

**Spatial and Temporal Transitions in the Composition and Transport of Carbon under
Variable Flow**

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partial fulfillment of the requirements for the degree of

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ABSTRACT

Recent studies have focused on dissolved organic matter (DOM) cycling throughout river corridors or in reservoirs, but few have explored DOM cycling in commonplace but understudied run-of-river (ROR) reservoir systems. Impoundments disrupt river flow patterns, as they increase hydraulic residence time and alter the flow of DOM downstream. During storms when the majority of DOM loading occurs, impoundments become less likely to hold DOM and will increase export of DOM downstream. In this study, we quantified DOM bioavailability and composition, carbon flux, and carbon dioxide (CO₂) gas evasion in a ROR reservoir system at baseflow conditions and across a 1.5-year storm event. This study used a combination of high frequency spatial sensor data geotagged to GPS coordinates along the river to reservoir transition, and grab samples of surface water taken at two U.S. Geological Survey stream gauges and three additional sites. The landscape and shallow flow paths to ROR reservoir systems resulted in the export of both aromatic carbon and labile organic matter present within these waters, as water was mixed and exported downstream. Additionally, the reservoir was a net sink of DOC and BDOC flux, while also a source of DIC flux. Finally, CO₂ evasion was magnified by high flow, with the reservoir changing from a sink to a source of CO₂ to the atmosphere. ROR reservoirs may undergo “short-circuiting” during high flow, which alters DOM transformations and transport of carbon downstream. Our results provide critical insight on carbon dynamics in ROR reservoir systems and highlight the need to incorporate riverine DOM into carbon budgets, especially under variable flow conditions.

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GENERAL AUDIENCE ABSTRACT

Recent studies have focused on dissolved organic matter (DOM) cycling through river corridors, as DOM provides energy to aquatic food webs and can be converted to carbon dioxide (CO₂) through microbial respiration. Few studies have explored DOM cycling in commonplace but understudied run-of-river (ROR) reservoir systems. ROR reservoirs are created by the implementation of a dam across a river channel and use the flow of the river to generate hydroelectric power. During storms, when the majority of DOM loading occurs, impoundments become less likely to hold DOM and will increase export of DOM downstream. In this study, we quantified DOM quality and composition, DOM transport, and carbon dioxide (CO₂) gas evasion in a ROR reservoir system at baseflow conditions and across a 1.5 year storm event. This study used a combination of high frequency spatial sensor data combined with GPS coordinates along the river to reservoir transition, and grab samples of surface water taken at two U.S. Geological Survey stream gauges and three additional sites. Results show that the landscape and shallow flow paths to ROR reservoir systems resulted in the export of both high and low quality carbon present within these waters, as water was mixed and exported downstream. Additionally, the reservoir was a net sink of DOM flux, retaining 40.7% of the total DOM loading for the storm event. Finally, CO₂ evasion was magnified by the storm event, with the reservoir changing from a sink to a source of CO₂ to the atmosphere. Our results provide critical insight on carbon dynamics in ROR reservoir systems and highlight the need to incorporate riverine DOM into carbon budgets, especially under variable flow conditions.

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List of Abbreviations

ADCP Acoustic Doppler Current Profiler

BDOC Bioavailable Dissolved Organic Carbon

CDOM Coarse Dissolved Organic Matter

CO_3^{2-} Carbonate

CO_2 Carbon Dioxide

DO Dissolved Oxygen

DOC Dissolved Organic Carbon

H Hydrogen

HCO_3^- Bicarbonate

H_2CO_3 Carbonic Acid

N Nitrogen

O Oxygen

P Phosphorus

R^2 Correlation Coefficient

ROR Run-of-River

1. Literature Review

1.1 Introduction

Organic carbon is the backbone of biology in both terrestrial and aquatic systems. A large fraction of organic carbon within aquatic ecosystems is dissolved organic matter (DOM) (Aitkenhead-Peterson et al. 2003, Battin et al. 2008). While approximately 50% of DOM is carbon, the remaining percentage includes nitrogen (N), phosphorus (P), hydrogen (H), and oxygen (O) (Thurman 1985, Johnson 2010, McDowell et al. 2006). DOM influences geochemical reactions, nutrient uptake and cycling, and productivity of food webs (Kaplan and Cory 2016, Jane et al. 2017). DOM has the capacity to bind pollutants, such as heavy metals, and transport them downstream (Weng et al. 2002). DOM also plays a role in drinking water treatment, as treated water pulled from rivers can create chlorine (Cl^-) disinfection by-products from its reactions with DOM (Dotson et al 2009).

DOM cycling within a river network should therefore be a significant component of climate change studies, as DOM contributes carbon to global carbon cycles and is converted to carbon dioxide (CO_2) through microbial respiration (Metting 1993). Though the production of CO_2 from DOM and its subsequent release to the atmosphere is not as large a flux as that produced by anthropogenic sources, present estimates are around 2.1 Pg C yr^{-1} (Raymond et al. 2013). These fluxes are significant to global carbon balances, as they can change diurnally, seasonally, and with variable flow (Aitkenhead-Peterson et al. 2003, Raymond et al. 2016). Recent studies have focused on understanding DOM cycling throughout river corridors (Raymond et al. 2016, Kaiser et al. 2017). One such system that is not well-understood is run-of-river reservoirs (ROR), defined as rivers that have been impounded to create hydroelectric

impoundments, using the flow rate of the river to generate power (Office of Energy Efficiency & Renewable Energy 2017). These systems disrupt the normal flow pattern of the river by creating reservoirs along their flow paths to hold water for electrical production. Furthermore, reservoirs increase water residence times which likely alters biogeochemical cycling and DOM transport (Paerl and Huisman 2008). Reservoirs created from impoundments can also change the flux of both organic and inorganic carbon to the atmosphere and to downstream waters (Aitkenhead-Peterson et al. 2003, Tranvik et al. 2009).

This review examines DOM sources to better understand different contributions of carbon to river ecosystems. This review will then examine the composition of DOM and how it affects the transformations of DOM. Lastly, this review will describe typical transport processes for DOM, and inorganic carbon's role in DOM processes.

1.2 Dissolved Organic Matter – Transformations and Transport

1.2.1 Sources of Dissolved Organic Matter

DOM in natural waters is sourced from both the terrestrial and aquatic landscapes. Terrestrial sources include soils, leaf detritus, and products of incomplete decomposition of plants and animals (Aiken et al. 1985). Terrestrial DOM within freshwater is referred to as allochthonous carbon, and enters rivers and stream networks via shallow subsurface flow, groundwater, and high-discharge storm events (Kaplan and Cory, 2016, Raymond et al. 2016). DOM within freshwater sourced from photosynthesis by aquatic plants, bacteria, and algae, and by the decomposition of detritus is known as autochthonous carbon (Carlson and Hansell 2015, Jane et al. 2017). The contribution of these DOM sources changes spatially and temporally along a river network due to changes in riverbed geomorphology, land use, and hydrology. For

instance, a large storm event could provide a significant influx of allochthonous carbon to the river, thus altering the DOM pool within the river network. DOM concentrations, measured as dissolved organic carbon (DOC), tend to vary with different ecosystem types, as shown by Table 1 below. Soils from the terrestrial landscape tend to have the highest concentrations of DOM, while ocean waters typically have the lowest concentrations.

Table 1.1. Examples of DOC and SUVA₂₅₄ values

Ecosystem	DOC (mg L⁻¹)	SUVA₂₅₄ (L m⁻¹mg⁻¹)
Soils	35 – 45 ¹⁷	2.8 – 3.3 ¹⁷
Wetland	15 – 30 ³⁷	2.8 – 4.2 ^{23,40}
Groundwater	0.5 – 3.7 ¹	1.7 – 3.7 ²³
Lake	1 – 25 ²	3.2 – 4.3 ²⁷
Stream / River	0.5 – 30 ^{2,25,26,48}	2.8 – 5.3 ^{21,57}
Ocean	0.5 - 3.0 ²	0 - 1.7 ⁵⁹

Spatial changes in sources of DOM are often understood through the river continuum concept (RCC) (Vannote et al. 1980). The RCC stipulates that a river's physical conditions change along a gradient of headwater streams to larger rivers. The gradient of changes along the river continuum have a great effect on the sources and transformations of DOM, and rivers are inclined towards chemostasis (Vannote et al. 1980, Creed et al. 2015). It is expected that there would be greater amounts of allochthonous carbon in headwater streams, since there is more shade and greater terrestrial inputs of DOM. As these streams transition along the RCC to larger, wider rivers without shade, there are greater concentrations of autochthonous carbon, as terrestrial inputs of carbon decrease and more primary production of carbon can occur (Vannote et al. 1980, Creed et al. 2015). DOC concentrations are directly related to discharge,

Anthropogenic alterations to river systems, such as the implementation of impoundments, are also likely to alter the spatial distribution of DOM. Impoundments create slow flow and increase residence time in rivers, and will likely change the normal transport and transformations of DOM (Duan et al. 2007).

1.2.2 Composition of Dissolved Organic Matter

DOM is comprised of many different components, including plant biomass, litter, humus, amino acids, lignins and proteins (Nelson and Sommers 1965, Thurman 1985). As mentioned previously, DOM is sourced from a combination of allochthonous or autochthonous sources. Allochthonous carbon is primarily made up of fulvic and humic substances, and accounts for approximately 50% of total DOM composition (Thurman 1985). Allochthonous carbon also contains stable lignins, lipids, and pyrogenics, which tend to be structurally complex and more persistent in freshwaters (Lehmann and Kleber 2015). Conversely, autochthonous carbon tends to be less structurally complex and more biologically available than allochthonous carbon (Thorpe and Delong 2002, Kritzberg et al. 2005, Guillemette et al. 2013). Autochthonous carbon is comprised of low molecular weight materials, such as carbohydrates, proteins and organic acids (Hansen et al. 2016).

The carbon contained in DOM is generally divided into two classes based on its availability to organisms. The two classes - labile and refractory - do not completely define the composition of carbon in DOM; rather a combination of the two classes exists. Labile carbon is the fraction of organic matter that has the most rapid turnover times and its oxidation drives fluxes of CO₂ between soils and water to the atmosphere. Labile carbon is easily consumed due to its saturated, chain-like structure, and supports heterotrophic metabolism (Kaplan and Cory 2016). Refractory carbon can only be slowly decomposed because it is partially oxidized and is essentially inert

due to its aromatic, ring structure (Kaplan and Cory 2016). Overall, labile carbon tends to be more reactive in river ecosystems, while refractory carbon tends to be more persistent. The quality of this DOM changes downstream as its sources become less allochthonous and more autochthonous (Creed et al. 2015).

1.2.3 Transformations of Dissolved Organic Matter

Within a ROR network, DOM undergoes many transformations and its concentration alters as it moves downstream (Wollheim et al. 2015). When allochthonous carbon enters a stream, its compounds are broken down by bacteria, which then respire CO₂ to the water column. The CO₂ is either released to the atmosphere or transported downstream to be used by primary producers for photosynthesis (Aiken et al. 1985). The primary producers transform CO₂ into organic compounds, which are then released by secretion or autolysis (Carlson and Hansell 2015). Primary consumers, such as heterotrophic aerobic bacteria, utilize the organic compounds for energy and mineralize them into CO₂ (Aiken et al. 1985, Carlson and Hansell 2015). Metabolism of DOM is not 100% efficient, and refractory, persistent compounds not utilized will be transported downstream. Generally, it is expected that higher rates of respiration rather than gross primary production will occur in headwater streams where primary production is low due to shading effects and external inputs of carbon are high. The mineralization of DOM to CO₂ is altered down this continuum, as respiration is highest in headwaters but internal primary production increases downstream with decreases in shading (Odum 1956, Hotchkiss et al. 2015).

DOM can also be transformed through photodegradation or complexation, which occurs when DOM becomes photoexcited by light energy from the sun and is broken down into simpler compounds. The simpler compounds created include labile, low-molecular weight DOM, refractory, partially oxidized DOM, and CO₂ (Kaplan and Cory 2016). Photodegradation can

have mixed effects, increasing or decreasing DOM lability, and can either reduce or increase the rate of bacterial respiration (Tranvik and Bertilsson 2001). Thus, photodegraded DOM that has become less labile will result in reduced mineralization of DOM to CO₂. Alternatively, DOM can become more labile and broken down more quickly through metabolism (Kaplan and Cory 2016).

Differing hydrologic regimes play a large role in the transformations of DOM, and the damming of rivers is likely to alter these transformations in many ways (McCully 2001; Catalan 2016). Short residence times found in rivers create reduced time for microorganisms to use and break down organic carbon in DOM (Harvey 2016). Conversely, long residence times found in lakes and reservoirs allow for greater time for microorganisms to break down the organic carbon in DOM, greater contact surface time with river sediments, and increased fixation of carbon as CO₂ from the atmosphere or release of CO₂ from respiration (Harvey 2016, Covino 2017). Thus, the productivity of the aquatic food web is likely to change as the DOM pool is altered by hydrologic regime from more labile to more refractory carbon or vice versa.

1.2.4 Transportation of Dissolved Organic Matter

The transport characteristics of DOM affect the chemical and physical changes it will undergo. As mentioned previously, terrestrial inputs of carbon will occur on a regular basis to a stream. Some of this carbon comes from overland flow, while other sources include groundwater flow into a system. The distance DOM travels downstream is known as its spiraling length, and is largely dependent on its bioavailability and river flow (Newbold et al. 1982). Labile carbon will travel shorter distances due to its high bioavailability, and thus it has a short spiraling length (Covino 2017). Refractory or persistent carbon will travel longer distances downstream due to its low bioavailability, so it has a long spiraling length (Kaplan and Cory 2016, Covino 2017). The

spiraling length of all DOM increases as river size grows larger downstream and discharge increases (Kaplan and Cory 2016, Covino 2017).

A large flux of allochthonous carbon enters through runoff during a storm due to increased overland flow, which increases water connection to the terrestrial landscape (Raymond et al. 2016). The runoff flushes less processed carbon in, which alters the DOM pool from higher loads of autochthonous carbon to higher loads of allochthonous carbon. A storm can also increase water discharge within the aquatic ecosystem, which decreases residence time and increases export of DOM downstream. This is likely to affect the typical composition and bioavailability of DOM transported downstream (Raymond and Spencer 2015, Raymond et al. 2016).

1.3 Dissolved Inorganic Carbon – Transport and Processes

Inorganic carbon exists as CO_2 in the atmosphere, and in many forms dissolved in water, including CO_2 , carbonic acid (H_2CO_3), bicarbonate (HCO_3^-) and carbonate (CO_3^{2-}). The fractions of inorganic carbon within the water column depends largely on the surrounding pH and buffering capacity (Dodds and Whiles 2010). The role of inorganic carbon (specifically CO_2) in rivers and reservoirs to biogeochemical cycling is important, as studies have shown that rivers tend to be supersaturated with CO_2 compared to the atmosphere (e.g. Raymond et al. 1997, Raymond et al. 2013).

Inorganic carbon enters the stream ecosystem from the terrestrial environment through many different pathways. CO_2 produced from metabolism in soils and H_2CO_3 and HCO_3^- produced from weathering in groundwater are hydrologically transported into streams (Finlay 2002). Mineralization of these inputs tends to be greater than primary production, particularly in

smaller streams. These waters tend to be supersaturated with CO₂. As mentioned previously, CO₂ plays a role in the metabolism of all aquatic organisms, and is used to produce carbon (as DOC) and oxygen (O₂) (Aiken et al. 1985, Carlson and Hansell 2015). CO₂ concentrations, in lakes and reservoirs especially, can vary spatially and temporally and may limit gross primary productivity in periods of low CO₂ (Hamden et al. 2018).

Running waters have the potential to evade CO₂ to or draw in CO₂ from the atmosphere based on saturation, and therefore can either be sources or sinks of CO₂ (La Quere et al 2009, Butman and Raymond 2011). Nutrients can also play a role in the evasion of CO₂, as it has been shown that an increase in the emission of CO₂ to the atmosphere can occur after the addition of nutrients, such as nitrogen (N) and phosphorus (P), due to increased microbial respiration (Rosemond et al. 2016). Geomorphology and discharge will also influence the transport and cycling of CO₂. CO₂ concentrations within the water column tend to decrease with increasing stream size during baseflow conditions, largely due to increased algal uptake with increasing stream size (Finlay 2002). CO₂ concentrations in water tend to decrease with increasing discharge, though this is likely driven by sources of CO₂. Low discharge results in higher CO₂ concentrations due to low degassing, unlike in higher flows where CO₂ concentrations are lower due to higher turbulence in the water which allows for high degassing of CO₂ to the atmosphere (Finlay 2002, Covino 2017).

1.4 Characterization of DOM: A multi-pronged approach

Due to the chemical complexity of DOM, characterizing its makeup and concentration is a multi-pronged approach. The concentration of DOM found in river ecosystems is measured by collecting DOC concentrations. The operational definition of DOC is any organic carbon in

solution that can pass through a 0.22µm GFF filter (Hedges 1992). DOC is a measure of the total organic carbon concentration of DOM, including organic carbon from plant biomass, litter, and humus. The composition of carbon in DOM is difficult to measure due to the chemical complexity of DOM. One method for determining the aromatic character of DOM is using a measure of specific ultraviolet absorbance (SUVA₂₅₄) (Weishaar et al. 2003). SUVA₂₅₄ is calculated by dividing a sample's ultraviolet absorbance at 254 nanometers (m⁻¹) by the DOC concentration (mg L⁻¹). SUVA₂₅₄ is a simple measure of the aromaticity of the molecules that comprise DOM. SUVA₂₅₄ values tend to vary with ecosystem types (Table 1.1). One other method for determining DOM's aromatic character has been to use fluorescence spectroscopy to distinguish pools of compounds within DOM (Mopper and Schultz 1993, Chen et al. 2003). These methods allow for the distinction of aromatic compounds within DOM, and allow for a better understanding of the type of DOM carbon present within a system.

Many studies have focused on the transfer of carbon and water between air and surface waters, but it has been difficult to identify the factors that specifically control these fluxes in freshwaters. It has also been difficult to correctly identify concentrations and types of carbon in river networks as they are transported downstream and decomposed. One method of “tracking” carbon cycling and transport has been to use isotopic signatures. ¹³C is a value that indicates the origin and migration pathways for carbon sources for both dissolved organic carbon and dissolved inorganic carbon (van Geldern et al. 2013). ¹³C is an isotope ratio of heavy to light isotopes, ¹³C/¹²C, and is used to determine levels of processed carbon, respiration and primary production, and gas transfer velocity (*k*) (van Geldern et al. 2013). More positive values for the isotopic ratios indicate that “lighter”, more processed carbon dominates; whereas more negative values indicate that “heavier”, more enriched carbon dominates (van Geldern et al. 2013).

Tracers composed of ^{13}C have been utilized in many studies to quantify pathways and carbon cycling in freshwater systems (Hall 1995, Cole et al. 2002, Lyon and Ziegler 2009, Hotchkiss and Hall 2015). Carbon isotopes give insight into how available the carbon is as an energy source. Since the focus of this paper is to quantify changes in carbon species resulting from high flow, it is expected that younger, less processed carbon released to stream water after a storm will dominate the species of carbon within the water column, and will likely be flushed downstream with increasing discharge (Schiff et al. 1997, Neff et al. 2006, Raymond et al. 2007, Sanderman et al. 2009).

1.5 Conclusion

Previous studies on DOM transport and cycling show rivers and streams alter carbon quality and quantity both spatially and temporally. The implementation of impoundments on these waters changes the hydrologic regime by slowing river flow and increasing residence time. This in turn alters the biogeochemical processes and the timing and location of reaction sites with which these processes occur naturally. Flood pulses from high precipitation storm events will likely further change the transport and cycling of DOM along this discontinuum, as new water from the landscape and upstream will replace or mix with older water in the system. The water column stability could be disrupted as hydraulic residence time is altered. DOM transport after a storm event is well-known (Raymond et al. 2015), but how DOM fluxes, bioavailability, and transformations are altered in a ROR and during high flow is less extensively studied (Awad et al. 2017, Chow et al. 2011).

1.6 Research Objectives

We quantified DOM concentrations, flux, bioavailability and composition, as well as CO₂ gas evasion, spatially along a river to reservoir transect at baseflow and during high flow. Our objectives were to determine:

- (1) how a reservoir alters DOM bioavailability and composition during high flow versus baseflow;
- (2) how high flow alters the flux of carbon in a ROR reservoir system; and
- (3) how high flow affects CO₂ gas evasion in a ROR reservoir system.

This study contributes to the discussion on the impacts of man-made impoundments on riverine biogeochemistry and overall function.

1.7 Organization of Thesis

This document is organized around a journal article that will be submitted for publication in *Limnology and Oceanography*. A literature review precedes the article, providing an overview of biogeochemical cycling, transport, and controls on DOM in rivers and reservoirs. Chapter 2 will be the paper submitted for publication in *Limnology and Oceanography*.

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2. Spatial and Temporal Transitions in the Composition and Transport of Carbon under Variable Flow

In preparation for Limnology and Oceanography

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2.1 Introduction

Dissolved organic matter (DOM) generally represents greater than 50% of the total organic carbon pool within rivers, with the remaining organic carbon bound within sediments or detritus (e.g. leaves and wood) (Malcolm 1985). DOM is composed primarily of carbon, but is also composed of nitrogen (N), phosphorus (P), hydrogen (H), and oxygen (O) (Thurman 1985, Johnson 2010, McDowell et al. 2006). DOM supports geochemical reactions, nutrient uptake and cycling, and productivity of food webs (Kaplan and Cory 2016; Jane et al. 2017). DOM contributes to global carbon cycles and is oxidized to carbon dioxide (CO₂) through microbial respiration (Metting 1993; Hotchkiss et al. 2015). Rivers and other inland waters contribute CO₂ gas emissions to the atmosphere, which are sourced from DOM mineralization or by CO₂ - rich groundwater and soil water inputs (Butman and Raymond 2011; Lauerwald et al. 2015). Current estimates of CO₂ emissions from inland waters are around 2100 mil. metric tonsC yr⁻¹ (Raymond et al. 2013), a small fraction compared to the 9855 mil. metric tonsC yr⁻¹ emitted from anthropogenic sources (Boden et al. 2017). DOM and CO₂ fluxes should be a key component of climate change studies and represented in global carbon balances since they can change diurnally, seasonally, and with variable flow (Aitkenhead-Peterson et al. 2003; Raymond et al. 2016).

Recent studies have focused on DOM cycling throughout river corridors (Raymond et al. 2016, Kaiser et al. 2017); however, one such system that is not well-understood is run-of-river (ROR) reservoirs. These systems disrupt normal river flow patterns, creating a reservoir formed by the construction of an impoundment. Reservoirs serve multiple functions, such as water level and flood control, irrigation, recreational activities, municipal drinking water, and generation of hydroelectric power (Rutledge et al. 2011; Office of Energy Efficiency & Renewable Energy

2017). Reservoirs also increase water residence time, which alters biogeochemical cycling and transport of DOM (Parks and Baker 1997; Paerl and Huisman 2008; Oliver et al. 2016).

Additionally, reservoirs are likely to change the flux of both organic and inorganic carbon to the atmosphere and downstream (Aitkenhead-Peterson et al. 2003; Tranvik et al. 2009; Williamson et al. 2009; Oliver et al. 2016).

At baseflow conditions, deep groundwater is the primary source of river water. After a storm, shallow subsurface flow paths from the terrestrial landscape are activated by precipitation and runoff, shifting water source contribution between “old” and “new” water (Pearce et al. 1986). Reservoirs, which are generally stratified into water layers based on salinity and temperature, receive river water before releasing water downstream. The contribution of water from each of the layers to downstream flow is likely to change as discharge, temperature, and other water quality parameters are altered by high flow.

