**0.018**	**4.412**	**9.197**	**0.005**	**401**
	Frauenkron Well	3/4/2014	**0.103**	**7.140**	**0.002**	**0.018**	**4.621**	**9.687**	**0.010**	**408**
	Frauenkron Spring	3/4/2014	**0.089**	**7.939**	**0.010**	**0.017**	**4.428**	**9.567**	**0.005**	**467**
	Frauenkron Spring	3/17/2014	**0.098**	**8.255**	**0.027**	**0.013**	**5.095**	**8.284**	**0.041**	**635**
	Jerry Lee Spring	3/4/2014	**0.102**	**7.477**	**0.029**	**0.019**	**4.729**	**9.631**	**0.005**	**394**
	Rostvold Spring Bank	3/4/2014	**0.087**	**4.475**	**0.003**	**0.014**	**2.727**	**10.825**	**0.005**	**320**
	Rostvold Spring 28A74	9/12/2013	**0.079**	**4.278**	**0.002**	**0.013**	**2.574**	**10.400**	**0.005**	**329**