Export of DOM in rivers and reservoirs is expected to increase during high flow (Inamdar et al. 2006; Raymond and Saiers 2010). Large fluxes of external, allochthonous carbon enters through shallow subsurface flow paths and increased overland flow, which increases landscape connectivity (Raymond et al. 2016). The contribution of allochthonous carbon alters the DOM pool composition from more autochthonous, or algal, carbon to a mixture of old and new carbon with varying composition and reactivity (Hood et al. 2006; Tranvik et al. 2009). As residence time, source contribution of water, and discharge are altered, the composition and bioavailability of DOM found within and downstream of an ROR reservoir is likely to change (Raymond and Spencer 2015; Raymond et al. 2016).

In this study, we quantified DOM cycling and transport through an ROR reservoir system during variable flow and weather. We quantified DOM concentrations, flux, bioavailability and

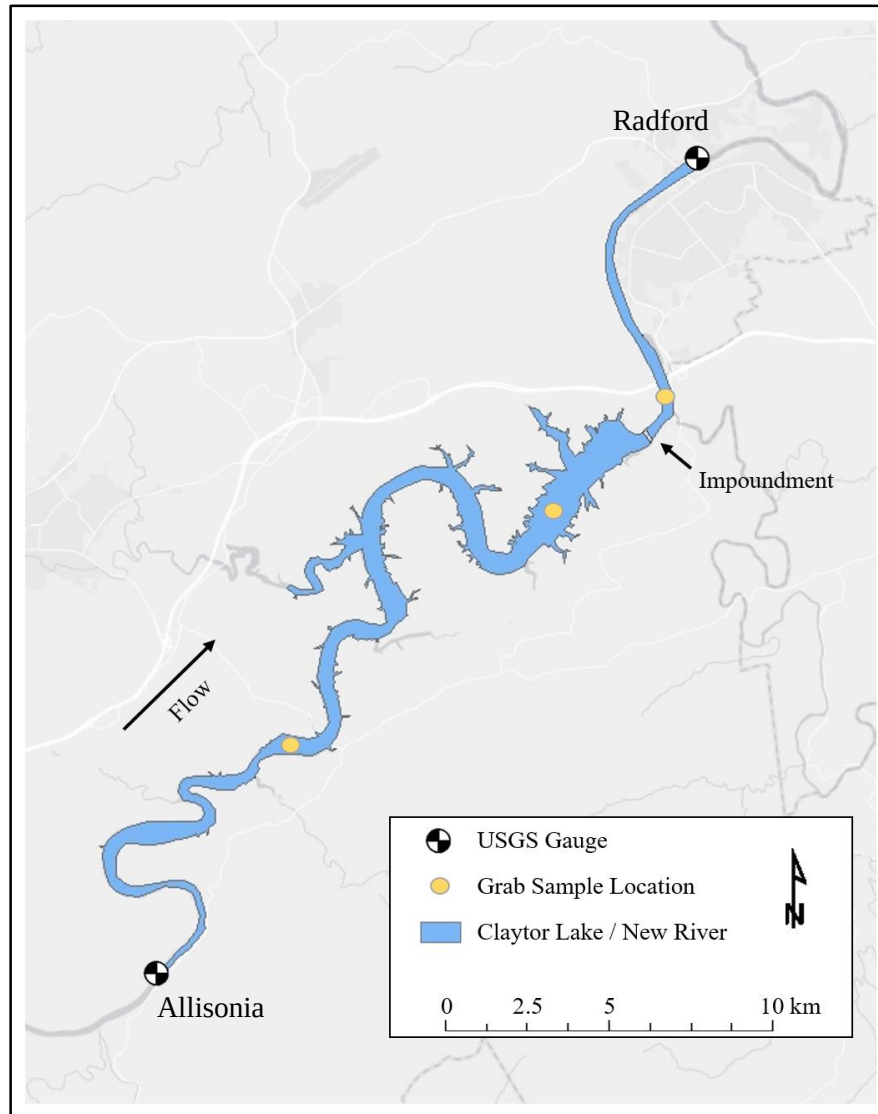
composition, and CO₂ gas evasion along a river to reservoir transect at baseflow and during a 1.5-yr storm event (USGS 2017). Our objectives were to determine (1) how the reservoir altered DOM bioavailability and composition during transitions from baseflow to high flow; (2) how high flow altered the flux of carbon in the ROR reservoir system; and (3) how high flow affected CO₂ gas evasion in the ROR reservoir system. Our results will provide critical insight on carbon dynamics in commonplace but understudied ROR reservoir systems and highlight the need to incorporate riverine DOM into carbon budgets.

2.2 Methods

2.2.1 Site description

The New River is a 6th order river that flows north from North Carolina, into Virginia, and then into the Kanawha River in West Virginia (USGS 2017). This study focuses on a 42 km segment of the New River extending from USGS gauge 03168000 in Allisonia, VA, through an impounded reservoir (Claytor Lake), and extending downstream to USGS gauge 03171000 in Radford, VA (Figure 2.1). The entire study reach contains 15 km of river transitioning into 17 km of reservoir with 10 km of river downstream. Claytor Lake is a moderately eutrophic lake with an average depth of 15 m, a maximum depth of 37.5 m, a surface area of 18 km² and ranges from approximately 0.29 to 0.95 km wide (Roseberry 1951; Boaze 1972; Kohler et al. 1986; Copeland 1999). Claytor Lake is primarily used for hydroelectric power generation and is operated by the Appalachian Power Company (AEP 2008; VA State Parks 2018).

Figure 2.1. Site map of Claytor Lake / New River. This figure depicts USGS gauge locations (white and black checkered circles), grab sample locations (yellow circles), and the study reach of Claytor Lake / New River (blue polygon).

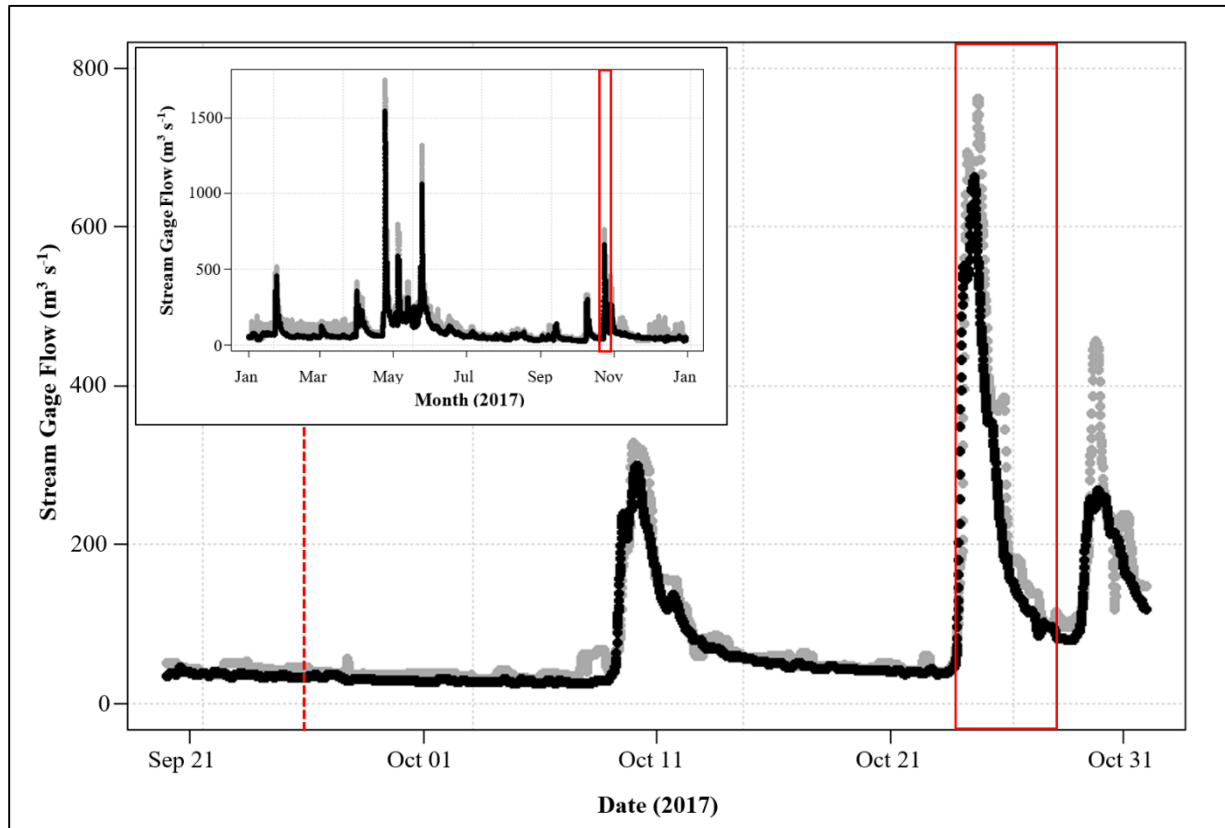


2.2.2 Sampling campaigns

Sampling campaigns were conducted, one at baseflow and five across a storm hydrograph, using a combination of sensor observations and grab samples of surface water. The first sampling campaign was conducted on September 25, 2017 to capture the ROR reservoir

system while at baseflow. The following five sampling campaigns were conducted from October 24 to October 28, 2017, immediately following a 1.5-year storm event (Figure 2.2).

Figure 2.2 Stream gauge flow ($\text{m}^3 \text{s}^{-1}$) versus time in 2017. Points represent flow at USGS gauge 03168000 in Allissonia, VA (black) and USGS gauge 03171000 in Radford, VA (gray). Samples were collected at baseflow (red dashed line) and at the peak and falling limb of the high flow hydrograph (red box). Inset figure shows annual streamflow at USGS gauge 03168000 (black) and USGS gauge 03171000 (gray), with the measured high flow event highlighted in red.



Sensor observations were collected using a high frequency sampling approach adapted from Crawford et al. (2014). Water was continuously pumped from surface water on a moving boat while data was collected using an S::CAN spectrometer, a YSI data sonde, and a Eosense CO_2 probe. Data collected from the sensors included DOC, temperature, dissolved oxygen (DO),

conductivity, turbidity, pH, and CO₂ concentrations in water. S::CAN readings between 220 nm - 750 nm were calibrated to measured DOC concentrations (mg L⁻¹) using grab sample analyses ($R^2 = 0.971$, Appendix Figure B.2.1).

Grab samples of surface water were collected in 40 ml ashed glass amber vials at five sampling locations, and filtered through a pre-ashed 45 µm filter using a Geotech Peristaltic GeoPump (Denver, CO). Field blanks were collected simultaneously as a quality control measure. The grab samples were transported on ice and refrigerated in the lab prior to analysis. After each sampling campaign, water samples were analyzed for: (1) DOC and dissolved inorganic carbon (DIC) using a Shimadzu TOC-V CPH analyzer; (2) Specific Ultraviolet Absorbance (SUVA₂₅₄) using the Shimadzu TOC-V analyzer in combination with a Shimadzu Spectrophotometer (Weishaar 2003); (3) carbon isotopic signature (13C) using a Picarro G2131-i Analyzer for Isotopic CO₂ and an Aurora 1030W TOC Analyzer; and (4) bioavailable dissolved organic carbon (BDOC) measured via an incubation technique (Fellman et al 2008, Hosen et al 2014).

2.2.3 River carbon flux calculations

USGS gauge 03168000 at Allisonia, VA and USGS gauge 03171000 at Radford, VA provided flow data at the boundaries of the sampling transect, while the operator of Claytor Dam, AEP, provided tailwater flow data from the impoundment. All other flow data were collected using an acoustic doppler current profiler (ADCP) mounted to the boat. Analyte fluxes (DOC, DIC, BDOC) at each sampling location were then calculated from water sample concentrations and flow data using the following equation:

$$Flux = Q * C \quad (1)$$

where Flux is the rate of exchange of the parameter (Mg d^{-1}), Q is measured discharge ($\text{m}^3 \text{s}^{-1}$), and C is the concentration for a desired water quality parameter (mg L^{-1}).

2.2.4 CO_2 evasion calculations

Dissolved CO_2 concentrations were used to calculate CO_2 evasion within the ROR system. Calculations were adapted from Crawford et al. 2015 to determine daily total stream CO_2 evasion (moles d^{-1}). It was assumed that the atmospheric concentration of CO_2 was 400 ppm (NOAA, 2017). CO_2 evasion was calculated as a function of the difference between CO_2 concentration (moles m^{-3}) in the stream and the atmospheric equilibrium CO_2 concentration (moles m^{-3}), gas transfer velocity (m d^{-1}), and water surface area (m^2) (Crawford et al. 2015):

$$\text{CO}_{2,Tot} = (\text{CO}_{2,meas} - \text{CO}_{2,sat}) * k * SA \quad (2)$$

Stream surface area (SA) was measured via spatial analysis in ArcGIS 10.4 using National Hydrography Dataset (NHD) polygons. Gas transfer velocity (k) within the river portion of the study reach was calculated using the methods from Crawford et al. (2015) and Raymond et al. (2013). We used a k value of 1.0 m d^{-1} for the reservoir portion of the study reach based on the global average gas transfer velocity for lakes and reservoirs (McDonald et al. 2013; Raymond et al. 2013).

2.2.5 Bioavailable DOC incubation

BDOC was measured via an incubation technique adapted from Fellman et al. (2008) and Hosen et al. (2014). In this method, ashed amber glass vials were filled with 24 ml of grab sample and 1 ml of bacterial inoculum made from the Fellman et al. method (2008). One vial from each sampling location was filtered through a 0.2 micron GFF filter into new ashed amber glass vials and measured for Day 1 DOC concentrations using a Shimadzu TOC-V CPH analyzer. A second set of vials prepared for the experiment, using the same mixture of 24 ml of

grab sample from each site and 1 ml of inoculum, was incubated in the dark at 25°C for 14 days. After 14 days the inoculated samples were filtered through 0.2 micron GFF filters into new ashed amber glass vials, then measured for DOC concentration. A vial containing 24 ml of Millipore water and 1 ml of inoculum was used as a quality control measure for each set of vials. BDOC (mg L⁻¹) was then calculated as the difference between DOC concentration (mg L⁻¹) on Day 1 and Day 14 of the incubation experiment:

$$BDOC = DOC_{day\ 1} - DOC_{day\ 14} \quad (3)$$

2.2.6 Hydrology calculations

To better understand the movement of water through the ROR reservoir during high flow, we calculated the stratification of water in Claytor Lake Reservoir and the contribution of water from the surface and deep water layers to downstream flow. We first calculated the contribution of water to downstream flow at baseflow conditions, where temperature was used as a conservative variable. Then, surface water temperature measurements in the reservoir and downstream of the impoundment were used to estimate the contribution of deep water to downstream flow, as this variable was not directly measured (Equation 4):

$$\%DW\ Contribution = \frac{(T_{DS}-10)}{(T_{SW}-10)} \quad (4)$$

Where % *DW Contribution* is the percentage of deep water contribution to downstream flow, T_{DS} is temperature measured below the impoundment, and T_{SW} is temperature measured in surface water of the reservoir.

2.2.6 Statistics

Statistical differences between DOC, BDOC and DIC fluxes for upstream and immediately downstream of the impoundment were examined. First, normality of the data at the Allisonia USGS gauge site and downstream of Claytor Lake Dam was evaluated using a Shapiro

- Wilk test and quantile - quantile plots. The flux data was found to be non-normally distributed, and thus non-parametric statistics were used for further evaluation. The Kruskal-Wallis test was used to determine if there were statistical differences in carbon fluxes among the sites located at the Allisonia USGS gauge, downstream of Claytor Dam, and the Radford USGS gauge site.

Wilcoxon Rank Sum tests were used for pairwise comparisons for flux data between the Allisonia USGS gauge and downstream of Claytor Dam, between Claytor Dam and the Radford USGS gauge, and lastly between the Allisonia and Radford USGS gauges. P-values were then corrected using a post hoc Bonferroni correction, and statistical differences were evaluated at an alpha value of 0.05. The same statistical analyses were used for CO₂ gas evasion comparisons between baseflow and during high flow.

2.3 Results

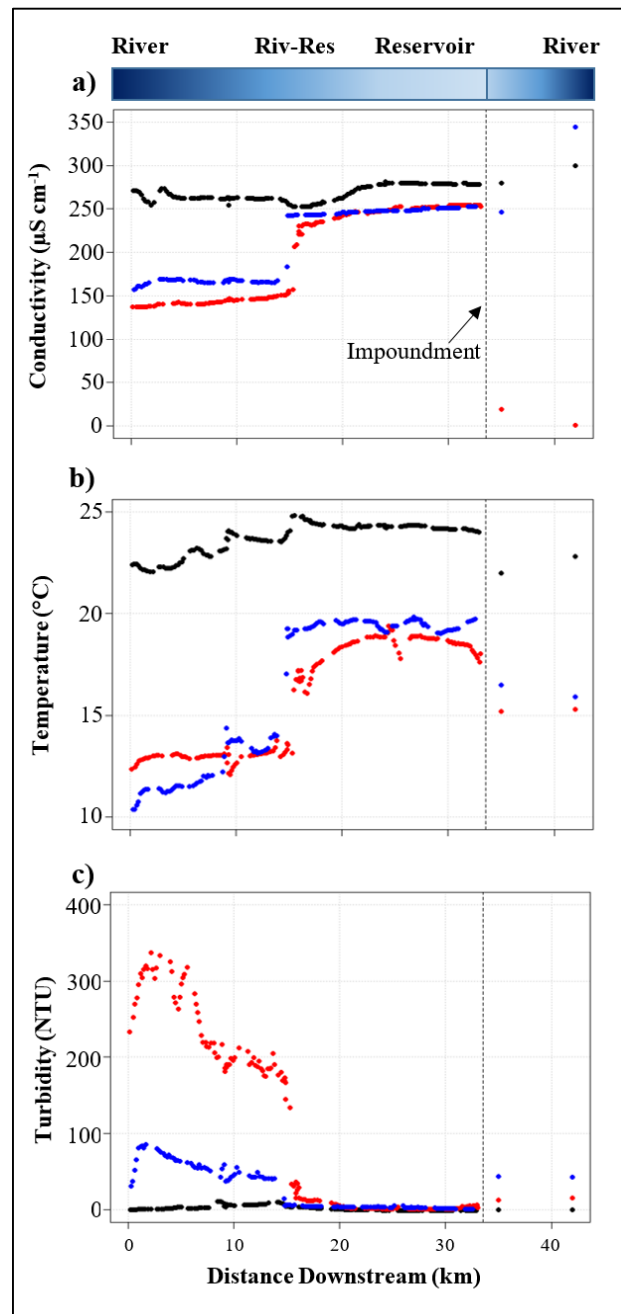
2.3.1 Hydrology and water quality parameters

Streamflow and surface water quality were altered by high flow. Peak recorded streamflow values were 663 m³ s⁻¹ and 762 m³ s⁻¹ at the Allisonia and Radford USGS gauges respectively (Figure 2.2). Spatial and temporal differences for each solute were observed across high flow in surface water along the study reach (Figure 2.3, Appendix Table A.1). Baseflow conductivity remained constant, with values ranging from 250 µS cm⁻¹ to 280 µS cm⁻¹ along the river to reservoir transition, and 250 µS cm⁻¹ to 300 µS cm⁻¹ downstream (Figure 2.3a). Surface water temperature during baseflow ranged from 21.6 °C to 24.3 °C from river to reservoir, and decreased downstream to approximately 22 °C (Figure 2.3b). High flow conductivity and temperature were increased along the river to reservoir transition, with conductivity increasing from 145 µS cm⁻¹ to 250 µS cm⁻¹ (Figure 2.3a), and temperature increasing from 10 °C to 19.9

°C (Figure 2.3b). Downstream of the impoundment, both conductivity and temperature decreased compared to upstream (Figure 2.3a, 2.3b). Turbidity at baseflow was undetectable along the river to reservoir transition and downstream of the impoundment (Figure 2.3c). During high flow, turbidity increased in the river and decreased noticeably at the river to reservoir transition point (15 km) where concentrations fell from 350 NTU to 16 NTU, and then continued to decrease to 0 NTU in the reservoir (Figure 2.3c). Turbidity increased downstream of the impoundment from 0 to 50 NTU following high flow (Figure 2.3c).

As mentioned previously, we calculated the movement of water within the reservoir by determining the stratification of water within the reservoir and the contribution of water to downstream flow. We found that at baseflow, the contribution of water to downstream flow was 85.2% surface water and 14.8% deep water (Appendix Table B.3.1). During high flow, the contribution of reservoir water to downstream flow shifted to 77.2% surface water and 22.8% deep water (Appendix Table B.3.1). While only an estimation, this source water contribution analysis suggests diving of river water during high flow, pushing deep water up and downstream. Further analysis and depth profiles are needed to confirm our analysis.

Figure 2.3 Longitudinal profiles of (a) conductivity, (b) temperature, and (c) turbidity in surface water versus distance downstream from the Allisonia stream gauge. Data plotted show water quality parameters at baseflow (black), high flow day 2 (red) and high flow day 4 (blue). The impoundment is represented by the black dashed line. The Radford stream gauge is the endpoint of the longitudinal profiles. The blue color bars at the top of the figure show the transition from river to reservoir, and the transition back to river below the impoundment.



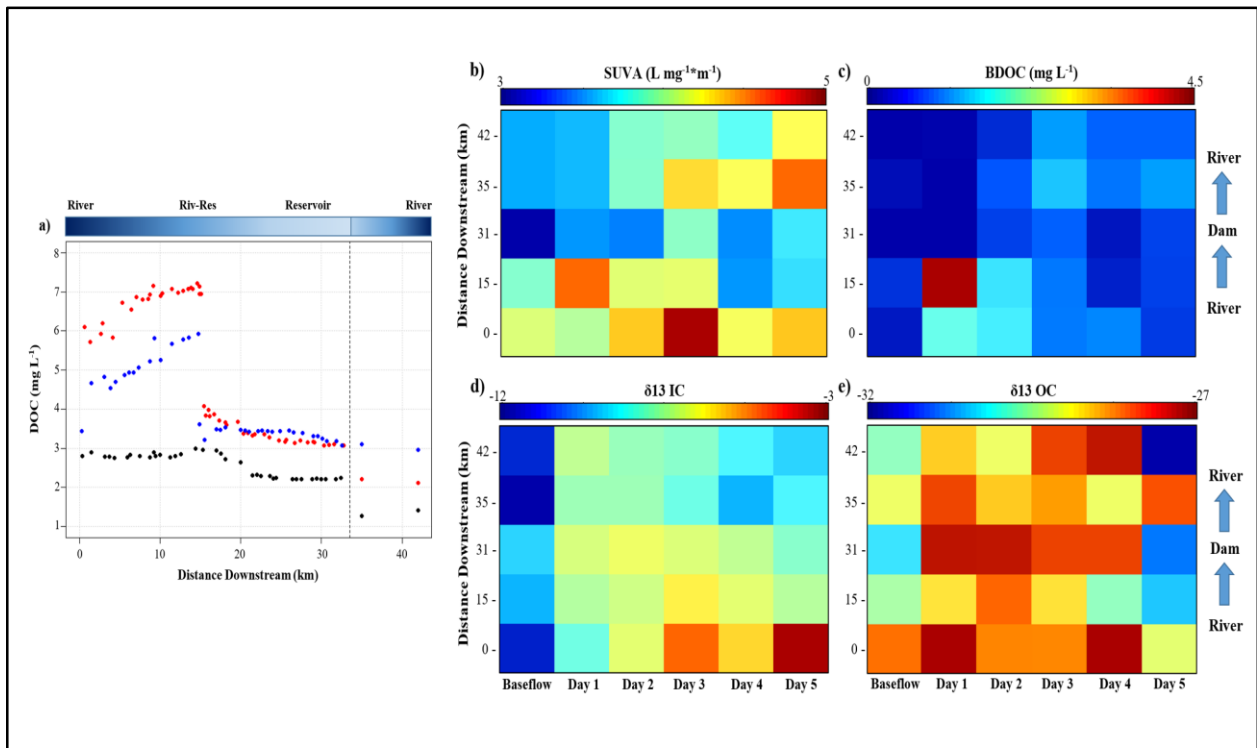
2.3.2 DOM: Bioavailability and Composition

DOM concentration, measured by DOC concentration, remained fairly constant during baseflow conditions, with values decreasing from approximately 3 mg L⁻¹ to 2 mg L⁻¹ along the river to reservoir transition, and 1 mg L⁻¹ to 1.5 mg L⁻¹ downstream of the impoundment (Figure 2.4a, Appendix Table A.1.). During high flow DOC concentrations were much higher in the river than in the reservoir, with values decreasing from 7 mg L⁻¹ to 3 mg L⁻¹ along the river to reservoir transition (Figure 2.4a). Downstream of the impoundment, DOC concentrations decreased further to approximately 2 to 3 mg L⁻¹ (Figure 2.4a).

Baseflow SUVA₂₅₄ values ranged from approximately 3 L mgC⁻¹ m⁻¹ to 4 L mgC⁻¹ m⁻¹ (Figure 2.4a, Appendix Table A.3), which is within the typical surface water range of 1 L mgC⁻¹ m⁻¹ to 6 L mgC⁻¹ m⁻¹ (Hansen et al. 2016). SUVA₂₅₄ values increased by day 3 of high flow to a range of 3.7 mgC⁻¹ m⁻¹ to 4.6 L mgC⁻¹ m⁻¹ upstream and downstream of the impoundment (Figure 2.4b, Appendix Table A.3). This indicated an increase in the aromaticity of carbon in DOM both upstream and downstream of the reservoir. No changes were seen within the reservoir itself, which suggests that DOM from upstream was transported to downstream waters by day 3 of high flow. BDOC concentrations also changed. At baseflow, BDOC values were approximately 0 mg L⁻¹ (Figure 2.4c). During high flow, BDOC concentration increased to 3 mg L⁻¹ in the river portion of the ROR reservoir system, but did not increase in the reservoir or downstream of Claytor Dam (Figure 2.4c, Appendix Table A.3).

Figure 2.4 Longitudinal profile of (a) DOC in surface water versus distance downstream from the Allisonia stream gauge. Data show DOC at baseflow (black), high flow day 2 (red) and high flow day 4 (blue). The impoundment is represented by the black dashed line. The Radford stream gauge is the endpoint of the longitudinal profile. The blue color bar at the top of (a) shows the transition from river to reservoir, and the transition back to river below the impoundment.

Color matrix t-graphs illustrate spatiotemporal variability of b) SUVA, c) BDOC, d) $\delta^{13}\text{C}_{\text{IC}}$ and e) $\delta^{13}\text{C}_{\text{OC}}$ in surface water. These t-graphs show change in time along the x-axis from baseflow to high flow days 1 through 5, change in location along the y-axis from upstream to downstream with Claytor Lake Dam located at 31 km, and concentration or value indicated by color, with color bar scales above each graph for reference.



$^{13}\text{C}/^{12}\text{C}$ ratios were used to determine levels of processed carbon at baseflow and during high flow. $\delta\text{C}_{\text{IC}}$ ranged from -12 to -9 at baseflow, but increased to approximately -3 to -8 during high flow (Figure 2.4d, Appendix Table A.3). More negative values of $\delta^{13}\text{C}_{\text{IC}}$ generally indicate

higher levels of respiration in water, though these values are generally between -22 to -36 (Raymond and Bauer, 2001a, 2001b; Finlay and Kendall 2008). More positive values indicate degassing/exchange between -18 to -6, or photosynthesis (-20 to -8). $\delta^{13}\text{C}_{\text{OC}}$ ranged from -28 to -29 at baseflow, but increased to approximately -27 to -28 during high flow before falling to -32 to -29 by the end of the sampling period (Figure 2.4d, Appendix Table A.3). Riverine $\delta^{13}\text{C}_{\text{OC}}$ values are approximately equal to -28.2 (Finlay and Kendall 2008). More positive values of $\delta^{13}\text{C}_{\text{OC}}$ indicate greater source contribution from soil organic matter, whereas more negative values indicate source contribution from autotrophs (Finlay and Kendall 2008).

2.3.3 Carbon flux

DOC concentration from water grab samples (Appendix Table A.3.) and streamflow were used to estimate DOC flux during high flow at the most upstream location (Allisonia) and immediately below Claytor Dam. DOC flux peaked on day 1 of the high flow at Allisonia, with values increasing from 3.3 Mg d^{-1} at baseflow to approximately 380 Mg d^{-1} (Table 2.1). Downstream DOM flux also peaked on day 1 of the high flow, and values increased from 4.1 Mg d^{-1} at baseflow to approximately 213 Mg d^{-1} (Table 2.1, Appendix Table A.4). Flux between Allisonia and downstream of Claytor Dam were not statistically different ($p\text{-value} > 0.05$) (Appendix Table A.5). Overall, DOM flux at both sampling sites declined on the descending limb of the hydrograph.

Table 2.1 DOC flux (Mg d^{-1}) for the Allisonia stream gauge and downstream of Claytor Lake Reservoir at baseflow (September 25) and during high flow (October 24 through October 28).

Date	Allisonia - DOC Flux (Mg d^{-1})	DS Impoundment - DOC Flux (Mg d^{-1})
25 September 2017	3.32	4.08
24 October 2017	380	213
25 October 2017	98.2	67.3
26 October 2017	28.4	46.7
27 October 2017	25.2	22.2
28 October 2017	11.7	20.1
Standard Deviation	(+/-) 155	(+/-) 77.1

Table 2.2 Total carbon fluxes upstream (Allisonia) and downstream of the impoundment. The final column contains the calculated difference in fluxes from upstream to downstream, indicating whether the reservoir was a source or sink of carbon fluxes.

Parameter Flux	Allisonia	DS Impoundment	Delta Flux	Standard Deviation
DOC Flux (Mg d^{-1})	775	460	-315	(+/-) 78.0
BDOC Flux (Mg d^{-1})	119	9.01	-110	(+/-) 11.5
DIC Flux (Mg d^{-1})	418	631	212	(+/-) 79.0

Total carbon fluxes in upstream and downstream surface water were also calculated for the high flow event. Fluxes were calculated by integrating fluxes (Appendix Table A.4.) for each parameter over time for the entire high flow event (October 25 - October 28). DOC flux at Allisonia was 774.8 Mg d^{-1} , and 459.7 Mg d^{-1} immediately downstream of Claytor Dam (Table 2.2). The difference in flux between the two sites revealed that the impoundment was a net sink of DOC as it retained 315.1 Mg d^{-1} of DOC across high flow (Table 2.2). The impoundment was also found to be a sink of BDOC flux, as flux decreased from 118 Mg d^{-1} upstream to 9.01 Mg d^{-1} downstream of the impoundment and 109.9 Mg d^{-1} was retained (Table 2.2). DIC flux showed a different trend, as flux increased from upstream to downstream and values ranged from 418 Mg d^{-1} to 630.6 Mg d^{-1} respectively. The impoundment acted as a source of DIC and released 212.2 Mg d^{-1} DIC flux. (Table 2.2). Flux between Allisonia and downstream of Claytor Dam was not statistically different ($p\text{-value} > 0.05$) for DOC and BDOC, but was statistically different for DIC (Appendix Table A.5).

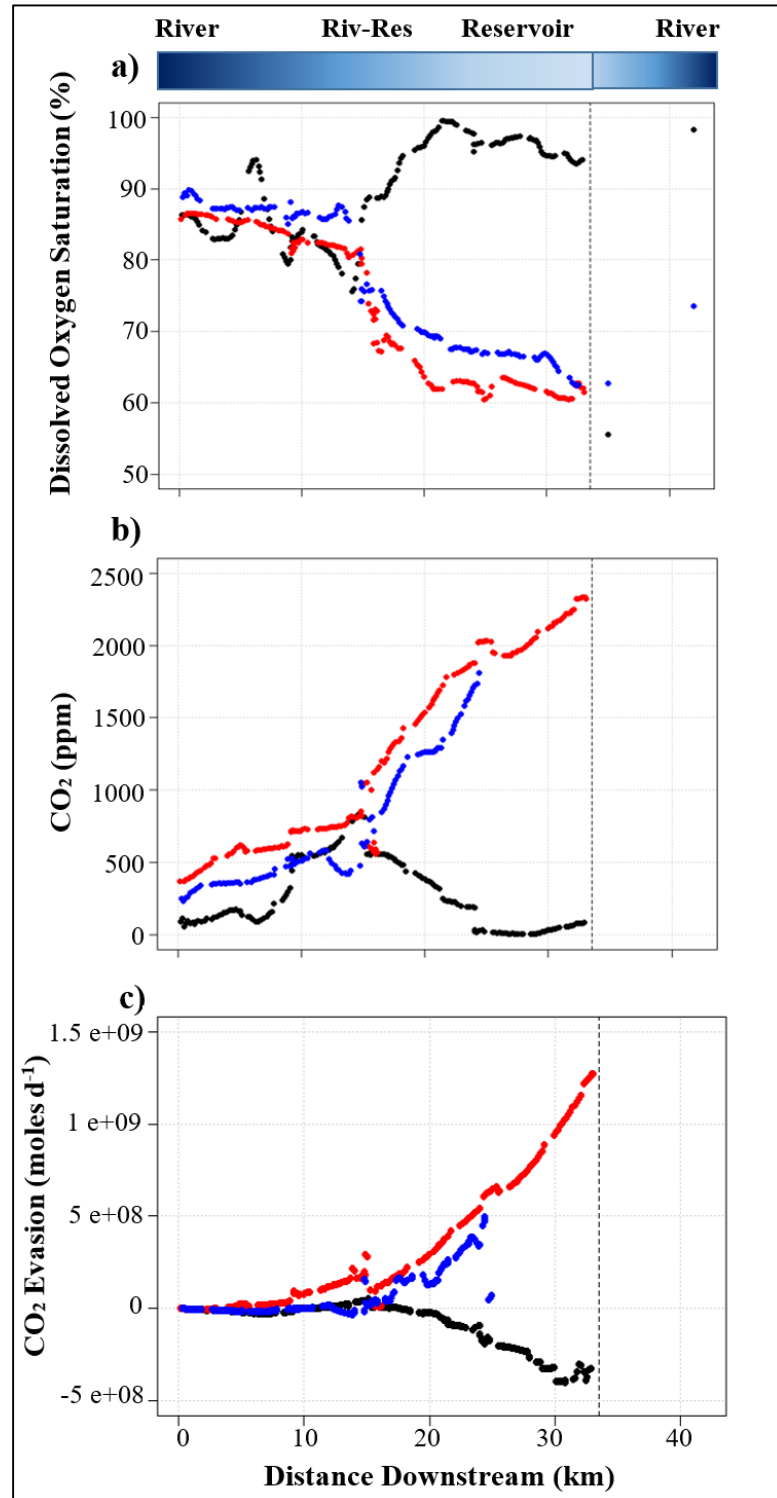
2.3.4 Spatial variation in CO_2 gas evasion

Baseflow DO saturation increased along the river to reservoir transition from approximately 85% to approximately 100%, and then decreased to 55% saturation immediately below the impoundment. DO saturation then increased moving downstream as influence from the reservoir decreased and water returned to upstream conditions (Figure 2.5a, Appendix Table A.1.). During high flow, DO saturation decreased along the river to reservoir transition from 90% to 60% saturation, with the most noticeable decreases at the river to reservoir transition point (15 km) (Figure 2.5a, Appendix Table A.1.). Data for DO saturation were not collected on day 2 of the event, as the sensor malfunctioned at that time. However, DO saturation below the impoundment was similar to surface water DO saturation by event day 4, and then increased downstream (Figure

2.5a, Appendix Table A.1.). Baseflow CO₂ concentrations ranged from less than 50 ppm to greater than 500 ppm at baseflow (sd = 0.117), with the highest concentrations at the transition point between the New River and Claytor Lake (km 15) (Figure 2.5b, Appendix Table A.1.). Contrary to high flow DO saturation, CO₂ concentrations increased downstream along the river to reservoir transition, with values increasing from approximately 250 ppm to 2400 ppm (Figure 2.5b, Appendix Table A.1.)

To calculate CO₂ evasion, the difference between CO₂ partial pressure of surface water and the atmospheric equilibrium concentration of CO₂ was first calculated (Table A.2.). For a majority of the baseflow CO₂ measurements, surface water CO₂ was undersaturated with respect to the atmosphere and dCO₂ values ranged from -11 mol m⁻³ to 8 mol m⁻³. Conversely, most of the storm event surface water CO₂ was supersaturated with respect to the atmosphere. Storm event day 2 dCO₂ measurements ranged from -4 mol m⁻³ to 41 mol m⁻³, and storm event day 4 dCO₂ measurements ranged from -6 mol m⁻³ to 30 mol m⁻³ (Table A.2.).

Figure 2.5. Longitudinal profiles of a) CO₂ evasion versus distance downstream and b) delta CO₂ versus distance downstream in the ROR system. Data plotted show flux at baseflow (black), high flow day 2 (red) and high flow day 4 (blue). Data for high flow day 4 end at 25 km downstream due to sensor error.



During high flow, CO₂ evasion in the reservoir section of the ROR reservoir system shifted from drawing into the reservoir at baseflow to evasion out of the reservoir (Figure 2.5c, Appendix Table A.2.). Baseflow evasion ranged from -4.00×10^8 mol to 5.09×10^7 mol, but the largely negative measurements showed a drawing-in of CO₂ from the atmosphere (Figure 2.5c). Conversely, most of the high flow surface water CO₂ was supersaturated with respect to the atmosphere. High flow event day 2 dCO₂ measurements ranged from -5.47×10^6 mol to 1.2×10^9 mol, and day 4 dCO₂ measurements ranged from -3.21×10^7 mol to 4.96×10^8 mol (Figure 2.5c). High flow CO₂ measurements showed CO₂ evasion to the atmosphere (Figure 2.5c). Flux data for CO₂ was statistically different from baseflow to high flow days 2 and 4 (p-values < 0.05) (Appendix Table A.6.).

2.4. Discussion

2.4.1 Hydrologic flow alteration from storm event and ROR reservoir system

Hydrologic flow variability within the ROR reservoir system and from the storm affected DOM dynamics. Storm flow contributed higher concentrations of solutes to the system as a result of increased discharge from precipitation, overland flow, and runoff (Raymond et al. 2016). Water residence time in the reservoir varied throughout the storm event, and was influenced by the change in discharge of incoming river water from upstream. Average annual residence time calculated from mean streamflow in the reservoir is generally around 11.76 mo; however, during the October storm event residence time decreased from about 18.6 mo to just 32 d (Figure A.1). Decreased residence time may be one explanation for the changes in DOM flux and other solutes post-storm.

Our results suggest the importance of “short circuiting” in the ROR reservoir system immediately post-storm. At baseflow, water used for hydroelectric power is sourced from the metalimnion of the reservoir (AEP 2008). Decreased mixing from stratification causes warmer waters at the surface to be moved through a reservoir above the denser, cool water in the hypolimnion (Oliver et al. 2016). Our source water contribution analysis suggests a slightly different path for river water transported through the reservoir. As mentioned previously, we found that surface water contribution decreased post-storm, and that residence time of water within the reservoir decreased (B.3, Table B.3.1, Figure A.1.). Even so, it is likely that incoming water from the river may have “short-circuited” its flow path through the reservoir, as many of the variables that increased upstream after the storm event generally showed increases in the surface water of the reservoir and downstream of the impoundment only a few days later (Figure 2.3, Figure 2.4, Figure 2.5). This suggests that the reservoir could behave as a sink of solutes during baseflow conditions and high residence times, but may revert to a source of solutes and CO₂ emissions to downstream waters when residence time is short and storage in the reservoir is bypassed during high flow.

2.4.2 *Compositional changes in DOM*

As sources of DOM become less autochthonous and more allochthonous due to increased landscape connectivity from a storm, it is expected that aromaticity and humic content of DOC will both increase (Tranvik et al. 2009). In this study, DOM composition analyses showed an increase in both aromaticity and in the lability of carbon in the river section of the ROR system. Higher DOM loading from the storm increased SUVA₂₅₄ values and BDOC concentrations within the river, though reservoir values remained relatively unaltered. Downstream of the reservoir, SUVA₂₅₄ values increased while BDOC concentrations remained relatively unaltered.

These findings coincide with previous research, which states that storm events are expected to alter river and reservoir DOM dynamics by supplying increased inputs of coarse DOM (CDOM) as well as some labile DOC (Tranvik et al. 2009). One would expect to see an increase in the aromaticity and decrease in the lability of DOM after a storm, but runoff from our high flow event flushed aromatic carbon into the river, which then mixed with labile carbon already present. This altered the DOM pool composition to a mixture of allochthonous and autochthonous carbon. The SUVA₂₅₄ value data also suggest that shorter residence time in the reservoir from the storm event allowed for most of the aromatic carbon in the river to be immediately transported downstream of the reservoir.

We found that both $\delta^{13}\text{C}_{\text{OC}}$ and $\delta^{13}\text{C}_{\text{IC}}$ values increased from baseflow to the storm event. This finding explains our results for DOM composition from SUVA₂₅₄, BDOC, and DIC because we observed a shift from more autochthonous, microbial sources at baseflow to more allochthonous, terrestrially derived DOC post-storm. $\delta^{13}\text{C}_{\text{IC}}$ values measured at baseflow showed respiration as the greatest source of DIC, while post-storm values indicated high CO₂ outgassing in the surface waters due to increased discharge and decreased water residence time. Increased concentrations of CO₂ within the reservoir resulted in an increase in downstream DIC concentrations, and $\delta^{13}\text{C}_{\text{IC}}$ values indicated an enrichment in DIC in these waters.

2.4.3 Reservoirs as sources of CO₂ gas evasion

CO₂ gas evasion varied spatially throughout the falling limb of the storm hydrograph. At baseflow, the reservoir acted as a sink for CO₂ gas evasion and exhibited a net uptake of CO₂ from the atmosphere (-4.00×10^8 to approximately 0 mol). Post-storm, the reservoir exhibited a net CO₂ gas evasion because CO₂ concentrations were super-saturated in the surface water and degassed to the atmosphere (approximately 0 mol to 1.28×10^9 mol). There are two potential

reasons for this result. One is that higher turbulence in the surface water due to increased discharge from the storm allowed for degassing of CO₂ to the atmosphere (Finlay 2002; Covino 2017). From the source contribution analysis, we found that deeper water may have been pushed towards the surface with increasing river discharge (Appendix B.3). Mixing and higher contribution of deep, oxygen-depleted water may have been a contributor to the net efflux of CO₂ to the atmosphere. Further, the influx of higher loads of DOM, especially BDOC, may have provided a source of energy to primary consumers in the surface water. This would allow for the mineralization of carbon from DOM to CO₂. The reservoir acted as a sink of BDOC flux across the storm event (-110 Mg d⁻¹, Table 2.1b), which suggests BDOC was consumed and mineralized to CO₂ and evaded to the atmosphere. These findings contribute to knowledge of rivers and reservoirs as sources of CO₂ to the atmosphere, and further emphasize the need to include river and reservoir CO₂ evasion in carbon budgets.

2.5 Conclusion

In this study, we quantified spatial and temporal transitions in the composition and transport of carbon through an ROR reservoir system during variable flow. We determined how the ROR reservoir altered DOM bioavailability and composition, carbon flux, and CO₂ gas evasion during transitions from baseflow to high flow. Findings from this research indicate that runoff from storms connects landscape and shallow flow paths to ROR reservoir systems, resulting in an export of both terrestrial, aromatic carbon and labile organic matter already present in these waters. Additionally, reservoirs may undergo “short circuiting”, allowing for increased DOM and solute loading upstream to somewhat bypass the reservoir and continue its export downstream. Finally, this research dictates that reservoirs morph from sinks to sources of

CO₂ gas evasion during storm events. Our results provide critical insight on carbon dynamics in ROR reservoir systems and highlight the need to incorporate riverine DOM into carbon budgets, especially under variable flow conditions. We advise future studies to pursue interactions between systems to capture the whole nature of inland waters. By studying only rivers or reservoirs and failing to investigate the connection between them, future research will not be able to fully understand carbon composition and transport. Water quality managers and impoundment personnel will need to monitor carbon dynamics in the future because water quality within reservoirs and downstream will be altered as storms become more frequent due to climate change.

2.5.1 Future Recommendations

Additional spectroscopic analyses such as fluorescence would be helpful in identifying the material composition of DOM (McKnight et al. 2001). Fluorescence would aid in identifying compositional changes of DOM in ROR reservoir systems from baseflow to post-storm and in explaining SUVA₂₅₄ values and source contribution of DOM to these systems (McGlynn and McDonnell 2003). We also suggest using depth profiles to help quantify source contribution of water and stratification in ROR reservoirs. Depth profiles would help to understand whether water within the reservoir mixes with incoming river water, is pushed out of the reservoir, or remains in place as river water moves across the top. DOM and other solute fluxes are likely to change depending on the behavior of water within the ROR reservoir system.

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Appendix

Appendix A: Additional site tables and figures

Table A.1. Longitudinal data for temperature, conductivity, pH, turbidity, dissolved oxygen saturation, and DOC in surface water versus distance downstream from the Allisonia stream gauge in the ROR system. Data are water quality parameters at baseflow (September 25), high flow day 2 (October 25) and high flow day 4 (October 27). The Radford stream gauge is the endpoint of the longitudinal data.

September 25 - Baseflow							October 25 - Post-storm Day 2							October 27 - Post-storm Day 4						
Distance (km)	Temperature (°C)	Conductivity (mS cm ⁻¹)	pH	Turbidity (NTU)	ODOSat (%)	DOC (mg L ⁻¹)	Distance (km)	Temperature (°C)	Conductivity (mS cm ⁻¹)	pH	Turbidity (NTU)	ODOSat (%)	DOC (mg L ⁻¹)	Distance (km)	Temperature (°C)	Conductivity (mS cm ⁻¹)	pH	Turbidity (NTU)	ODOSat (%)	DOC (mg L ⁻¹)
Std. Dev	(+/-) 0.993	(+/-) 13.5	(+/-) 0.265	(+/-) 2.47	(+/-) 5.76	(+/-) 0.465	(+/-) 2.53	(+/-) 0.14	(+/-) 0.0465	(+/-) 0.129	(+/-) 101.3	(+/-) 8.92	(+/-) 1.58	(+/-) 3.49	(+/-) 0.0393	(+/-) 0.0935	(+/-) 35.3	(+/-) 8.80	(+/-) 0.954	
0.0	21.9		7.6	0.600	83.3	2.97	0.0	12.6	0.14	6.54	368.9	84.8	5.95	0.1	11.2	0.171	6.62	97.1	87.1	4.76
0.0	21.9	259	7.6	0.600	83.5		0.0	12.6	0.14	6.55	366	84.7	5.23	0.1	11.3	0.169	6.62	99.7	87.1	4.74
0.0	21.8	258	7.6	0.600	83.7		0.0	12.5	0.14	6.55	365.6	84.7		0.1	11.3	0.171	6.63	97.4	87	
0.1	21.8	259	7.6	0.500	83.9		0.0							0.1	11.3	0.172	6.63	98	87.1	
0.1	21.9	261	7.6	0.500	84.2	2.94	0.0							0.1	11.3	0.172	6.64	98.8	87.1	
0.1	21.9	260	7.61	0.400	84.4		0.0						6.07	0.1	11.4	0.171	6.64	99.7	87.1	4.84
0.1	21.9	258	7.62	0.600	84.4		0.0	12.4	0.14	6.59	341.6	84.5		0.1	11.3	0.172	6.64	98.3	87.1	
0.1							0.0	12.3	0.14	6.6	350.7	84.5		0.1	11.3	0.172	6.64	98.3	87.2	
0.1						2.97	0.0	12.3	0.14	6.6	342.4	84.4		0.1	11.4	0.171	6.66	93.6	87.1	
0.1							0.0	12.2	0.14	6.6	346	84.5	6.44	0.1	11.4	0.171	6.66	93.3	87.1	4.97
0.1	21.7	251	7.6	0.600	83.5		0.0	12.2	0.14	6.61	335.5	84.4		0.1	11.4	0.171	6.66	93.3	87.2	
0.1	21.6	251	7.58	0.600	83.3		0.0	12.2	0.14	6.61	336.4	84.4		0.1	11.4	0.171	6.66	94.1	87.3	
0.1	21.6	250	7.57	0.600	83	2.98	0.0	12.1	0.14	6.62	331.1	84.5		0.1	11.4	0.171	6.67	95.1	87.3	
0.1	21.6	249	7.55	0.400	82.7		0.0	12.1	0.139	6.62	333	84.5	6.35	0.1	11.5	0.171	6.67	96.7	87.3	4.96
0.1	21.6	249	7.54	0.300	82.4		0.0	12.1	0.139	6.62	318.1	84.4		0.1	11.5	0.172	6.66	95.4	87.4	
0.1	21.6	249	7.53	0.100	82.3		0.0	12.1	0.139	6.62	326.4	84.2		0.1	11.5	0.172	6.66	94.5	87.3	
0.1	21.5	248	7.52	0.300	82.2	2.98	0.0	12.0	0.139	6.63	314.9	84.3		0.1	11.5	0.172	6.65	93.3	87.4	
0.1	21.5	248	7.51	0.200	82.1		0.0	12.0	0.139	6.63	299.7	84.3	6.26	0.1						4.96
0.1	21.5	248	7.51	0.300	82		0.0	11.9	0.139	6.62	285.9	84.3		0.1						
0.1	21.5	248	7.5	0.200	82.1		0.0	11.9	0.139	6.63	299.9	84.3		0.1						
0.1	21.5	248	7.49	0.300	82.1	3.00	0.0	11.9	0.139	6.64	293	84.4		0.1	11.5	0.172	6.63	101.1	87.4	
0.1	21.5	248	7.49	0.300	82.1		0.0	11.9	0.138	6.64	283.3	84.3	6.24	0.1	11.5	0.172	6.62	98.6	87.4	4.94
0.1	21.5	248	7.49	0.100	82.1		0.0	11.8	0.138	6.64	278.3	84.2		0.1	11.5	0.172	6.62	97.6	87.4	
0.1	21.5	248	7.48	0.300	82.1		0.0							0.1	11.5	0.172	6.62	93.2	87.4	
0.1	21.5	248	7.48	0.300	82.1	2.97	0.0							0.1	11.5	0.173	6.62	92.5	87.4	
0.1	21.5	248	7.48	0.300	82.1		0.0						6.28	0.1	11.5	0.172	6.61	91.3	87.5	4.95
0.1	21.5	248	7.48	0.400	82.1		0.0	11.7	0.138	6.63	242	84.2		0.1	11.5	0.172	6.62	91	87.5	
0.1						2.99	0.0	11.7	0.138	6.63	248.4	84.2		0.1	11.5	0.172	6.62	94.6	87.5	
0.1							0.0	11.6	0.137	6.63	247	84.3		0.1	11.5	0.172	6.62	95	87.5	
0.1							0.0	11.6	0.137	6.63	245.4	84.2	6.23	0.1	11.6	0.172	6.63	94.4	87.5	4.91
0.1	21.5	248	7.47	0.600	82.1		0.0	11.6	0.137	6.62	243.4	84.2		0.1	11.6	0.171	6.63	94.5	87.5	
0.1	21.5	248	7.47	0.600	82.1		0.0	11.6	0.137	6.61	236.9	84.2		0.1	11.6	0.172	6.64	93.9	87.6	
0.1	21.6	248	7.47	0.500	82.1	3.03	0.0	11.5	0.137	6.61	236.8	84.2		0.1	11.6	0.173	6.64	94.3	87.5	
0.1	21.6	248	7.47	0.500	82		0.0	11.5	0.137	6.62	234.9	84.2	6.10	0.1	11.6	0.173	6.64	92.7	87.6	4.96
0.1	21.5	248	7.47	0.400	82.1		0.0	11.5	0.137	6.61	225.4	84.1		0.1	11.6	0.172	6.64	93.2	87.6	
0.1	21.6	248	7.46	0.300	82		0.0	11.5	0.137	6.6	224.3	84.2		0.1	11.6	0.172	6.63	94	87.7	
0.1	21.6	248	7.47	0.300	82.1	2.97	0.0	11.4	0.137	6.6	222.9	84.1		0.1	11.6	0.172	6.64	93.8	87.7	
0.1	21.6	248	7.47	0.300	82.2		0.0	11.4	0.136	6.59	220.8	84.1	6.27	0.1						4.95
0.1	21.6	248	7.47	0.300	82.2		0.0	11.4	0.136	6.59	234.1	84.1		0.1						
0.1	21.6	248	7.47	0.400	82.2		0.0	11.4	0.136	6.59	213.5	84.1		0.1						
0.1	21.6	248	7.48	0.300	82.2	2.98	0.0	11.4	0.136	6.59	211	84		0.1	11.7	0.173	6.64	93.9	87.7	
0.1	21.6	248	7.47	0.300	82.1		0.0	11.4	0.136	6.59	202.2	83.9	6.36	0.1	11.7	0.173	6.64	94.1	87.7	4.94
0.1	21.6	248	7.47	0.400	82.1		0.0	11.3	0.136	6.58	209.2	83.9		0.1	11.7	0.173	6.64	94	87.8	
0.1	21.6	248	7.47	0.400	82.1		0.0							0.1	11.7	0.173	6.65	94.2	87.8	
0.1	21.6	248	7.47	0.400	82	3.02	0.0							0.1	11.7	0.173	6.65	93.3	87.8	
0.1	21.6	248	7.47	0.300	82		0.0						6.40	0.1	11.7	0.172	6.65	95	87.8	4.92
0.1	21.6	248	7.46	0.500	81.9		0.0	11.2	0.136	6.59	192.4	84		0.1	11.7	0.172	6.65	94.3	87.8	
0.1						2.98	0.0	11.2	0.136	6.61	190.8	84		0.1	11.7	0.172	6.65	95.3	87.8	
0.1							0.0	11.2	0.136	6.62	187.5	84.1		0.1	11.7	0.172	6.64	93.7	87.8	
0.1							0.0	11.2	0.135	6.62	186.6	84	6.41	0.1	11.7	0.173	6.65	93.8	87.8	4.95
0.1	21.6	248	7.46	0.400	81.8		0.0	11.2	0.135	6.62	181.3	84.1		0.1	11.7	0.172	6.66	93.6	87.9	
0.1	21.6	248	7.46	0.500	81.9		0.0	11.2	0.135	6.62	175.8	84.1		0.1	11.7	0.172	6.66	94	87.8	
0.1	21.6	248	7.45	0.500	81.9	3.01	0.0	11.2	0.135	6.63	175.1	84.1		0.1	11.7	0.172	6.67	97.2	87.9	
0.1	21.6	248	7.45	0.600	81.9		0.0	11.1	0.135	6.63	173.7	84	6.31	0.1	11.8	0.172	6.66	94.9	88	4.94
0.1	21.6	248	7.45	0.400	81.9		0.0	11.1	0.135	6.63	171.6	84.1		0.1	11.8	0.172	6.67	93.1	88	
0.1	21.6	248	7.45	0.500	81.9		0.0	11.1	0.135	6.62	169.1	84.1		0.1	11.8	0.172	6.67	93.3	87.9	
0.1	21.6	248	7.45	0.500	82	2.96	0.0	11.1	0.135	6.63	173.7	84.1		0.1	11.8	0.172	6.67	93.1	87.9	
0.1	21.6	248	7.45	0.400	82		0.0	11.1	0.135	6.63	166.9	84.1	6.37	0.1						4.92
0.1	21.6	248	7.46	0.400	82		0.0	11.1	0.135	6.63	163.8	84.1		0.1						
0.1	21.6	248	7.45	0.400	81.9		0.0	11.1	0.135	6.63	156.5	84.1		0.1						
0.1	21.6	248	7.45	0.400	81.9	2.99	0.0	11.1	0.135	6.63	158.3	84.1		0.1	11.8	0.172	6.66	91.6	88	
0.1	21.6	248	7.45	0.600	81.9		0.0	11.0	0.135											

Cont.	September 25 - Baseflow						October 25 - Post-storm Day 2						October 27 - Post-storm Day 4							
Distance (km)	Temperature (°C)	Conductivity (mS cm ⁻¹)	pH	Turbidity (NTU)	ODOSat (%)	DOC (mg L ⁻¹)	Distance (km)	Temperature (°C)	Conductivity (mS cm ⁻¹)	pH	Turbidity (NTU)	ODOSat (%)	DOC (mg L ⁻¹)	Distance (km)	Temperature (°C)	Conductivity (mS cm ⁻¹)	pH	Turbidity (NTU)	ODOSat (%)	DOC (mg L ⁻¹)
0.1	21.9	250	7.46	0.600	83.7	2.97	0.0							0.1	11.9	0.173	6.67	97.7	88.2	
0.1	21.9	249	7.46	0.400	83.7		0.0						6.27	0.1	11.9	0.173	6.67	94.6	88.1	4.99
0.1	21.9	250	7.46	0.300	83.7		0.0	11.2	0.134	6.6	208.6	84.9		0.1	11.9	0.173	6.68	93.5	88.2	
0.1							0.0	11.3	0.134	6.6	200.7	84.8		0.1	11.9	0.172	6.68	91.9	88.2	
0.1						2.98	0.0	11.4	0.133	6.6	183.7	84.9		0.1	11.9	0.172	6.68	92.1	88.2	
0.1							0.0	11.5	0.133	6.58	181.3	84.8	6.28	0.1	11.9	0.172	6.67	92.8	88.3	4.93
0.1	21.9	250	7.47	0.300	83.9		0.0	11.5	0.133	6.57	175.4	84.9		0.1	11.9	0.172	6.67	93.5	88.2	
0.1	21.9	250	7.47	0.300	84		0.0	11.5	0.133	6.57	174.2	84.8		0.1	11.9	0.172	6.68	92.8	88.2	
0.1	21.9	250	7.47	0.300	84.1	3.01	0.0	11.5	0.134	6.57	177.4	84.9		0.1	12.0	0.173	6.69	92.2	88.2	
0.1	21.9	250	7.47	0.200	84		0.0	11.5	0.134	6.57	171.6	85	6.28	0.1	11.9	0.172	6.69	90.2	88.2	4.96
0.1	21.9	250	7.47	0.400	83.9		0.0	11.6	0.134	6.56	169.2	84.8		0.1	11.9	0.172	6.7	90.8	88.3	
0.1	21.8	250	7.47	0.400	83.9		0.0	11.6	0.134	6.57	166	84.8		0.1	11.9	0.172	6.69	91.3	88.3	
0.1	21.8	250	7.48	0.500	83.8	2.98	0.0	11.6	0.134	6.56	158.7	85		0.1	12.0	0.172	6.68	90	88.2	
0.1	21.8	250	7.47	0.400	83.5		0.0	11.6	0.134	6.56	162	85	6.28	0.1						4.97
0.1	21.8	250	7.46	0.400	83.4		0.0	11.6	0.134	6.56	162.1	85		0.1						
0.1	21.8	250	7.46	0.600	83.4		0.0	11.6	0.134	6.56	159.8	85.1		0.1						
0.0	21.8	250	7.45	0.500	83.4	2.95	0.0	11.6	0.134	6.56	159.4	85		0.1	12.0	0.172	6.68	101.1	88.2	
0.0	21.9	249	7.45	0.400	83.5		0.0	11.6	0.134	6.56	156.9	85.1	6.30	0.1	12.0	0.172	6.68	103.7	88.3	4.96
0.0	21.9	249	7.45	0.400	83.6		0.0	11.6	0.134	6.56	156.8	85.1		0.1	12.0	0.173	6.68	102.7	88.3	
0.0	21.9	250	7.45	0.500	83.6		0.0							0.1	12.0	0.173	6.68	99.6	88.2	
0.0	21.9	250	7.44	0.600	83.5	2.99	0.0							0.1	12.0	0.173	6.69	98	88.3	
0.0	21.9	250	7.44	0.500	83.8		0.0						6.25	0.1	12.0	0.174	6.69	97.2	88.1	4.91
0.0	21.9	250	7.45	0.300	83.9		0.0	11.7	0.134	6.58	159.7	85		0.1	12.0	0.174	6.69	95.8	88.2	
0.0							0.0	11.7	0.134	6.59	156.6	85		0.1	11.9	0.174	6.7	95.2	88.2	
0.0						2.98	0.0	11.7	0.134	6.59	152.4	85		0.1	11.9	0.174	6.69	95.6	88.2	
0.0							0.0	11.7	0.134	6.59	151.4	85	6.29	0.1	11.9	0.173	6.69	95.5	88.2	4.94
0.0	22.1	252	7.48	0.300	85		0.0	11.7	0.134	6.59	152.9	85		0.1	11.9	0.174	6.69	96.4	88.2	
0.0	22.1	254	7.48	0.200	85.3		0.0	11.8	0.134	6.59	151.8	85		0.1	11.9	0.175	6.69	91.5	88.2	
0.0	22.2	257	7.48	0.100	85.4	2.96	0.0	11.7	0.134	6.6	159.3	85.1		0.0	12.0	0.175	6.67	93.1	88.3	
0.0	22.2	260	7.49	0.100	85.7		0.0	11.8	0.134	6.6	157.7	85.1	6.29	0.0	12.0	0.175	6.67	93.6	88.3	4.96
0.0	22.3	264	7.5	0.300	85.6		0.0	11.8	0.134	6.6	151.7	85.2		0.0	12.0	0.174	6.66	95.7	88.2	
0.0	22.3	269	7.51	0.300	85.5		0.0	11.8	0.134	6.61	157.7	85.2		0.0	12.0	0.174	6.66	93.3	88.3	
0.0	22.4	271	7.51	0.500	85.3	2.96	0.0	11.8	0.134	6.6	153.9	85.2		0.0	12.0	0.174	6.66	95.1	88.3	
0.0	22.4	274	7.51	1.000	85.1		0.0	11.8	0.134	6.59	150	85.2	6.23	0.0						4.94
0.0	22.4	275	7.52	1.200	84.8		0.0	11.8	0.134	6.58	152.6	85.2		0.0						
0.0	22.4	276	7.52	1.400	84.8		0.0	11.9	0.134	6.58	159.9	85.3		0.0						
0.0	22.4	277	7.52	1.600	85.1	3.00	0.0	11.9	0.134	6.58	174.6	85.4		0.0	12.0	0.177	6.65	86.1	88.2	
0.0	22.5	278	7.5	2.200	83.9		0.0	11.9	0.134	6.58	197	85.3	6.17	0.0	12.0	0.178	6.64	86.5	88.3	4.91
0.0	22.5	278	7.46	2.500	82.5		0.0	12.0	0.134	6.58	222.7	85.4		0.0	12.0	0.179	6.63	87.7	88.4	
0.0	22.5	278	7.43	2.200	81.5		0.0							0.0	12.1	0.18	6.64	88.2	88.4	
0.0	22.5	277	7.41	1.700	81	3.04	0.0							0.0	12.1	0.18	6.62	85.8	88.2	
0.0	22.5	276	7.4	1.400	81.1		0.0						6.11	0.0	12.1	0.181	6.62	87.6	88.3	5.02
0.0	22.5	275	7.41	1.200	81.5		0.0	12.2	0.136	6.55	302.6	86		0.0	12.1	0.181	6.62	87	88.3	
0.0							0.0	12.3	0.136	6.54	290.6	86.1		0.0	12.1	0.181	6.62	89.6	88.2	
0.0						2.97	0.0	12.4	0.136	6.53	315	85.8		0.0	12.0	0.18	6.63	90	88.3	
0.0							0.0	12.4	0.136	6.52	310.6	85.7	6.25	0.0	12.0	0.18	6.63	90.7	88.4	5.04
0.0	22.5	271	7.48	0.600	84.2		0.0	12.5	0.137	6.51	304.5	86.2		0.0	12.0	0.179	6.64	88.9	88.3	
0.0	22.5	270	7.48	0.400	84.5		0.0	12.6	0.137	6.52	321	86		0.0	12.0	0.178	6.64	87.5	88.3	
0.0	22.5	270	7.5	0.400	84.9	3.00	0.0	12.6	0.138	6.51	320.8	85.9		0.0	11.9	0.178	6.64	83.2	88.2	
0.0	22.5	269	7.53	0.200	85.4		0.0	12.6	0.139	6.51	334.4	85.9	6.31	0.0	11.8	0.177	6.65	76.5	87.8	4.95
0.0	22.5	269	7.54	0.100	85.6		0.0	12.7	0.14	6.51	334.4	86.1		0.0	11.7	0.174	6.65	67.8	88.4	
0.0	22.5	269	7.56	0.100	85.9		0.0	12.7	0.141	6.51	338.7	85.9		0.0	11.5	0.172	6.65	56.3	87.6	
0.0	22.5	269	7.58	0.300	86	2.99	0.0	12.8	0.142	6.51	337.2	85.6		0.0	11.3	0.171	6.67	48.9	87.4	
0.0	22.5	269	7.59	0.300	86.1		0.0	12.8	0.143	6.51	334.1	85.8	6.32	0.0						4.58
0.0	22.5	269	7.6	0.200	86.2		0.0	12.8	0.144	6.51	341.2	85.8		0.0						
0.0	22.5	269	7.61	0.200	86.3		0.0	12.8	0.144	6.51	343.4	85.8		0.0						
0.0	22.5	269	7.63	0.100	86.3	3.00	0.0	12.8	0.145	6.52	341.6	85.8		0.1	10.6	0.157	6.68	30.3	88.9	
0.0	22.5	268	7.63	0.100	86.3		0.0	12.9	0.144	6.53	333.6	85.8	6.23	0.1	10.6	0.155	6.68	31.3	88.9	3.41
0.0	22.5	268	7.64	0.200	86.3		0.0	12.9	0.144	6.53	337.7	85.8		0.1	10.5	0.155	6.66	29.6	88.5	
0.0	22.5	268	7.64	0.200	86.4		0.0							0.1	10.4	0.154	6.65	28.4	88.3	
0.0	22.5	268	7.65	0.200	86.4	2.99	0.0							0.2	10.4	0.156	6.66	28.3	88.9	
0.0	22.5	268	7.65	0.100	86.4		0.0						6.24	0.3	10.4	0.157	6.63	30.7	88.8	3.44
0.0	22.5	268	7.66	0.000	86.4		0.0	12.8	0.142	6.55	267.8	85.7		0.4	10.4	0.158	6.64	37.7	89.4	
0.0							0.0	12.7	0.142	6.54	271.6	85.6		0.6	10.6	0.161	6.62	52	89	
0.0						3.00	0.0	12.7	0.141	6.54	258.6	85.4		0.7	10.8	0.161	6.61	65.7	89.9	
0.0							0.0	12.6	0.14	6.53	254.7	85.4	6.10	1.0	10.9	0.161	6.62	74.8	90.1	3.67
0.0	22.5	269	7.68	0.200	86.5		0.0	12.6	0.14	6.53	252.9	85.6		1.0	11.2	0.16	6.63	80.9	89.7	
0.0	22.5	269	7.68	0.100	86.5		0.0	12.6	0.139	6.54	240.2	85.6		1.2	11.3	0.162	6.64	83.3	89.3	
0.0	22.5	269	7.69	0.300	86.5	3.01	0.0	12.5	0.139	6.54	236.2	85.7		1.3	11.3	0.163	6.64	83.7	89	
0.0	22.5	269	7.69	0.500	86.5		0.0	12.5	0.139	6.54	240.6	85.5	6.16	1.5	11.4	0.163	6.64	81.4	88.6	4.66
0.0	22.5	269																		

Cont.	September 25 - Baseflow						October 25 - Post-storm Day 2						October 27 - Post-storm Day 4							
Distance (km)	Temperature (°C)	Conductivity (mS cm ⁻¹)	pH	Turbidity (NTU)	ODOSat (%)	DOC (mg L ⁻¹)	Distance (km)	Temperature (°C)	Conductivity (mS cm ⁻¹)	pH	Turbidity (NTU)	ODOSat (%)	DOC (mg L ⁻¹)	Distance (km)	Temperature (°C)	Conductivity (mS cm ⁻¹)	pH	Turbidity (NTU)	ODOSat (%)	DOC (mg L ⁻¹)
0.0						2.83	0.0	12.4	0.137	6.55	244	86		3.7	11.3	0.168	6.64	68.9	87.1	
0.0							0.0	12.4	0.137	6.55	244.5	86	6.10	3.8	11.3	0.168	6.64	71.6	87.3	4.53
0.0	22.5	270	7.72	0.100	86.5		0.0	12.4	0.137	6.55	243.1	86		4.0	11.4	0.168	6.64	69.3	87.3	
0.0	22.5	270	7.72	0.100	86.4		0.0	12.4	0.137	6.55	243.5	86.1		4.1	11.5	0.168	6.64	68.2	87.4	
0.0	22.5	270	7.71	0.100	86.6	2.85	0.0	12.5	0.137	6.55	245.9	86		4.3	11.5	0.169	6.63	67	87.4	
0.1	22.5	270	7.71	0.100	86.5		0.0	12.4	0.137	6.55	240.8	86.1	6.15	4.5	11.6	0.169	6.63	64.7	87.2	4.69
0.1	22.5	270	7.71	0.200	86.5		0.0	12.4	0.137	6.55	240.3	86.1		4.7	11.5	0.169	6.63	64.5	87	
0.1	22.5	270	7.71	0.200	86.5		0.0	12.4	0.137	6.55	231.9	86.1		4.8	11.5	0.167	6.65	63.4	87	
0.1	22.5	270	7.71	0.100	86.5	2.84	0.0	12.4	0.137	6.55	230.5	86.1		5.0	11.5	0.168	6.59	67	87.1	
0.1	22.5	270	7.71	0.100	86.6		0.0	12.4	0.137	6.55	236	86.1	6.13	5.0						5.02
0.1	22.5	271	7.71	0.100	86.5		0.0	12.4	0.137	6.55	232.1	86.1		5.0						
0.1	22.5	271	7.71	0.100	86.5		0.0	12.4	0.137	6.55	231.4	86		5.0						
0.1	22.5	270	7.71	0.100	86.5	2.86	0.0	12.4	0.137	6.55	229	86.1		5.6	11.5	0.168	6.61	63.7	87.2	
0.1	22.5	271	7.71	0.100	86.6		0.0	12.4	0.137	6.55	233.4	86.1	6.13	5.6	11.5	0.168	6.61	62.1	87.3	4.87
0.1	22.5	271	7.71	0.100	86.5		0.0	12.4	0.137	6.55	234.9	86.1		5.9	11.5	0.168	6.61	59.5	87.2	
0.1	22.4	271	7.71	0.200	86.4		0.0							5.9	11.5	0.168	6.61	61.1	87	
0.1	22.5	271	7.71	0.000	86.5	2.86	0.0							6.1	11.6	0.167	6.62	58.3	87.3	
0.1	22.5	271	7.71	0.100	86.5		0.0						6.11	6.1	11.6	0.167	6.62	57.8	87.3	4.93
0.1	22.4	271	7.71	0.200	86.3		0.0	12.4	0.137	6.55	225.4	86.1		6.3	11.7	0.167	6.61	56.8	87.3	
0.1							0.0	12.4	0.137	6.54	231.5	86		6.3	11.7	0.166	6.61	56	87.3	
0.1						2.86	0.0	12.4	0.137	6.54	228.1	86.1		6.6	11.8	0.166	6.6	54.6	87.3	
0.1							0.0	12.4	0.137	6.55	228.8	86.1	6.11	6.7	11.8	0.166	6.6	58.9	87.4	4.94
0.1	22.4	271	7.72	0.400	86.4		0.0	12.4	0.137	6.55	219.8	86.1		6.9	11.8	0.165	6.6	54.9	87.3	
0.2	22.4	271	7.72	0.300	86.3		0.0	12.4	0.137	6.55	223.3	86.1		6.9	12.0	0.165	6.6	54.3	87.2	
0.3	22.4	271	7.73	0.400	86.3	2.81	0.0	12.4	0.137	6.55	216.8	86.1		7.1	12.0	0.165	6.6	55.2	87.2	
0.5	22.4	271	7.73	0.300	86.3		0.0	12.4	0.137	6.55	222.9	86.1	6.14	7.3	12.0	0.165	6.59	54.2	87.4	5.07
0.6	22.4	270	7.73	0.400	86.4		0.0	12.4	0.137	6.56	225	86.1		7.5	12.0	0.165	6.58	53.5	87.4	
0.8	22.4	269	7.72	0.400	86.3		0.0	12.4	0.137	6.56	225.6	86.1		7.7	12.1	0.165	6.58	51	87.4	
1.0	22.3	267	7.72	0.400	86.3	2.84	0.0	12.4	0.137	6.55	226.9	86.1		7.8	12.1	0.165	6.57	47.9	87.3	
1.0	22.2	266	7.73	0.500	86.1		0.0	12.4	0.137	6.55	235.7	86.2	6.12	7.8						5.16
1.2	22.2	261	7.73	0.700	86		0.0	12.4	0.137	6.55	240.3	86.2		7.8						
1.3	22.2	259	7.72	0.700	85.7		0.0	12.4	0.137	6.55	236.6	86.1		7.8						
1.5	22.1	258	7.71	0.900	85.4	2.89	0.0	12.4	0.137	6.55	239.1	86.1		8.7	12.2	0.165	6.55	43.2	86	
1.6	22.1	258	7.7	0.700	84.9		0.0	12.4	0.137	6.54	237.5	86.2	6.06	8.7	12.2	0.165	6.55	43	86	5.22
1.8	22.1	255	7.69	0.700	84.5		0.0	12.4	0.138	6.54	243.1	86.2		8.9	12.3	0.165	6.54	45.2	86	
1.8	22.1	254	7.67	1.200	84.2		0.0							8.9	12.3	0.166	6.53	45.5	85.9	
2.1	22.1	254	7.66	0.900	84	2.76	0.0							8.9	12.3	0.165	6.54	48.8	86.1	
2.2	22.1	257	7.65	0.900	83.9		0.0						6.07	8.9	12.4	0.165	6.53	50.1	86.2	5.43
2.3	22.1	260	7.64	1.000	83.6		0.0	12.4	0.138	6.55	222.9	86.1		8.9	12.4	0.165	6.53	50.7	86.5	
2.3							0.0	12.4	0.138	6.55	226.1	86.1		8.9	12.5	0.167	6.52	51.7	86.4	
2.3						2.77	0.0	12.4	0.138	6.56	223.2	86.1		8.9	12.5	0.167	6.52	52.5	86.3	
2.3							0.0	12.4	0.137	6.56	220.1	86.1	6.12	8.9	12.5	0.166	6.51	53.2	86.4	5.53
2.7	22.3	271	7.6	1.000	83		0.0	12.4	0.137	6.55	219.5	86.1		8.9	12.5	0.167	6.51	55.6	86.2	
2.9	22.3	273	7.59	1.000	82.9		0.1	12.4	0.137	6.55	219.6	86.1		8.9	12.6	0.166	6.51	56.5	86.2	
3.1	22.3	273	7.59	1.000	83	2.78	0.1	12.4	0.137	6.56	218.8	86.1		8.9	12.6	0.166	6.51	55.2	86.1	
3.3	22.3	272	7.58	1.200	82.9		0.1	12.4	0.137	6.55	222.9	86.1	6.06	8.9	12.6	0.166	6.52	55.4	85.9	5.63
3.3	22.2	270	7.59	1.200	83		0.1	12.4	0.137	6.55	224.7	86.2		8.9	12.6	0.166	6.53	54.2	86	
3.6	22.2	267	7.58	1.500	83.1		0.1	12.4	0.137	6.55	228.5	86.1		8.9	12.6	0.165	6.53	53.9	85.8	
3.7	22.2	267	7.57	1.400	83	2.78	0.1	12.4	0.137	6.55	225.1	86.1		8.9	12.6	0.166	6.54	53.9	85.6	
3.8	22.2	265	7.56	1.800	83		0.1	12.4	0.137	6.55	221.9	86.2	6.11	8.9						
4.0	22.3	264	7.55	1.800	83		0.1	12.4	0.137	6.55	218.6	86.2		8.9						
4.2	22.3	264	7.54	1.900	83.2		0.1	12.4	0.137	6.56	217.1	86.1		8.9						
4.3	22.4	263	7.53	2.300	83.5	2.76	0.1	12.4	0.137	6.55	214.1	86.1		8.9	12.6	0.166	6.54	52.7	85.4	
4.5	22.4	263	7.53	3.100	84.3		0.1	12.4	0.137	6.55	212.2	86.2	6.03	8.9	12.7	0.166	6.53	53.8	85.2	5.62
4.6	22.5	262	7.54	3.900	84.9		0.1	12.4	0.137	6.55	208.2	86.1		8.9	12.7	0.166	6.54	55.2	85.2	
4.9	22.6	262	7.55	3.900	85.6		0.1							8.9	12.7	0.166	6.55	52.7	85.2	
5.0	22.6	262	7.57	3.900	86.2	2.82	0.1							8.9	12.8	0.166	6.55	51.5	85.1	
5.0	22.7	262	7.59	3.200	86.8		0.1						6.03	8.9	12.8	0.168	6.55	54.1	85.1	
5.2	22.7	262	7.61	2.700	87.9		0.1	12.4	0.137	6.55	233.3	85.8		8.9	12.9	0.169	6.56	52.7	85	
5.2							0.5	12.4	0.138	6.56	239	86		8.9	12.9	0.167	6.54	52.3	85.1	
5.2						2.78	0.5	12.5	0.137	6.56	252.4	86.3		8.9	12.9	0.167	6.57	51.3	85.2	
5.2							0.6	12.6	0.137	6.57	269.4	86.5	6.10	8.9	12.9	0.167	6.57	52.3	85.3	5.37
5.6	23.1	262	7.73	2.100	92.5		0.8	12.8	0.137	6.57	278	86.6		8.9	13.0	0.167	6.58	53.4	85.1	
5.8	23.1	262	7.75	2.000	93		1.0	12.8	0.137	6.58	295.5	86.6		9.0	13.0	0.167	6.57	52.9	85.2	
5.9	23.1	262	7.77	1.800	93.5	2.77	1.2	12.9	0.137	6.58	309.2	86.6		9.0	13.0	0.167	6.58	53.1	85.2	
6.0	23.1	262	7.79	1.700	93.9		1.3	12.9	0.137	6.58	304.3	86.5	5.72	9.0	13.0	0.167	6.58	51.3	85.2	5.72
6.1	23.2	262	7.8	1.500	94.2		1.5	12.9	0.137	6.58	315	86.4		9.0	13.0	0.167	6.59	50.8	85.1	
6.2	23.2	262	7.8	1.400	94.3		1.6	12.9	0.138	6.58	319.5	86.4		9.0	13.1	0.166	6.6	50.1	85	
6.3	23.2	262	7.8	1.500	94.1	2.83	1.8	12.9	0.138	6.59	316.4	86.4		9.0	13.2	0.166	6.59	51.6	85.1	
6.5	23.2	262	7.79	2.000	93.2		2.1	13.0	0.138	6.59	322.9	86.3	5.81	9.0						

Cont.	September 25 - Baseflow							October 25 - Post-storm Day 2							October 27 - Post-storm Day 4						
Distance (km)	Temperature (°C)	Conductivity (mS cm ⁻¹)	pH	Turbidity (NTU)	ODOsat (%)	DOC (mg L ⁻¹)		Distance (km)	Temperature (°C)	Conductivity (mS cm ⁻¹)	pH	Turbidity (NTU)	ODOsat (%)	DOC (mg L ⁻¹)	Distance (km)	Temperature (°C)	Conductivity (mS cm ⁻¹)	pH	Turbidity (NTU)	ODOsat (%)	DOC (mg L ⁻¹)
8.7	23.1	261	7.44	10,500	79.8	2.77		4.7	13.1	0.143	6.58	289.6	85.3		9.0	13.7	0.166	6.69	50.6	85.2	
8.9	23.1	261	7.42	10,200	79.5			4.7	13.1	0.143	6.58	294.3	85.3	6.33	9.0	13.7	0.168	6.69	51.1	85.1	5.46
9.1	23.2	261	7.4	8,900	79.6			4.7	13.1	0.142	6.58	288.4	85.2		9.0	13.7	0.168	6.72	53.2	85	
9.1	23.2	262	7.38	7,800	80			4.7	13.0	0.141	6.58	262.9	85.3		9.0	13.7	0.168	6.74	50.2	85.1	
9.2	23.2	262	7.38	6,500	80.4	2.88		4.8	13.0	0.141	6.57	272.8	85.3		9.0	13.7	0.168	6.76	51.1	85	
9.2	23.2	262	7.37	6,200	80.8			4.8	13.0	0.141	6.56	283.7	85.3	6.44	9.0						5.80
9.2	23.2	262	7.36	5,900	81			4.8	13.0	0.141	6.55	278.5	85.3		9.0						
9.2	23.2	262	7.36	4,800	81.1			5.0	13.0	0.141	6.55	296.4	85.3		9.0						
9.2	23.2	263	7.36	4,500	81.2	2.84		5.2	13.0	0.14	6.55	304.6	85.4		9.0	13.7	0.168	6.8	45.9	84.9	
9.2	23.2	263	7.35	4,100	81.9			5.3	12.9	0.14	6.55	309	85.5	6.72	9.0	13.7	0.168	6.8	46.9	84.9	5.09
9.2	23.2	263	7.35	4,200	82.4			5.4	12.9	0.14	6.54	301.2	85.5		9.0	13.7	0.168	6.8	47.4	85	
9.2	23.3	263	7.35	3,900	82.8			5.4							9.0	13.7	0.167	6.8	46.8	85	
9.2	23.3	263	7.35	3,600	83	2.86		5.4							9.0	13.8	0.167	6.74	48.5	85	
9.2	23.3	263	7.36	3,500	83.2			5.4						0.32	9.0	13.9	0.167	6.7	47.7	84.9	5.44
9.2	23.3	263	7.36	3,300	83.3			5.6	12.9	0.14	6.56	317.9	85.6		9.0	14.1	0.167	6.68	48.8	84.9	
9.2								6.3	12.9	0.14	6.56	313.3	85.5		9.0	14.2	0.167	6.68	47.3	85	
9.2						2.83		6.3	12.9	0.14	6.55	283	85.4		9.0	14.2	0.164	6.68	46.7	85.5	
9.2								6.4	12.9	0.14	6.55	270	85.3	6.55	9.0	14.3	0.164	6.68	45.5	85.6	5.53
9.2	23.3	262	7.38	3,700	83.4			6.6	12.9	0.14	6.55	258.3	85.1		9.0	14.3	0.166	6.68	47.6	85.7	
9.2	23.3	262	7.37	3,700	83.3			6.7	13.0	0.14	6.55	246.6	85		9.0	14.3	0.166	6.68	47.1	85.7	
9.2	23.3	263	7.37	3,700	83.1	2.84		6.9	13.0	0.14	6.55	228.5	84.9		9.0	14.3	0.165	6.67	49.4	85.9	
9.2	23.4	262	7.37	4,000	82.9			7.1	13.0	0.141	6.55	219.3	84.7	6.87	9.0	14.3	0.165	6.68	46.5	86	5.65
9.2	23.3	262	7.37	4,400	82.8			7.3	13.0	0.141	6.55	219.2	84.7		9.0	14.3	0.166	6.67	45	86	
9.2	23.4	262	7.37	4,900	82.7			7.4	13.0	0.142	6.54	214.3	84.5		9.0	14.3	0.165	6.67	46.3	86.3	
9.2	23.4	262	7.37	4,800	82.5	2.83		7.6	13.0	0.142	6.54	213.1	84.5		9.0	14.3	0.165	6.65	46.1	86.5	
9.2	23.4	262	7.36	5,100	82.3			7.8	13.0	0.142	6.54	218.5	84.4	6.80	9.0						5.78
9.2	23.4	262	7.36	5,200	82.2			8.1	13.0	0.143	6.54	218.4	84.2		9.0						
9.2	23.4	262	7.36	5,200	82.1			8.2	13.0	0.143	6.53	205.9	84.1		9.0						
9.2	23.4	262	7.35	5,100	82.1	2.84		8.4	13.1	0.143	6.53	199.5	84.1		9.0	14.3	0.168	6.66	47.1	87	
9.2	23.4	262	7.35	5,300	82.1			8.5	13.1	0.143	6.53	200.7	84	6.82	9.0	14.3	0.168	6.65	46.7	87.2	5.52
9.2	23.4	262	7.35	5,100	82.1			8.7	13.1	0.143	6.53	196.3	83.9		9.0	14.4	0.168	6.66	46.7	86.9	
9.2	23.4	262	7.34	5,200	82.1			8.7							9.0	14.4	0.168	6.64	47.3	87.3	
9.2	23.4	262	7.34	5,100	82.2	2.83		8.7							9.0	14.4	0.168	6.62	47	87.3	
9.2	23.4	262	7.34	5,000	82.2			8.7						6.94	9.0	14.4	0.168	6.63	48.6	87.3	5.81
9.2	23.4	262	7.34	4,800	82.3			8.9	13.1	0.144	6.53	216.6	83.7		9.0	14.4	0.168	6.65	47.5	87.4	
9.2								9.2	13.1	0.143	6.53	229.6	83.6		9.0	14.4	0.168	6.66	45.7	87.4	
9.2						2.82		9.2	13.1	0.143	6.54	226	83.6		9.0	14.4	0.168	6.66	47.1	87.7	
9.2								9.2	13.2	0.143	6.54	228.4	83.6	6.79	9.0	14.4	0.169	6.66	51.3	87.7	5.78
9.2	23.4	262	7.34	4,400	82.4			9.2	13.2	0.143	6.55	225.9	83.6		9.0	14.4	0.168	6.63	59.3	88.1	
9.2	23.4	262	7.34	4,300	82.5			9.2	13.2	0.144	6.55	228.8	83.6		9.2	14.4	0.168	6.62	53.4	88.3	
9.2	23.4	262	7.34	4,200	82.6	2.86		9.2	13.2	0.144	6.56	235.2	83.5		9.2	14.4	0.169	6.62	49.3	88.2	
9.2	23.5	262	7.34	4,200	82.7			9.2	13.2	0.144	6.56	234.5	83.4	6.97	9.2	14.4	0.169	6.62	47.9	88.1	5.74
9.2	23.5	262	7.34	4,000	82.8			9.2	13.2	0.144	6.57	232.1	83.4		9.2	14.4	0.169	6.61	47.6	88.1	
9.2	23.5	262	7.34	4,200	82.8			9.2	13.2	0.144	6.57	228.3	83.3		9.2	14.4	0.168	6.62	47.4	88.1	
9.2	23.5	262	7.35	4,000	82.9	2.83		9.2	13.2	0.144	6.57	221.6	83.2		9.2	14.4	0.168	6.61	46.6	88	
9.2	23.5	262	7.35	3,900	83			9.2	13.2	0.144	6.57	213.6	83.2	6.93	9.2						
9.2	23.5	262	7.35	3,900	83			9.2	13.2	0.144	6.58	211.3	83.2		9.2						
9.2	23.5	262	7.35	3,900	83.1			9.2	13.2	0.144	6.58	213.2	83.1		9.2						
9.2	23.5	262	7.35	3,700	83.1	2.83		9.2	13.2	0.144	6.58	213.6	83.1		9.2	14.3	0.168	6.63	49.3	87.8	
9.2	23.5	262	7.36	3,700	83.2			9.2	13.2	0.144	6.58	213.8	83	6.91	9.2	14.4	0.167	6.62	46.6	87.6	5.73
9.2	23.6	262	7.36	3,600	83.2			9.2	13.2	0.144	6.58	218	83		9.2	14.2	0.167	6.62	46.6	87	
9.2	23.6	262	7.36	3,600	83.2			9.2							9.2	14.1	0.168	6.61	47.3	87.2	
9.2	23.6	262	7.36	3,700	83.2	2.86		9.2							9.2	14.2	0.168	6.62	49.8	87.1	
9.2	23.6	262	7.36	3,700	83.2			9.2						6.84	9.2	14.1	0.169	6.63	52.3	87.2	5.77
9.2	23.6	262	7.36	3,600	83.1			9.2	13.2	0.144	6.59	197.9	83		9.2	14.1	0.169	6.65	49.8	87.3	
9.2								9.2	13.2	0.144	6.6	203.7	83.1		9.2	14.1	0.169	6.64	50.7	87.1	
9.2						2.84		9.2	13.2	0.144	6.6	207.1	83		9.2	14.1	0.169	6.65	51.4	86.9	
9.2								9.2	13.2	0.144	6.61	209.5	83	6.89	9.2	14.0	0.169	6.64	49.8	87	5.78
9.2	23.6	262	7.37	3,600	83.2			9.2	13.2	0.144	6.61	212.7	83		9.2	14.1	0.169	6.64	50.5	86.9	
9.2	23.6	262	7.36	3,400	83.2	2.88		9.2	13.2	0.144	6.61	216.3	82.9		9.2	14.1	0.169	6.64	50.7	87.2	
9.2	23.6	262	7.37	3,500	83.2			9.2	13.2	0.144	6.61	216	82.9		9.2	14.1	0.169	6.65	49.6	87	
9.2	23.6	262	7.37	3,700	83.2			9.2	13.2	0.144	6.61	207.9	82.9	6.84	9.2	14.1	0.168	6.64	48.8	87	5.74
9.2	23.6	262	7.37	3,700	83.2			9.2	13.2	0.144	6.61	211.6	82.9		9.2	14.2	0.168	6.64	46.3	87.1	
9.2	23.6	263	7.38	3,400	83.2			9.2	13.2	0.144	6.61	217.1	82.9		9.2	14.2	0.168	6.64	47.7	87.2	
9.2	23.6	263	7.39	3,300	83.2	2.90		9.2	13.2	0.144	6.61	216.7	82.9		9.2	14.1	0.168	6.63	47	87.4	
9.1	23.7	262	7.39	3,300	83.2			9.2	13.3	0.144	6.61	215.8	82.8	6.89	9.2						5.64
9.1	23.7	262	7.39	3,200	83.2			9.2	13.3	0.144	6.62	214.4	82.7		9.2						
9.1	23.7	263	7.4	3,200	83.2			9.2	13.3	0.144	6.62	212.2	82.7		9.2						
9.1	23.7	263	7.4	3,300	83.2	2.86															

Cont.	September 25 - Baseflow						October 25 - Post-storm Day 2						October 27 - Post-storm Day 4							
Distance (km)	Temperature (°C)	Conductivity (mS cm ⁻¹)	pH	Turbidity (NTU)	ODOSat (%)	DOC (mg L ⁻¹)	Distance (km)	Temperature (°C)	Conductivity (mS cm ⁻¹)	pH	Turbidity (NTU)	ODOSat (%)	DOC (mg L ⁻¹)	Distance (km)	Temperature (°C)	Conductivity (mS cm ⁻¹)	pH	Turbidity (NTU)	ODOSat (%)	DOC (mg L ⁻¹)
9.1	23.7	263	7.37	3.700	82.8	2.83	9.2	13.3	0.144	6.58	214.3	82.6		10.7	13.6	0.168	6.6	48.9	87	
9.1	23.7	263	7.36	3.700	82.7		9.2	13.3	0.144	6.58	218.3	82.6	6.87	10.7						5.70
9.1	23.7	263	7.36	3.900	82.7		9.2	13.3	0.144	6.58	216.5	82.6		10.7						
9.1	23.7	263	7.36	3.900	82.6		9.2	13.3	0.144	6.58	213	82.6		10.7						
9.1	23.7	263	7.36	3.900	82.5	2.81	9.2	13.3	0.144	6.59	212	82.6		11.5	13.4	0.167	6.61	46.5	86.3	
9.1	23.7	263	7.35	4.100	82.3		9.2	13.3	0.144	6.59	209.1	82.5	6.93	11.5	13.4	0.166	6.62	44.5	86	5.67
9.1	23.7	263	7.34	4.200	82		9.2	13.3	0.144	6.59	208.8	82.5		11.7	13.2	0.166	6.62	42.9	85.8	
9.1	23.7	263	7.34	4.100	81.8		9.2							11.9	13.3	0.166	6.62	42.9	85.7	
9.1	23.7	263	7.33	4.200	81.8	2.81	9.2							12.0	13.1	0.165	6.61	42.4	85.8	
9.1	23.7	263	7.33	4.200	81.8		9.2						6.91	12.2	13.2	0.165	6.61	42.7	85.8	5.70
9.2	23.7	263	7.32	4.100	81.8		9.2	13.3	0.145	6.6	190.9	82.6		12.2	13.2	0.166	6.58	49	86.1	
9.2							9.2	13.3	0.145	6.61	195	82.5		12.5	13.2	0.166	6.59	43.7	86.2	
9.2						2.84	9.2	13.3	0.145	6.61	203.8	82.5		12.7	13.3	0.166	6.59	42.5	86.4	
9.2							9.2	13.3	0.145	6.62	205.1	82.6	6.94	12.9	13.3	0.166	6.58	41.2	87.1	5.78
9.2	23.7	263	7.33	3.900	82.1		9.2	13.3	0.145	6.62	209.1	82.5		13.0	13.4	0.166	6.58	41.1	87.7	
9.2	23.7	263	7.32	4.000	82.2		9.2	13.3	0.145	6.62	212.4	82.6		13.2	13.6	0.165	6.58	40.3	87.7	
9.2	23.7	262	7.33	4.000	82.2	2.80	9.2	13.3	0.145	6.62	211.6	82.6		13.2	13.9	0.165	6.58	40.6	87.4	
9.2	23.7	263	7.33	3.900	82.4		9.2	13.3	0.145	6.62	212.2	82.5	7.01	13.5	14.0	0.165	6.58	40.7	86.8	5.83
9.2	23.7	262	7.33	3.800	82.6		9.2	13.3	0.145	6.62	202.5	82.6		13.6	14.1	0.166	6.57	40.4	85.9	
9.2	23.7	262	7.33	3.900	82.6		9.2	13.3	0.145	6.62	210.2	82.6		13.8	14.0	0.167	6.56	40.7	85.5	
9.2	23.7	262	7.33	4.000	82.7	2.84	9.2	13.3	0.145	6.62	203.1	82.6		14.0	13.9	0.167	6.54	35	87.7	
9.2	23.7	262	7.33	4.200	82.7		9.2	13.3	0.145	6.62	204.2	82.6	7.00	14.0						5.94
9.2	23.7	262	7.33	4.000	82.7		9.2	13.3	0.145	6.62	208.1	82.6		14.0						
9.2	23.7	262	7.33	4.000	82.8		9.2	13.4	0.145	6.62	208.8	82.5		14.0						
9.2	23.7	262	7.34	4.000	82.8	2.82	9.2	13.4	0.145	6.62	207.8	82.4		14.8	16.8	0.178	6.49	16.2	81.7	
9.2	23.7	262	7.34	4.200	82.9		9.2	13.4	0.145	6.62	208.8	82.4	7.05	14.8	17.1	0.183	6.5	14.2	80.8	5.92
9.2	23.7	262	7.34	4.100	83		9.2	13.4	0.145	6.62	213.7	82.4		14.9	17.2	0.186	6.51	11.8	79.4	
9.2	23.7	261	7.33	4.200	83		9.2							14.9	17.6	0.209	6.51	10.8	77.5	
9.2	23.8	261	7.34	4.600	83	2.80	9.2							14.9	17.9	0.22	6.51	9.8	77	
9.2	23.8	261	7.34	5.100	83		9.2						7.09	14.9	18.2	0.223	6.51	8.6	75.9	3.59
9.2	23.8	261	7.34	5.300	83		9.2	13.3	0.145	6.59	186.3	82.5		14.9	18.1	0.234	6.5	8.8	74.6	
9.2							9.2	13.3	0.145	6.58	193.2	82.5		14.9	18.1	0.236	6.5	8.9	74.4	
9.2						2.80	9.2	13.3	0.145	6.57	192	82.4		14.9	18.1	0.237	6.51	8.5	74.4	
9.2							9.2	13.3	0.145	6.57	188.4	82.4	7.16	14.9	18.2	0.237	6.53	8.4	74.6	3.54
9.2	23.9	261	7.37	6.400	82.7		9.2	13.3	0.145	6.56	191.7	82.4		14.9	18.3	0.238	6.55	8.1	74.6	
9.2	23.8	261	7.36	6.100	82.7		9.2	13.3	0.145	6.56	193.1	82.4		14.9	18.3	0.239	6.56	7.6	74.9	
9.2	23.9	261	7.36	6.000	82.7	2.84	9.2	13.3	0.145	6.56	192.4	82.4		14.9	18.4	0.239	6.57	7.3	75.2	
9.2	23.9	261	7.35	6.400	82.8		9.2	13.3	0.145	6.56	192.7	82.4	7.08	14.9	18.5	0.239	6.58	7.2	75.1	
9.2	23.9	261	7.34	6.200	82.8		9.2	13.3	0.145	6.56	193.1	82.4		14.9	18.6	0.24	6.59	7	75.1	
9.2	23.9	260	7.34	6.500	82.8		9.2	13.3	0.145	6.56	192.6	82.4		14.9	18.6	0.239	6.61	6.6	75.3	
9.2	24.0	259	7.35	6.600	82.7	2.86	9.2	13.3	0.145	6.56	198.9	82.3		14.9	18.7	0.24	6.62	6.7	75.4	
9.2	24.0	254	7.35	7.500	82.7		9.2	13.4	0.145	6.56	188.5	82.2	7.09	14.9						3.53
9.3	24.3	66	7.32	8.100	82.6		9.2	13.4	0.145	6.56	185.3	82.2		14.9						
9.3	24.1	261	7.36	6.900	82.8		9.2	13.4	0.145	6.56	196.2	82		14.9						
9.4	24.0	262	7.36	6.500	83	2.81	9.2	13.4	0.145	6.57	186.5	81.8		14.9	18.7	0.241	6.64	6.2	75.6	
9.5	24.0	262	7.37	6.500	83		9.2	13.4	0.145	6.57	181.6	81.7	7.15	14.9	18.7	0.241	6.65	6.4	75.7	3.56
9.7	24.0	262	7.38	6.400	83.3		9.3	13.4	0.145	6.57	182.1	81.8		14.9	18.7	0.241	6.66	6.4	75.9	
9.7	23.9	262	7.39	6.700	83.6		9.3							14.9	18.7	0.241	6.68	7.3	76.1	
9.9	23.9	263	7.39	5.900	83.9	2.84	9.3							14.9	18.7	0.241	6.69	6.3	76.2	
10.1	23.8	263	7.39	5.200	84.3		9.3						7.16	14.9	18.7	0.242	6.7	5.9	75.5	3.55
10.3	23.8	263	7.4	5.000	84.1		9.3	13.3	0.145	6.56	200.3	82		14.9	18.8	0.242	6.7	6.1	74.7	
10.3							9.3	13.4	0.145	6.56	205.1	81.9		14.9	18.8	0.242	6.7	6.1	74.3	
10.3						2.77	9.3	13.4	0.145	6.55	208.3	81.8		14.9	18.9	0.241	6.7	5.9	74.1	
10.3							9.3	13.4	0.145	6.55	205.7	81.7	7.21	14.9	18.9	0.242	6.69	6.2	74.1	3.62
10.9	23.7	262	7.4	6.300	83.4		9.3	13.3	0.145	6.55	190.2	82		14.9	19.0	0.242	6.7	5.9	74.2	
11.0	23.7	262	7.4	6.500	83.3		9.3	13.1	0.145	6.54	186.8	82.4		14.9	19.0	0.242	6.71	5.9	74.6	
11.2	23.7	262	7.39	6.700	82.6	2.76	9.2	13.2	0.145	6.53	193.7	82.3		14.9	18.9	0.242	6.71	5.9	74.7	
11.3	23.7	262	7.37	6.500	82.2		9.2	13.2	0.145	6.53	191.5	82	7.17	14.9	18.8	0.242	6.72	5.7	74.6	3.69
11.5	23.7	262	7.36	6.500	82		9.2	12.7	0.146	6.52	185.9	81		14.9	18.8	0.242	6.73	6.6	74.1	
11.7	23.7	261	7.36	6.000	81.9		9.3	12.2	0.147	6.52	190.4	81.3		14.9	18.8	0.242	6.72	5.8	73.6	
11.9	23.7	261	7.35	6.100	81.7	2.80	9.4	12.1	0.146	6.51	190	81.8		14.9	18.8	0.242	6.71	6	73.3	
12.0	23.6	261	7.34	6.100	81.4		9.5	12.2	0.145	6.51	188.4	82.1	7.12	14.9						3.58
12.2	23.6	261	7.34	6.600	81.2		9.5	12.3	0.145	6.51	190.1	82.6		14.9						
12.4	23.6	261	7.33	7.000	80.9		9.7	12.5	0.144	6.5	198.7	82.5		14.9						
12.6	23.6	261	7.32	7.000	80.6	2.85	9.9	12.6	0.145	6.5	195.9	82.9		14.9	19.0	0.242	6.73	6.5	73.8	
12.7	23.6	262	7.31	7.500	80.1		10.1	12.7	0.145	6.49	199.7	82.9	6.90	14.9	18.9	0.242	6.72	6.2	73.9	3.64
12.9	23.6	262	7.3	7.200	79.5		10.3	12.8	0.145	6.48	196.9	82.9		14.9	19.0	0.242	6.72	6.1	74.3	
13.0	23.6	262	7.28	7.600	79		10.3							14.9	19.0	0.242	6.72	5.9	74.3	
13.2	23.6	262	7.28	8.100	78.6	2.89	10.3							14.9	19.0	0.242	6.72	6.1	74.3	
13.3	23.6	262	7.26	9.000	78.1		10.3						6.96	14.9	18.9	0.242	6.72	5.9	74.5	3.

Cont.	September 25 - Baseline							October 25 - Post-storm Day 2							October 27 - Post-storm Day 4						
Distance (km)	Temperature (°C)	Conductivity (mS cm ⁻¹)	pH	Turbidity (NTU)	ODOsat (%)	DOC (mg L ⁻¹)		Distance (km)	Temperature (°C)	Conductivity (mS cm ⁻¹)	pH	Turbidity (NTU)	ODOsat (%)	DOC (mg L ⁻¹)	Distance (km)	Temperature (°C)	Conductivity (mS cm ⁻¹)	pH	Turbidity (NTU)	ODOsat (%)	DOC (mg L ⁻¹)
15.3	24.4	253	7.32	4.300	85	2.89		14.9							15.1	18.8	0.242	6.96	6.1	75.9	
15.3	24.4	253	7.32	4.300	85.1			14.9						6.75	15.1	18.9	0.242	6.9	6.4	75.7	3.48
15.3	24.4	253	7.32	4.300	85.1			14.9	13.6	0.154	6.43	152.3	79.8		15.1	18.9	0.242	6.87	6.8	75.6	
15.3								14.9	13.6	0.154	6.43	153.7	79.8		15.3	18.9	0.242	6.86	6.7	76	
15.3						2.94		14.9	13.6	0.154	6.43	156.8	79.8		15.3	19.0	0.242	6.88	6.5	76.6	
15.3								14.9	13.6	0.154	6.43	157.4	79.8	6.86	15.5	19.1	0.242	6.88	6.1	76.7	3.48
15.3	24.4	253	7.33	4.200	85.2			14.9	13.6	0.154	6.43	157.8	79.8		15.5	19.2	0.242	6.9	5.9	76.7	
15.3	24.5	253	7.33	4.200	85.2			14.9	13.6	0.154	6.42	158.5	79.9		15.5	19.2	0.242	6.9	5.7	76.6	
15.3	24.5	253	7.33	4.200	85.3	2.92		14.9	13.6	0.154	6.42	154.2	79.9		15.5	19.2	0.242	6.9	5.5	76.2	
15.3	24.5	253	7.33	4.200	85.4			14.9	13.6	0.154	6.42	158.2	79.9	6.83	15.5	19.2	0.243	6.89	5.7	75.7	3.22
15.3	24.5	253	7.33	4.000	85.4			14.9	13.6	0.154	6.42	166.6	80		15.7	19.2	0.243	6.85	5.9	75.6	
15.3	24.5	253	7.33	4.000	85.5			14.9	13.6	0.154	6.43	166.1	79.9		15.7	19.2	0.243	6.83	6.2	75.8	
15.3	24.5	253	7.33	4.100	85.7	2.92		14.9	13.6	0.154	6.43	167	79.9		15.8	19.2	0.243	6.84	6.3	76.2	
15.3	24.5	253	7.34	4.000	85.8			14.9	13.6	0.154	6.43	171.7	79.9	6.78	15.8						3.45
15.3	24.5	253	7.34	4.000	85.9			14.9	13.6	0.154	6.43	175.9	79.8		15.8						
15.3	24.5	253	7.34	4.000	85.9			14.9	13.6	0.154	6.44	161.6	79.8		15.8						
15.3	24.5	253	7.35	4.000	86.1	2.91		14.9	13.6	0.154	6.44	149.9	79.9		16.5	19.3	0.243	6.86	5.3	77.1	
15.3	24.5	253	7.35	4.000	86.1			14.9	13.5	0.155	6.44	148	80.1	6.79	16.5	19.3	0.243	6.86	5.1	76.7	
15.3	24.5	253	7.35	4.000	86.4			14.9	13.5	0.155	6.44	158.4	80.1		16.5	19.3	0.243	6.88	5.1	75.7	
15.3	24.5	253	7.36	3.900	86.4			14.9							16.7	19.3	0.243	6.9	5	74.9	
15.3	24.6	253	7.36	4.000	86.5	2.92		14.9							16.8	19.3	0.243	6.9	4.8	74.3	
15.3	24.6	253	7.36	4.000	86.5			14.9						6.96	16.9	19.3	0.243	6.9	5	73.9	3.48
15.3	24.6	253	7.37	3.900	86.7			14.9	13.6	0.155	6.44	140.1	79.8		17.1	19.3	0.243	6.89	4.7	73.5	
15.3								14.9	13.6	0.155	6.43	147.2	79.8		17.2	19.4	0.243	6.9	5	73.1	
15.3						2.95		14.9	13.6	0.155	6.43	154.4	79.8		17.3	19.4	0.243	6.89	5	72.7	
15.3								14.9	13.6	0.155	6.43	158.8	79.8	6.77	17.5	19.5	0.243	6.88	4.8	72.4	3.47
15.3	24.6	253	7.39	4.000	87.3			14.9	13.6	0.155	6.43	154.2	79.8		17.6	19.5	0.243	6.88	4.8	72.1	
15.3	24.6	253	7.39	4.000	87.2			14.9	13.6	0.155	6.43	151.8	79.9		17.8	19.6	0.243	6.88	4.7	71.7	
15.3	24.6	253	7.4	3.900	87.5	2.93		14.9	13.6	0.155	6.43	158.5	79.9		17.9	19.6	0.243	6.86	4.7	71.3	
15.3	24.6	253	7.4	3.900	87.6			14.9	13.6	0.155	6.43	160.3	79.8	6.81	18.1	19.6	0.244	6.85	4.7	71.1	3.53
15.3	24.6	253	7.4	3.900	87.6			14.9	13.6	0.154	6.43	167.1	79.8		18.2	19.5	0.244	6.84	4.5	70.8	
15.3	24.6	253	7.41	3.900	87.7			14.9	13.6	0.154	6.43	157.8	79.8		18.5	19.4	0.245	6.84	4.5	70.6	
15.3	24.6	253	7.41	3.800	87.6	2.99		14.9	13.6	0.154	6.43	153.2	79.8		18.6	19.4	0.245	6.83	4.5	70.4	
15.3	24.6	253	7.4	3.600	87.6			14.9	13.6	0.155	6.43	152	79.9	6.86	18.6						3.55
15.3	24.6	253	7.4	3.700	87.7			14.9	13.6	0.155	6.43	152.7	79.9		18.6						
15.3	24.6	253	7.4	3.700	87.7			14.9	13.6	0.155	6.43	154.9	79.9		18.6						
15.3	24.6	253	7.41	3.700	87.8	2.97		14.9	13.6	0.155	6.43	162.6	79.9		19.4	19.5	0.245	6.82	4.4	70.2	
15.3	24.6	253	7.41	3.700	87.7			14.9	13.6	0.155	6.43	159.3	79.9	6.94	19.4	19.5	0.245	6.82	4.4	70.5	3.47
15.3	24.7	253	7.41	3.700	87.7			14.9	13.6	0.155	6.43	159.3	79.9		19.4	19.7	0.244	6.82	4.1	70.4	
15.3	24.7	253	7.4	3.700	87.8			14.9							19.6	19.6	0.245	6.82	4	70.2	
15.3	24.7	253	7.4	3.600	87.9	2.98		14.9							19.8	19.5	0.245	6.81	4.3	69.9	
15.3	24.7	253	7.4	3.600	87.9			14.9						6.91	20.0	19.5	0.246	6.8	4	69.9	3.47
15.3	24.7	253	7.4	3.600	87.9			14.9	13.6	0.155	6.44	146.7	79.8		20.1	19.5	0.246	6.8	4	69.8	
15.3								14.9	13.6	0.155	6.44	152.1	79.7		20.3	19.6	0.245	6.8	3.7	69.6	
15.3						2.96		14.9	13.6	0.155	6.44	152.9	79.8		20.3	19.6	0.245	6.8	3.7	69.5	
15.3								14.9	13.6	0.155	6.44	161.6	79.7	6.87	20.5	19.6	0.246	6.79	3.6	69.3	3.46
15.3	24.7	253	7.41	3.700	87.9			14.9	13.6	0.155	6.44	159.4	79.8		20.6	19.6	0.246	6.79	3.7	69.3	
15.3	24.7	253	7.4	3.700	88			14.9	13.6	0.155	6.44	156.8	79.7		20.8	19.7	0.246	6.79	3.9	69.1	
15.3	24.7	253	7.4	3.900	88	2.93		14.9	13.6	0.155	6.44	158.9	79.7		20.9	19.7	0.246	6.8	3.4	69.3	
15.3	24.7	253	7.4	3.800	87.9			14.9	13.6	0.155	6.44	153.9	79.7	6.91	21.0	19.7	0.246	6.8	3.4	69.3	3.42
15.3	24.7	253	7.41	3.800	88			14.9	13.6	0.155	6.45	152.2	79.7		21.1	19.7	0.246	6.79	3.3	69.2	
15.3	24.7	253	7.41	3.900	88			14.9	13.6	0.155	6.45	159.7	79.7		21.3	19.7	0.246	6.8	3.2	69	
15.3	24.7	253	7.41	3.900	88.1	2.94		14.9	13.6	0.155	6.45	159.7	79.7		21.5	19.7	0.247	6.78	3.3	68.8	
15.3	24.8	253	7.42	3.900	88.2			14.9	13.6	0.155	6.45	154.3	79.7	6.86	21.5						3.47
15.3	24.8	253	7.42	3.900	88.2			14.9	13.6	0.155	6.45	160.8	79.6		21.5						
15.3	24.8	253	7.42	3.900	88.2			14.9	13.6	0.155	6.45	157.7	79.6		21.5						
15.3	24.8	253	7.42	3.900	88.2	2.92		14.9	13.6	0.155	6.45	148.9	79.6		22.1	19.6	0.247	6.8	4.1	67.7	
15.3	24.8	253	7.43	3.900	88.1			14.9	13.6	0.155	6.45	147.6	79.6	6.86	22.1	19.6	0.247	6.78	4	67.5	3.44
15.3	24.8	253	7.43	3.900	88.1			14.9	13.6	0.155	6.46	153.5	79.4		22.3	19.6	0.247	6.79	3.7	67.5	
15.3	24.8	253	7.44	3.900	88.2			14.9							22.4	19.6	0.247	6.78	3.6	67.7	
15.3	24.8	253	7.46	3.900	88.5	2.96		14.9							22.5	19.6	0.247	6.78	3.5	67.8	
15.5	24.8	253	7.45	3.900	88.8			14.9						6.94	22.6	19.6	0.247	6.78	3.6	67.8	3.45
15.6	24.9	253	7.44	4.000	88.8			14.9	13.6	0.155	6.46	137.6	79.5		22.9	19.6	0.247	6.79	3.5	67.8	
15.6								14.9	13.6	0.155	6.46	140.3	79.5		23.1	19.6	0.248	6.79	3.5	67.7	
15.6						2.90		14.9	13.5	0.155	6.45	142.7	79.4		23.2	19.6	0.248	6.79	3.4	67.5	
15.6								14.9	13.6	0.155	6.45	144.4	79.5	6.94	23.3	19.4	0.248	6.78	3.4	67.5	3.44
16.1	24.8	253	7.46	4.000	88.7			15.1	13.6	0.155	6.45	150	79.4		23.5	19.3	0.248	6.79	3.6	67.5	
16.3	24.8	253	7.45	4.100	88.7			15.1	13.6	0.155	6.45	147.3	79.4		23.6						

Cont.	September 25 - Baseflow							October 25 - Post-storm Day 2							October 27 - Post-storm Day 4						
Distance (km)	Temperature (°C)	Conductivity (mS cm ⁻¹)	pH	Turbidity (NTU)	ODOsat (%)	DOC (mg L ⁻¹)		Distance (km)	Temperature (°C)	Conductivity (mS cm ⁻¹)	pH	Turbidity (NTU)	ODOsat (%)	DOC (mg L ⁻¹)	Distance (km)	Temperature (°C)	Conductivity (mS cm ⁻¹)	pH	Turbidity (NTU)	ODOsat (%)	DOC (mg L ⁻¹)
18.4						2.69		15.3	13.2	0.157	6.44	134	78.2		24.7	18.9	0.248	6.72	3.6	65.9	
18.4								15.5	12.8	0.158	6.43	130.5	78.1	7.06	24.7	19.0	0.248	6.71	3.4	66.1	3.40
19.2	24.3	260	7.76	1.100	95.1			15.5	12.7	0.158	6.41	129.2	78.3		24.7	19.0	0.248	6.69	3.4	65.9	
19.2	24.3	260	7.77	0.900	95.4			15.5	13.2	0.164	6.39	120.3	79.4		24.7	19.1	0.248	6.68	3.4	65.7	
19.5	24.3	261	7.78	0.700	95.7	2.77		15.5	14.0	0.16	6.36	96	78		24.7	19.1	0.248	6.67	3.4	65.8	
19.5	24.3	261	7.79	0.700	95.8			15.5	14.2	0.181	6.31	89.1	77.3	7.04	24.7	19.1	0.248	6.67	3.4	66.3	3.36
19.6	24.3	262	7.81	0.700	95.8			15.5	14.2	0.185	6.32	95.1	77.2		24.7	19.1	0.248	6.65	3.5	66.4	
19.8	24.3	262	7.81	0.900	95.9			15.5	14.2	0.185	6.32	88.2	78.3		24.7	19.1	0.248	6.64	3.6	66.7	
20.0	24.3	262	7.83	0.700	96	2.63		15.5	14.6	0.184	6.32	72.8	76.8		24.7	19.1	0.248	6.65	3.5	67.1	
20.1	24.2	264	7.84	0.600	96.6			15.5	15.1	0.192	6.32	66.5	76.7	3.92	24.7						3.39
20.3	24.2	265	7.86	0.600	97.1			15.5	15.7	0.197	6.32	60.6	76.4		24.7						
20.5	24.2	267	7.87	0.400	97.5			15.5	15.7	0.199	6.33	63.5	75.3		24.7						
20.7	24.2	267	7.88	0.300	97.6	2.54		15.5	15.6	0.201	6.35	76.2	74.9		24.7	19.2	0.248	6.7	3.6	67.7	
20.7	24.2	268	7.89	0.100	97.9			15.5	15.4	0.202	6.36	80	74.2	4.11	24.7	19.2	0.248	6.7	3.4	67.3	
20.8	24.2	269	7.91	0.100	98			15.5	15.5	0.2	6.37	83.3	75		24.7	19.2	0.248	6.7	3.3	67	
21.0	24.2	269	7.93	0.000	98.2			15.5							24.7	19.2	0.248	6.71	3.3	66.7	
21.2	24.2	271	7.94	0.000	98.5	2.39		15.5							24.7	19.2	0.248	6.71	3.3	66.6	
21.2	24.2	272	7.96	-0.200	98.6			15.5						6.87	24.7	19.2	0.248	6.7	3.3	66.3	3.49
21.5	24.2	272	7.97	-0.200	98.6			15.5	15.7	0.197	6.39	47.6	75.9		24.7	19.2	0.248	6.7	3.3	66.4	
21.5								15.5	16.0	0.196	6.4	44.8	75.2		24.6	19.2	0.248	6.7	3.3	66.4	
21.5						2.31		15.5	16.2	0.198	6.41	38.5	74.2		24.6	19.2	0.248	6.69	3.3	66.2	
21.5								15.5	16.3	0.206	6.43	34	73.9	4.08	24.6	19.2	0.248	6.7	3.3	66.2	3.47
21.5	24.2	275	8.04	-0.200	98.9			15.7	16.8	0.209	6.44	31.4	72.9		24.6	19.2	0.248	6.69	3.4	66.4	
21.5	24.2	274	8.05	-0.400	99.1			15.8	16.7	0.22	6.43	35.7	72.1		24.6	19.2	0.248	6.69	3.4	66.5	
21.5	24.3	274	8.07	-0.300	99.2	2.34		15.8	16.7	0.221	6.44	36.3	71.6		24.6	19.2	0.248	6.69	3.5	66.5	
21.5	24.3	274	8.08	-0.300	99.3			16.0	16.6	0.221	6.45	34.9	71.8	3.99	24.6	19.2	0.248	6.69	3.5	66.4	3.44
21.5	24.3	274	8.09	-0.300	99.4			16.1	16.7	0.221	6.47	29.4	72.9		24.6	19.2	0.248	6.69	3.4	66.4	
21.5	24.3	274	8.1	-0.200	99.5			16.0	16.8	0.221	6.48	26	73.1		24.6	19.2	0.248	6.69	3.4	66.4	
21.5	24.3	274	8.11	-0.200	99.5	2.30		15.8	17.2	0.224	6.49	21.6	72.4		24.6	19.2	0.248	6.68	3.5	66.2	
21.6	24.4	273	8.1	-0.300	99.5			15.7	17.4	0.227	6.5	18.1	71.6	3.77	24.6						3.47
21.7	24.4	274	8.12	-0.200	99.3			15.7	17.5	0.228	6.5	18	70.6		24.6						
21.8	24.3	275	8.11	-0.300	99.4			15.7	17.6	0.227	6.51	17.5	69.6		24.6						
22.0	24.3	275	8.1	-0.400	99.4	2.32		15.7	17.6	0.228	6.52	16.7	69		24.6	19.2	0.248	6.67	3.6	66.2	
22.1	24.3	275	8.09	-0.400	99.4			15.7	17.5	0.228	6.53	15.8	68.7	3.76	24.6	19.2	0.248	6.67	3.6	66.2	3.46
22.2	24.3	276	8.08	-0.400	99.4			15.7	17.5	0.228	6.53	15.6	68.6		24.6	19.2	0.248	6.66	3.5	66.4	
22.4	24.3	276	8.08	-0.400	99.2			15.7							24.6	19.2	0.248	6.66	3.6	66.4	
22.5	24.3	276	8.08	-0.400	99.1	2.29		15.7							24.6	19.2	0.248	6.67	3.5	66.3	
22.7	24.3	276	8.08	-0.300	99			15.7						3.84	24.6	19.2	0.248	6.66	3.4	66.4	3.49
22.9	24.3	277	8.08	-0.300	98.9			15.8	17.5	0.228	6.56	15.5	68.2		24.6	19.2	0.248	6.67	3.4	66.4	
22.9								15.8	17.5	0.228	6.56	15.7	68.2		24.6	19.2	0.248	6.67	3.4	66.4	
22.9						2.39		15.8	17.5	0.228	6.57	16.1	68.2		24.6	19.2	0.248	6.68	3.4	66.5	
22.9								15.8	17.5	0.228	6.58	16.2	68.1	3.81	24.6	19.2	0.248	6.68	3.3	66.6	3.44
23.4	24.3	278	8.07	-0.200	98.1			15.8	17.5	0.228	6.59	15.8	68.2		24.6	19.3	0.248	6.67	3.3	66.5	
23.6	24.3	278	8.07	-0.200	98.1			15.8	17.5	0.228	6.59	15.6	68.2		24.6	19.3	0.248	6.67	3.3	66.6	
23.6	24.3	278	8.07	-0.200	98	2.28		15.8	17.4	0.229	6.59	15.3	68.2		24.6	19.3	0.248	6.67	3.2	66.6	
23.9	24.3	278	8.08	-0.400	97.8			15.8	17.4	0.229	6.6	15.8	68.2	3.79	24.6	19.3	0.248	6.67	3.4	66.7	3.46
24.0	24.3	278	8.08	-0.300	97.7			15.8	17.4	0.229	6.6	17.2	68.2		24.6	19.3	0.248	6.67	3.3	66.7	
24.2	24.3	278	8.07	-0.400	97.7			15.8	17.4	0.229	6.61	16.7	68.2		24.6	19.3	0.248	6.67	3.2	66.8	
24.2	24.3	278	8.08	-0.400	97.6	2.25		15.8	17.4	0.229	6.61	16.4	68.2		24.6	19.3	0.248	6.67	3.2	66.7	
24.2	24.4	279	8.08	-0.400	97.5			15.8	17.4	0.229	6.61	16.2	68.2	3.80	24.6						3.45
24.2	24.4	278	8.1	-0.200	97.5			15.8	17.4	0.229	6.62	16.1	68.2		24.6						
24.2	24.4	279	8.11	-0.300	97.4			15.8	17.4	0.229	6.62	16.4	68.2		24.6						
24.2	24.4	279	8.12	-0.500	97.4	1.19		15.8	17.4	0.229	6.62	16.4	68.2		24.6	19.3	0.248	6.67	3.2	66.9	
24.2	24.4	279	8.13	-0.400	97.4			15.8	17.4	0.229	6.63	16.4	68.2	3.82	24.6	19.4	0.248	6.67	3.2	66.9	3.46
24.2	24.4	279	8.13	-0.500	97.3			15.8	17.4	0.229	6.63	16.1	68.2		24.6	19.4	0.248	6.66	3.1	66.9	
24.2	24.5	279	8.14	-0.500	97.2			15.8	17.3	0.229	6.64	15.9	68.2		24.6	19.4	0.248	6.66	3.2	66.9	
24.2	24.5	279	8.14	-0.400	97.2	0.72		15.8							24.6	19.4	0.248	6.67	3.2	66.9	
24.2	24.5	279	8.14	-0.500	97.2			15.8						3.82	24.6	19.4	0.248	6.67	3.2	66.9	3.46
24.2	24.5	279	8.15	-0.500	97.2			15.8							24.6	19.4	0.248	6.67	3.2	66.8	
24.2								15.8	17.2	0.23	6.63	15.9	68.4		24.6	19.4	0.248	6.67	3.2	66.9	
24.2						0.53		15.8	17.2	0.23	6.63	15.7	68.3		24.6	19.4	0.248	6.67	3.2	66.9	
24.2								16.1	17.2	0.23	6.62	15.8	68.4	3.82	24.6	19.4	0.248	6.69	3	67	3.44
24.2	24.4	279	8.1	0.200	96.4			16.2	16.9	0.232	6.62	15	67.3		24.6	19.4	0.248	6.71	2.9	67	
24.2	24.5	279	8.08	0.200	96.3			16.5	16.6	0.232	6.61	15.1	66.5		24.6	19.4	0.248	6.72	2.9	66.9	
24.2	24.5	279	8.08	0.000	96.3	0.57		16.5	16.2	0.233	6.61	13.9	67.2		24.7	19.4	0.248	6.73	3.1	66.9	
24.2	24.5	279	8.08	0.300	96.1			16.7	16.1	0.233	6.62	13.5	68.8	3.86	24.8	19.4	0.248	6.74	3	67.1	3.44
24.2	24.5	279	8.07	0.300	96			16.9	16.5	0.232	6.62	11.7	69.5		25.0	19.4	0.248	6.75	3	67.1	
24.2	24.5	279	8.06	0.600	95.5			17.0	16.8	0.231	6.62	11									

Cont.	September 25 - Baseflow						October 25 - Post-storm Day 2						October 27 - Post-storm Day 4							
Distance (km)	Temperature (°C)	Conductivity (mS cm ⁻¹)	pH	Turbidity (NTU)	ODOsat (%)	DOC (mg L ⁻¹)	Distance (km)	Temperature (°C)	Conductivity (mS cm ⁻¹)	pH	Turbidity (NTU)	ODOsat (%)	DOC (mg L ⁻¹)	Distance (km)	Temperature (°C)	Conductivity (mS cm ⁻¹)	pH	Turbidity (NTU)	ODOsat (%)	DOC (mg L ⁻¹)
24.2	24.2	281	7.98	-0.800	95.5	2.23	20.3	18.4	0.243	6.64	4.7	63.4		27.5	19.5	0.25	6.7	2.8	66.7	
24.2	24.2	281	7.97	-0.800	95.5		20.3	18.4	0.243	6.64	4.2	62.8	3.38	27.7	19.4	0.251	6.69	2.5	66.7	3.40
24.2	24.2	281	7.97	-0.800	95.5		20.5	18.5	0.244	6.64	3.1	62.5		27.8	19.5	0.25	6.71	2.4	66.5	
24.2	24.2	281	7.96	-0.900	95.6		20.6	18.5	0.245	6.64	2.8	62.2		28.1	19.4	0.25	6.72	2.6	66.5	
24.2	24.2	281	7.96	-0.800	95.6	2.26	20.8	18.5	0.246	6.64	2.5	62		28.2	19.3	0.25	6.72	2.6	66.8	
24.2	24.2	282	7.96	-0.800	95.7		20.9	18.6	0.246	6.64	2.3	61.9	3.39	28.2						3.33
24.2	24.2	281	7.97	-0.900	95.8		21.0	18.6	0.246	6.64	2.1	62		28.2						
24.2	24.2	281	7.97	-0.900	95.6		21.1	18.6	0.247	6.64	2.2	62		28.2						
24.2	24.2	281	7.97	-0.900	95.7	2.27	21.5	18.6	0.247	6.65	2.2	62		29.0	19.1	0.25	6.7	2.3	66.5	
24.2	24.2	282	7.97	-0.800	95.7		21.5	18.6	0.246	6.65	2.1	61.9	3.33	29.0	19.1	0.25	6.69	2.4	66.4	3.32
24.2	24.2	281	7.97	-0.700	95.7		21.7	18.7	0.246	6.66	1.7	62		29.1	19.0	0.251	6.69	2.2	66.1	
24.2	24.2	281	7.97	-0.800	95.7		21.7							29.3	19.0	0.251	6.69	2.1	66.1	
24.2	24.2	281	7.97	-0.800	95.7	2.28	21.7							29.4	19.0	0.251	6.69	2	66.4	
24.2	24.2	281	7.97	-0.800	95.7		21.7						3.36	29.6	19.1	0.251	6.69	2	66.6	3.31
24.2	24.2	281	7.97	-0.900	95.6		22.4	18.8	0.245	6.66	1.7	62.8		29.7	19.1	0.251	6.68	1.9	66.9	
24.2							22.4	18.9	0.245	6.66	1.7	63		29.8	19.2	0.251	6.69	1.8	67	
24.2						2.24	22.6	18.8	0.246	6.66	1.7	63.1		30.0	19.2	0.251	6.71	1.7	66.8	
24.2							22.9	18.9	0.246	6.67	1.7	63.1	3.35	30.1	19.2	0.251	6.71	1.6	66.6	3.25
24.2	24.2	281	7.97	-0.800	95.7		23.1	18.9	0.246	6.67	1.5	63.1		30.3	19.2	0.251	6.7	1.5	66.4	
24.2	24.2	281	7.97	-0.800	95.7		23.2	18.9	0.247	6.66	1.5	63		30.4	19.2	0.251	6.71	1.5	66	
24.2	24.2	281	7.97	-0.800	95.7	2.25	23.4	18.9	0.247	6.67	1.5	63		30.5	19.2	0.251	6.71	1.4	65.7	
24.2	24.2	281	7.97	-0.800	95.7		23.5	18.9	0.247	6.67	1.4	63	3.27	30.7	19.2	0.251	6.71	1.5	65.3	3.19
24.2	24.2	281	7.97	-0.800	95.6		23.6	18.9	0.248	6.68	1.4	62.9		30.8	19.3	0.251	6.7	1.4	65	
24.2	24.2	281	7.97	-0.800	95.7		23.9	18.8	0.248	6.68	1.4	62.8		31.0	19.3	0.251	6.7	1.2	64.5	
24.2	24.2	281	7.98	-0.800	95.8	2.26	24.0	18.9	0.248	6.68	1.3	62.7		31.1	19.3	0.251	6.7	1.1	64.1	
24.2	24.2	281	7.98	-0.900	95.7		24.2	18.9	0.249	6.68	1.2	62.6	3.23	31.1						3.22
24.2	24.2	281	7.98	-0.900	95.6		24.2	18.9	0.249	6.69	1.1	62.4		31.1						
24.2	24.2	281	7.98	-0.800	95.6		24.2	18.9	0.248	6.69	1.2	62.2		31.1						
24.2	24.2	281	7.99	-0.800	95.6	2.25	24.2	19.1	0.248	6.7	1.3	62		31.9	19.5	0.252	6.72	0.6	63.9	
24.2	24.2	281	7.99	-0.900	95.7		24.2	19.1	0.248	6.71	1	62.1	3.20	31.9	19.6	0.253	6.73	0.6	63.5	3.18
24.2	24.2	281	7.99	-0.900	95.7		24.2	19.0	0.248	6.71	1.2	62.3		32.1	19.6	0.253	6.73	0.6	62.9	
24.2	24.2	281	7.99	-0.800	95.6		24.2							32.3	19.7	0.253	6.73	0.6	62.6	
24.2	24.2	281	8	-0.800	95.6	2.24	24.2							32.4	19.7	0.253	6.73	0.6	62.4	
24.1	24.2	281	8	-0.800	95.7		24.2						3.19	32.5	19.7	0.253	6.73	0.6	62.5	3.07
24.1	24.2	281	7.99	-0.800	95.6		24.3	19.1	0.249	6.72	1.2	62		32.7	19.8	0.254	6.74	0.5	63.1	
24.1							24.3	19.1	0.249	6.71	1.4	62.1		32.7	19.8	0.255	6.73	0.5	63.4	
24.1						2.26	24.3	19.1	0.249	6.71	1.3	62.1		32.7	19.9	0.254	6.72	0.5	64.1	
24.1							24.3	19.1	0.249	6.72	1.2	62.2	3.20	32.7	19.9	0.254	6.71	0.5	64.5	2.99
24.0	24.2	281	7.96	-0.800	95.7		24.3	19.0	0.249	6.72	1.1	62.3		32.7	19.9	0.255	6.72	0.4	65	
24.0	24.2	281	7.96	-0.800	95.7		24.4	19.0	0.249	6.72	1.2	62.3		32.7	19.9	0.255	6.73	0.4	65.2	
24.0	24.2	281	7.96	-0.800	95.6	2.27	24.4	19.1	0.249	6.72	1.2	62.3		32.7	19.9	0.255	6.74	0.4	65.1	
24.0	24.2	281	7.96	-0.800	95.6		24.4	19.1	0.249	6.72	1	62.3	3.20	32.7	19.9	0.255	6.75	0.4	65.3	3.04
24.0	24.2	281	7.96	-0.800	95.5		24.4	19.1	0.249	6.72	1.1	62.2		32.7	19.9	0.255	6.75	0.4	65.3	
24.0	24.2	281	7.95	-0.800	95.4		24.4	19.1	0.249	6.72	1	62		32.7	19.9	0.255	6.76	0.6	65.8	
24.0	24.2	281	7.95	-0.500	95.1	2.29	24.4	19.1	0.249	6.72	1.2	61.9		32.7	19.9	0.256	6.73	0.6	66.7	
24.0	24.2	282	7.95	-0.600	94.9		24.4	19.1	0.249	6.73	1.2	62.1	3.20	32.7						3.10
24.0	24.3	282	7.94	-0.400	94.6		24.4	19.1	0.249	6.73	1.2	62.2		32.7						
24.0	24.3	282	7.92	-0.400	94.4		24.4	19.1	0.249	6.74	1.2	62.2		32.7						
24.0	24.3	282	7.9	-0.200	94.2	2.25	24.4	19.2	0.249	6.74	1.1	62.2		32.7	19.9	0.256	6.7	0.8	67.9	
24.0	24.3	282	7.89	-0.100	94		24.4	19.2	0.249	6.74	1.1	62.3	3.15	32.7	19.9	0.256	6.69	0.7	68	3.08
24.0	24.3	282	7.88	-0.200	93.8		24.4	19.3	0.249	6.74	1.1	62.4		32.7	20.0	0.255	6.69	0.6	68.2	
24.0	24.3	282	7.87	-0.200	93.7		24.4							32.7	20.0	0.255	6.7	0.6	68.2	
24.0	24.3	282	7.86	-0.200	93.7	2.28	24.4							32.7	20.0	0.255	6.7	0.6	68.5	
24.0	24.3	282	7.86	-0.300	93.7		24.4						3.18	32.7	20.0	0.255	6.7	0.6	68.5	3.00
24.0	24.3	282	7.85	-0.400	93.8		24.4	19.3	0.249	6.76	0.9	62.1		32.7	20.0	0.255	6.71	0.7	68.6	
24.0							24.4	19.3	0.249	6.76	1	62.1		32.7	20.0	0.255	6.71	0.6	68.5	
24.0						2.26	24.4	19.3	0.249	6.76	1	62		32.7	20.0	0.255	6.73	0.5	68.4	
24.0							24.4	19.3	0.249	6.76	1	61.9	3.20	32.7	20.0	0.255	6.74	0.5	68.1	3.01
24.0	24.3	282	7.87	-0.600	94.6		24.4	19.3	0.249	6.77	1	61.8		32.7	20.0	0.255	6.72	0.5	68	
24.0	24.3	281	7.86	-0.600	94.8		24.4	19.3	0.249	6.77	1	61.7		32.7	20.0	0.255	6.72	0.6	68.1	
24.0	24.3	281	7.87	-0.700	94.8	2.29	24.4	19.3	0.249	6.78	1	61.8		32.7	20.0	0.255	6.71	0.5	68.4	
24.0	24.3	281	7.88	-0.700	95.1		24.4	19.3	0.249	6.78	1	61.7	3.19	32.7	20.0	0.255	6.72	0.6	68.5	3.02
24.0	24.3	281	7.88	-0.700	95.1		24.4	19.3	0.249	6.81	1	61.7		32.7	20.0	0.255	6.72	0.6	68.6	
24.0	24.3	281	7.89	-0.800	95.2		24.4	19.4	0.249	6.84	1	61.6		32.7	20.0	0.255	6.74	0.6	68.8	
24.1	24.3	281	7.89	-0.800	95.3	2.23	24.6	19.2	0.249	6.85	1	61.6		32.7	20.0	0.255	6.74	0.6	68.8	
24.1	24.3	281	7.89	-0.700	95.4		24.7	19.2	0.249	6.86	1	61.5	3.20	32.7						3.04
24.1	24.3	281	7.9	-0.800	95.6		24.9	18.7	0.251	6.89	0.9	60.5		32.7						
24.1	24.3	281	7.9	-0.800	95.7		25.0	18.4	0.252	7.01	1	60.6		32.7						
24.2	24.3	281	7.91	-0.800	95.8	2.22	25.3	18.1	0.253	7.06	1.4	61.1		32.7	20.0	0.255	6.76	0.6	69.3	
24.2	24.3	281	7.91	-0.800	95.9		25.5	17.8	0.253	7.06	3.9	62.3	3.17	32.7	20.0	0.255	6			

Cont.	September 25 - Baseflow						October 25 - Post-storm Day 2						October 27 - Post-storm Day 4							
Distance (km)	Temperature (°C)	Conductivity (mS cm ⁻¹)	pH	Turbidity (NTU)	ODOsat (%)	DOC (mg L ⁻¹)	Distance (km)	Temperature (°C)	Conductivity (mS cm ⁻¹)	pH	Turbidity (NTU)	ODOsat (%)	DOC (mg L ⁻¹)	Distance (km)	Temperature (°C)	Conductivity (mS cm ⁻¹)	pH	Turbidity (NTU)	ODOsat (%)	DOC (mg L ⁻¹)
24.0	24.2	280	7.93	-0.800	96.1	2.27	28.1	18.8	0.252	6.85	0.7	62.5		32.8	20.1	0.255	6.77	0.5	69.9	
24.0	24.2	280	7.94	-0.800	96.1		28.3	18.8	0.252	6.85	0.7	62.4	3.15	32.8						3.03
24.0	24.2	280	7.94	-0.800	96.1		28.5	18.8	0.252	6.84	0.8	62.3		32.8						
24.0	24.2	280	7.93	-0.800	96.1		28.7	18.8	0.252	6.83	0.9	62.2		32.8						
24.0	24.2	280	7.93	-0.800	96.2	2.22	28.8	18.8	0.253	6.82	0.8	62.1		32.8	20.1	0.255	6.76	0.5	70	
24.1	24.3	280	7.93	-0.800	96.2		29.0	18.8	0.253	6.82	0.7	61.9	3.16	32.8	20.1	0.255	6.77	0.5	70	3.03
24.2	24.3	280	7.93	-0.800	96.2		29.2	18.8	0.253	6.81	0.9	61.9		32.8	20.1	0.255	6.77	0.6	69.9	
24.4	24.3	280	7.93	-0.800	96.3		29.2							32.8	20.1	0.255	6.79	0.6	70	
24.4	24.3	280	7.94	-0.800	96.3	2.24	29.2							32.8	20.1	0.255	6.8	0.5	69.8	
24.7	24.3	280	7.94	-0.800	96.4		29.2						3.16	32.8	20.1	0.255	6.79	0.6	70	2.98
24.8	24.3	280	7.95	-0.800	96.4		30.0	18.7	0.253	6.81	0.9	61.5		32.8	20.1	0.255	6.8	0.5	70	
24.8							30.0	18.7	0.253	6.8	1	61.6		32.8	20.1	0.255	6.79	0.5	69.8	
24.8						2.24	30.1	18.6	0.254	6.8	1	61.4		32.8	20.1	0.255	6.79	0.5	69.8	
24.8							30.3	18.6	0.254	6.8	0.9	61.4	3.07	32.8	20.1	0.255	6.8	0.6	69.8	3.01
25.5	24.3	280	7.96	-0.800	96.1		30.5	18.6	0.254	6.8	0.9	61.3		32.8	20.1	0.255	6.79	0.6	69.7	
25.7	24.3	280	7.96	-0.800	96.2		30.6	18.6	0.254	6.8	1.2	61		32.8	20.1	0.255	6.78	0.5	69.6	
25.9	24.3	280	7.95	-0.800	96.3	2.34	30.8	18.5	0.254	6.8	1.2	60.9		32.8	20.1	0.255	6.78	0.6	69.6	
25.9	24.3	280	7.94	-0.800	96.5		30.9	18.5	0.254	6.79	1.4	60.7	3.08	32.8	20.1	0.255	6.77	0.5	69.7	2.99
26.1	24.3	280	7.94	-0.700	96.5		31.1	18.5	0.254	6.79	2.2	60.7		32.8	20.1	0.255	6.77	0.6	69.8	
26.2	24.3	280	7.94	-0.800	96.3		31.3	18.5	0.254	6.79	2.2	60.7		32.8	20.1	0.256	6.79	0.6	69.7	
26.4	24.3	280	7.94	-0.800	96.5	2.21	31.4	18.5	0.254	6.79	3.1	60.7		32.8	20.1	0.256	6.79	0.5	69.7	
26.5	24.3	280	7.95	-0.800	96.6		31.6	18.5	0.254	6.78	4.6	60.6	3.10	32.8	20.1	0.255	6.81	0.5	69.8	3.00
26.6	24.3	280	7.95	-0.800	96.9		31.8	18.5	0.254	6.78	3.5	60.5		32.8	20.1	0.255	6.82	0.6	69.9	
26.8	24.3	280	7.95	-0.900	97		31.9	18.4	0.254	6.78	4	60.6		32.8	20.1	0.255	6.84	0.5	69.9	
26.9	24.3	280	7.96	-0.800	97	2.21	32.1	18.4	0.254	6.78	4.7	60.6		32.8	20.1	0.255	6.85	0.5	69.9	
27.1	24.3	280	7.96	-0.900	97.1		32.2	18.4	0.254	6.77	6.2	60.7	3.00	32.8	20.1	0.255	6.86	0.4	69.9	3.00
27.2	24.3	279	7.95	-0.900	97.1		32.2	18.4	0.254	6.78	6.1	60.9		32.8	20.1	0.255	6.85	0.4	70	
27.4	24.3	279	7.96	-0.800	97.2		32.2							32.8	20.1	0.256	6.87	0.4	70	
27.6	24.3	279	7.96	-0.800	97.3	2.21	32.2							32.7	20.2	0.256	6.87	0.4	69.9	
27.8	24.3	279	7.96	-0.900	97.4		32.2						3.06	35.0	16.5	0.246	7	44	62.7	3.10
28.0	24.3	279	7.96	-0.900	97.3		32.2	18.1	0.254	6.81	4.7	61.9		42.0	15.9	0.344	7.13	42.9	73.6	2.96
28.0							32.2	18.1	0.254	6.81	5.6	62.1								
28.0						2.23	32.2	18.1	0.254	6.81	6.4	62.3								
28.0							32.2	18.1	0.254	6.81	6.5	62.4	3.10							
28.5	24.2	279	7.95	-0.800	97		32.3	18.2	0.253	6.81	5.2	62.5								
28.7	24.2	279	7.94	-0.800	97.1		32.4	18.1	0.254	6.81	4	62.8								
28.8	24.2	279	7.94	-0.800	96.9	2.21	32.6	17.9	0.254	6.79	5.6	62.7								
29.0	24.2	279	7.93	-0.800	96.8		32.8	17.8	0.254	6.78	5.4	62.2	3.08							
29.1	24.2	279	7.93	-0.800	96.8		33.0	17.6	0.254	6.78	6.8	62.1								
29.3	24.2	279	7.93	-0.700	96.5		33.1	17.6	0.254	6.78	6.7	62.8								
29.4	24.2	279	7.92	-0.700	95.9	2.23	33.1	17.8	0.253	6.78	5.6	62.9								
29.5	24.2	279	7.9	-0.600	95.2		33.1	17.9	0.252	6.78	4.3	62.5	3.07							
29.7	24.2	279	7.88	-0.500	94.8		33.1	17.9	0.252	6.78	4.1	62.4								
29.8	24.2	279	7.88	-0.500	94.7		33.1	17.9	0.252	6.77	4.7	62.3								
30.0	24.2	279	7.87	-0.500	94.6	2.20	33.1	17.9	0.253	6.76	4	62.1								
30.1	24.2	279	7.86	-0.600	94.6		33.1	18.0	0.253	6.76	4.1	62.1	3.05							
30.3	24.1	279	7.85	-0.600	94.6		33.1	18.0	0.252	6.76	3.4	62								
30.4	24.1	278	7.85	-0.600	94.5		33.1													
30.5	24.1	278	7.84	-0.600	94.5	2.22	33.1													
30.7	24.1	278	7.84	-0.600	94.6		33.1						3.06							
30.8	24.2	278	7.84	-0.700	94.8		33.1	18.0	0.253	6.77	3.1	61.8								
30.8							33.1	18.0	0.253	6.77	2.8	61.8								
30.8						2.22	33.1	18.0	0.253	6.76	2.5	61.8								
30.8							33.1	18.0	0.253	6.77	2.6	61.9	3.06							
31.4	24.2	280	7.84	-0.500	95		33.1	18.0	0.253	6.77	3.3	61.9								
31.6	24.2	280	7.83	-0.300	94.8		33.1	18.0	0.253	6.76	2.8	61.9								
31.8	24.2	278	7.83	-0.200	94.4	2.21	33.1	18.0	0.253	6.76	2.8	62								
31.9	24.1	278	7.82	-0.500	94.1		33.1	18.0	0.253	6.76	2.5	61.9	3.09							
32.1	24.1	278	7.8	-0.500	93.8		33.1	18.0	0.253	6.76	2.5	61.9								
32.3	24.1	278	7.8	-0.600	93.6		33.1	18.0	0.253	6.76	2.4	61.8								
32.4	24.1	278	7.8	-0.700	93.5	2.24	33.1	18.0	0.253	6.76	2.3	61.8								
32.6	24.0	278	7.79	-0.700	93.7		33.1	18.0	0.253	6.76	2.6	61.7	3.06							
32.7	24.0	278	7.79	-0.800	93.9		33.1	18.0	0.253	6.76	2.6	61.7								
32.9	24.0	278	7.79	-0.800	94.1		33.1	18.0	0.253	6.76	2.3	61.7								
35.0	22.0	280	6.8	-0.400		1.27	33.1	18.0	0.253	6.76	2.9	61.7								
42.0	22.8	300	7.5	0.100		1.41	33.1	18.0	0.253	6.76	2.6	61.7	3.05							
							33.1	18.0	0.253	6.76	2.8	61.7								
							33.1													
							33.1													
							33.1						3.09							
							33.1	18.1	0.253	6.77	1.9	61.8								
							33.1	18.1	0.253	6.77	1.8	61.8								
							33.1	18.1	0.253	6.77	1.7	61.8								
							33.1	18.0	0.253	6.77	1.8	61.9	3.08							
							33.1	18.0	0.253	6.76	1.8	61.9								
							33.1	18.0	0.253	6.76	2	61.8								
							33.1	18.1	0.253	6.76	2.2	61.5								
							33.1	18.1	0.253	6.76	2.1	61.5	3.06							
							33.1	18.0	0.253	6.76	2.5	61.5								
							33.1</													

Table A.2. Longitudinal data for CO₂ and CO₂ evasion in surface water versus distance downstream from the Allsonia stream gauge in the ROR system. Data are water quality parameters at baseflow (September 25), high flow day 2 (October 25) and high flow day 4 (October 27). The Radford stream gauge is the endpoint of the longitudinal data.

September 25 - Baseflow							October 25 - Post-storm Day 2							October 27 - Post-storm Day 4									
Distance (km)	CO ₂ aq. (ppm)	CO ₂ aq. (mol m ⁻³)	DeltaCO ₂ (mol m ⁻³)	Width of channel (m)	k CO ₂ (m d ⁻¹)	Surface Area (m ²)	Flux CO ₂ (mol)	Distance (km)	CO ₂ aq. (ppm)	CO ₂ aq. (mol m ⁻³)	DeltaCO ₂ (mol m ⁻³)	Width of channel (m)	k CO ₂ (m d ⁻¹)	Surface Area (m ²)	Flux CO ₂ (mol)	Distance (km)	CO ₂ aq. (ppm)	CO ₂ aq. (mol m ⁻³)	DeltaCO ₂ (mol m ⁻³)	Width of channel (m)	k CO ₂ (m d ⁻¹)	Surface Area (m ²)	Flux CO ₂ (mol)
Std. Dev.	(+/-)15.6	(+/-) 4.45	(+/-) 4.45	(+/-) 265.7	(+/-) 0.691	(+/-) 9.36*10 ⁶	(+/-) 1.01*10 ⁶	(+/-) 580.2	(+/-) 13.2	(+/-) 13.2	(+/-) 255.4	(+/-) 4.06	(+/-) 7.07*10 ⁶	(+/-) 2.35*10 ⁶	(+/-) 395.2	(+/-) 8.98	(+/-) 8.98	(+/-) 175.7	(+/-) 0.219	(+/-) 4.73*10 ⁶	(+/-) 5.57*10 ⁶		
0.0	333.0	7.6	-4.2	171.5	2.4	0.0	0.0	548.4	12.5	0.7	171.5	11.3	6813.9	53789.3	0.1	387.7	8.8	-3.0	171.5	1.3	0.0	0.0	
0.0	332.9	7.6	-4.2	171.5	2.4	0.0	0.0	518.8	11.8	0.0	171.5	11.3	6813.9	2115.2	0.1	414.9	9.4	-2.3	171.5	1.3	0.0	0.0	
0.0	308.9	7.0	-4.7	171.5	2.4	0.0	0.0	504.9	11.5	-0.3	171.5	11.3	6955.1	-22997.0	0.1	437.0	9.9	-1.8	171.5	1.3	0.0	0.0	
0.1	301.0	6.8	-4.9	171.5	2.4	0.0	0.0	485.8	11.0	-0.7	171.5	11.3	6955.1	-56461.3	0.1	455.1	10.3	-1.4	171.5	1.3	0.0	0.0	
0.1	274.8	6.2	-5.4	171.5	2.4	0.0	0.0	474.0	10.8	-1.0	171.5	11.3	6955.1	-77453.2	0.1	448.7	10.2	-1.6	171.5	1.3	0.0	0.0	
0.1	276.9	6.3	-5.5	171.5	2.4	0.0	0.0	463.9	10.5	-1.2	171.5	11.3	6955.1	-95474.6	0.1	436.0	9.9	-1.9	171.5	1.3	0.0	0.0	
0.1	287.1	6.5	-5.2	171.5	2.4	0.0	0.0	466.4	10.6	-1.2	171.5	11.2	6666.9	-86746.9	0.1	427.0	9.7	-2.1	171.5	1.3	0.0	0.0	
0.1	282.7	6.4	-5.3	171.5	1.3	0.0	0.0	461.1	10.5	-1.3	171.5	11.2	7004.4	-100469.2	0.1	417.1	9.5	-2.3	171.5	1.3	0.0	0.0	
0.1	280.3	6.4	-5.4	171.5	1.3	0.0	0.0	465.0	10.6	-1.2	171.5	11.2	7004.4	-93427.5	0.1	401.2	9.1	-2.6	171.5	1.3	0.0	0.0	
0.1	281.3	6.4	-5.4	171.5	1.3	0.0	0.0	468.3	10.6	-1.1	171.5	11.2	7004.4	-87364.9	0.1	391.3	8.9	-2.9	171.5	1.3	0.0	0.0	
0.1	283.6	6.4	-5.3	171.5	2.4	0.0	0.0	471.4	10.7	-1.0	171.5	11.1	6862.3	-80133.8	0.1	377.0	8.6	-3.2	171.5	1.3	0.0	0.0	
0.1	280.1	6.4	-5.4	171.5	2.4	0.0	0.0	467.5	10.6	-1.1	171.5	11.1	6862.3	-86806.7	0.1	370.5	8.4	-3.3	171.5	1.3	0.0	0.0	
0.1	284.7	6.5	-5.3	171.5	2.4	0.0	0.0	466.4	10.6	-1.2	171.5	11.1	6862.3	-88688.5	0.1	375.6	8.5	-3.2	171.5	1.3	0.0	0.0	
0.1	282.9	6.4	-5.3	171.5	2.4	0.0	0.0	472.6	10.7	-1.0	171.5	11.1	6862.3	-77996.3	0.1	357.1	8.1	-3.6	171.5	1.3	0.0	0.0	
0.1	287.7	6.5	-5.2	171.5	2.4	0.0	0.0	466.5	10.6	-1.2	171.5	11.1	6862.3	-88342.4	0.1	350.6	8.0	-3.8	171.5	1.3	0.0	0.0	
0.1	284.4	6.5	-5.3	171.5	2.4	0.0	0.0	470.4	10.7	-1.1	171.5	11.1	6862.3	-81522.4	0.1	347.0	7.9	-3.9	171.5	1.3	0.0	0.0	
0.1	288.3	6.6	-5.2	171.5	2.4	0.0	0.0	468.0	10.6	-1.1	171.5	11.1	6862.3	-85662.3	0.1	338.5	7.7	-4.1	171.5	1.3	0.0	0.0	
0.1	287.1	6.5	-5.2	171.5	2.4	0.0	0.0	466.2	10.6	-1.2	171.5	11.1	6862.3	-88639.1	0.1	337.4	7.7	-4.1	171.5	1.3	0.0	0.0	
0.1	286.8	6.5	-5.2	171.5	2.4	0.0	0.0	462.3	10.5	-1.3	171.5	11.1	6766.7	-93990.9	0.1	340.6	7.7	-4.0	171.5	1.3	0.0	0.0	
0.1	289.3	6.6	-5.2	171.5	2.4	0.0	0.0	467.8	10.6	-1.1	171.5	11.1	6766.7	-84634.1	0.1	337.2	7.7	-4.1	171.5	1.3	0.0	0.0	
0.1	284.6	6.5	-5.3	171.5	2.4	0.0	0.0	469.2	10.7	-1.1	171.5	11.0	6720.2	-81541.5	0.1	335.4	7.6	-4.1	171.5	1.3	0.0	0.0	
0.1	297.7	6.8	-5.0	171.5	2.4	0.0	0.0	469.1	10.7	-1.1	171.5	11.0	6720.2	-81634.8	0.1	335.6	7.6	-4.1	171.5	1.3	0.0	0.0	
0.1	289.8	6.6	-5.2	171.5	2.4	0.0	0.0	471.3	10.7	-1.1	171.5	11.0	6720.2	-77769.7	0.1	327.4	7.4	-4.3	171.5	1.3	0.0	0.0	
0.1	286.8	6.5	-5.2	171.5	2.4	0.0	0.0	475.2	10.8	-1.0	171.5	11.0	6720.2	-71212.5	0.1	334.9	7.6	-4.1	171.5	1.3	0.0	0.0	
0.1	285.8	6.5	-5.3	171.5	2.4	0.0	0.0	476.0	10.8	-0.9	171.5	11.0	6720.2	-69901.0	0.1	326.8	7.4	-4.3	171.5	1.3	0.0	0.0	
0.1	295.3	6.7	-5.1	171.5	2.4	0.0	0.0	482.8	11.0	-0.8	171.5	11.0	6720.2	-58472.7	0.1	333.8	7.6	-4.2	171.5	1.3	0.0	0.0	
0.1	289.4	6.6	-5.2	171.5	2.4	0.0	0.0	477.3	10.8	-0.9	171.5	11.0	6720.2	-67417.9	0.1	329.5	7.5	-4.3	171.5	1.3	0.0	0.0	
0.1	288.9	6.6	-5.2	171.5	2.4	0.0	0.0	480.2	10.9	-0.8	171.5	11.0	6635.7	-61726.8	0.1	329.5	7.5	-4.3	171.5	1.3	0.0	0.0	
0.1	288.3	6.6	-5.2	171.5	2.4	0.0	0.0	479.7	10.9	-0.9	171.5	11.0	6635.7	-62593.3	0.1	329.5	7.5	-4.3	171.5	1.3	0.0	0.0	
0.1	290.3	6.6	-5.2	171.5	1.3	0.0	0.0	483.9	11.0	-0.8	171.5	11.0	6635.7	-55551.3	0.1	331.3	7.5	-4.2	171.5	1.3	0.0	0.0	
0.1	288.7	6.6	-5.2	171.5	2.4	0.0	0.0	484.1	11.0	-0.8	171.5	10.9	6635.7	-55151.4	0.1	329.7	7.5	-4.3	171.5	1.3	0.0	0.0	
0.1	292.1	6.6	-5.1	171.5	2.4	0.0	0.0	487.0	11.1	-0.7	171.5	10.9	6720.2	-50982.2	0.1	332.8	7.6	-4.2	171.5	1.3	0.0	0.0	
0.1	289.6	6.6	-5.2	171.5	2.4	0.0	0.0	480.5	10.9	-0.8	171.5	10.9	6720.2	-61901.9	0.1	338.4	7.7	-4.1	171.5	1.3	0.0	0.0	
0.1	287.2	6.5	-5.2	171.5	2.4	0.0	0.0	487.0	11.1	-0.7	171.5	10.9	6720.2	-50922.9	0.1	332.5	7.6	-4.2	171.5	1.3	0.0	0.0	
0.1	291.1	6.6	-5.1	171.5	2.4	0.0	0.0	481.5	10.9	-0.8	171.5	10.9	6601.1	-59114.6	0.1	325.7	7.4	-4.4	171.5	1.3	0.0	0.0	
0.1	286.0	6.5	-5.3	171.5	2.4	0.0	0.0	478.2	10.9	-0.9	171.5	10.9	6601.1	-64366.6	0.1	331.1	7.5	-4.2	171.5	1.3	0.0	0.0	
0.1	291.8	6.6	-5.1	171.5	2.4	0.0	0.0	478.2	10.9	-0.9	171.5	10.9	6685.6	-65148.8	0.1	329.1	7.5	-4.3	171.5	1.3	0.0	0.0	
0.1	285.0	6.5	-5.3	171.5	2.4	0.0	0.0	491.3	11.2	-0.6	171.5	10.9	6685.6	-43536.6	0.1	327.5	7.4	-4.3	171.5	1.3	0.0	0.0	
0.1	288.4	6.6	-5.2	171.5	2.4	0.0	0.0	463.7	10.5	-1.2	171.5	10.9	6685.6	-89214.6	0.1	325.2	7.4	-4.4	171.5	1.3	0.0	0.0	
0.1	287.2	6.5	-5.2	171.5	2.4	0.0	0.0	476.9	10.8	-0.9	171.5	10.9	6720.2	-67592.2	0.1	322.9	7.3	-4.4	171.5	1.3	0.0	0.0	
0.1	290.2	6.6	-5.2	171.5	2.4	0.0	0.0	470.0	10.7	-1.1	171.5	10.9	6720.2	-79042.4	0.1	322.0	7.3	-4.4	171.5	1.3	0.0	0.0	
0.1	284.9	6.5	-5.3	171.5	2.4	0.0	0.0	462.3	10.5	-1.3	171.5	10.9	6720.2	-91737.3	0.1	316.9	7.2	-4.6	171.5	1.3	0.0	0.0	
0.1	280.1	6.4	-5.4	171.5	2.4	0.0	0.0	465.1	10.6	-1.2	171.5	10.9	6912.5	-89542.1	0.1	316.9	7.2	-4.6	171.5	1.3	0.0	0.0	
0.1	283.8	6.4	-5.3	171.5	2.4	0.0	0.0	463.4	10.5	-1.2	171.5	10.9	6912.5	-92393.1	0.1	324.7	7.4	-4.4	171.5	1.3	0.0	0.0	
0.1	282.0	6.4	-5.4	171.5	2.4	0.0	0.0	463.7	10.5	-1.2	171.5	10.9	6912.5	-92013.0	0.1	321.3	7.3	-4.5	171.5	1.3	0.0	0.0	
0.1	285.7	6.5	-5.3	171.5	2.4	0.0	0.0	456.9	10.4	-1.4	171.5	10.9	6912.5	-103607.2	0.1	323.5	7.3	-4.4	171.5	1.3	0.0	0.0	
0.1	278.4	6.3	-5.4	171.5	2.4	0.0	0.0	455.4	10.3	-1.4	171.5	10.8	6912.5	-105799.7	0.1	308.5	7.0	-4.7	171.5	1.3	0.0	0.0	
0.1	284.7	6.5	-5.3	171.5	1.3	0.0	0.0	448.0	10.2	-1.6	171.5	10.8	6593.8	-113062.9	0.1	319.8	7.3	-4.5	171.5	1.3	0.0	0.0	
0.1	278.7	6.3	-5.4	171.5	1.3	0.0	0.0	449.5	10.2	-1.5	171.5	10.8	6593.8	-110466.1	0.1	320.0	7.3	-4.5	171.5	1.3	0.0	0.0	
0.1	288.5	6.6	-5.2	171.5	1.3	0.0	0.0	437.0	9.9	-1.8	171.5	10.8	6593.8	-130635.3	0.1	320.1	7.3	-4.5	171.5				

Cont.	September 25 - Baseflow										October 25 - Post-storm Day 2										October 27 - Post-storm Day 4									
	Distance (km)	CO2 aq (ppm)	CO2 aq (mol m ⁻³)	DeltaCO2 (mol m ⁻³)	Width of channel (m)	k CO ₂ (m d ⁻¹)	Surface Area (m ²)	Flux Co2 (mol)	Distance (km)	CO2 aq (ppm)	CO2 aq (mol m ⁻³)	DeltaCO2 (mol m ⁻³)	Width of channel (m)	k CO ₂ (m d ⁻¹)	Surface Area (m ²)	Flux Co2 (mol)	Distance (km)	CO2 aq (ppm)	CO2 aq (mol m ⁻³)	DeltaCO2 (mol m ⁻³)	Width of channel (m)	k CO ₂ (m d ⁻¹)	Surface Area (m ²)	Flux Co2 (mol)						
0.1	275.0	6.2	-5.5	171.5	2.4	0.0	0.0	0.0	0.0	378.5	8.6	-3.2	171.5	10.8	6823.2	-232314.7	0.1	314.3	7.1	-4.6	171.5	1.3	0.0	0.0	0.0					
0.1	271.5	6.2	-5.6	171.5	2.4	0.0	0.0	0.0	0.0	370.6	8.4	-3.3	171.5	10.8	6966.2	-250272.5	0.1	311.4	7.1	-4.7	171.5	1.3	0.0	0.0	0.0					
0.1	275.6	6.3	-5.5	171.5	1.3	0.0	0.0	0.0	0.0	372.5	8.5	-3.3	171.5	10.8	6823.2	-241931.9	0.1	314.4	7.1	-4.6	171.5	1.3	0.0	0.0	0.0					
0.1	268.2	6.1	-5.7	171.5	1.3	0.0	0.0	0.0	0.0	365.1	8.3	-3.5	171.5	10.8	6823.2	-254110.8	0.1	311.5	7.1	-4.7	171.5	1.3	0.0	0.0	0.0					
0.1	269.3	6.1	-5.6	171.5	1.3	0.0	0.0	0.0	0.0	371.3	8.4	-3.3	171.5	10.7	6823.2	-243645.5	0.1	315.8	7.2	-4.6	171.5	1.3	0.0	0.0	0.0					
0.1	264.8	6.0	-5.7	171.5	2.4	0.0	0.0	0.0	0.0	367.6	8.4	-3.4	171.5	10.7	6823.2	-249880.9	0.1	311.2	7.1	-4.7	171.5	1.3	0.0	0.0	0.0					
0.1	265.9	6.0	-5.7	171.5	2.4	0.0	0.0	0.0	0.0	370.1	8.4	-3.4	171.5	10.7	6739.7	-242553.6	0.1	314.6	7.1	-4.6	171.5	1.3	0.0	0.0	0.0					
0.1	268.2	6.1	-5.7	171.5	2.4	0.0	0.0	0.0	0.0	362.8	8.2	-3.5	171.5	10.7	6739.7	-254643.6	0.1	314.0	7.1	-4.6	171.5	1.3	0.0	0.0	0.0					
0.1	261.4	5.9	-5.8	171.5	2.4	0.0	0.0	0.0	0.0	365.2	8.3	-3.5	171.5	10.7	6739.7	-250540.1	0.1	317.1	7.2	-4.6	171.5	1.3	0.0	0.0	0.0					
0.1	258.0	5.9	-5.9	171.5	2.4	0.0	0.0	0.0	0.0	358.1	8.1	-3.6	171.5	10.7	6739.7	-261451.1	0.1	311.3	7.1	-4.7	171.5	1.3	0.0	0.0	0.0					
0.0	271.0	6.2	-5.6	171.5	2.4	0.0	0.0	0.0	0.0	358.1	8.1	-3.6	171.5	10.7	6739.7	-262106.4	0.1	306.8	7.0	-4.8	171.5	1.3	0.0	0.0	0.0					
0.0	197.3	4.5	-7.3	171.5	2.4	0.0	0.0	0.0	0.0	351.4	8.0	-3.8	171.5	10.7	6786.0	-274954.9	0.1	309.1	7.0	-4.7	171.5	1.3	0.0	0.0	0.0					
0.0	254.8	5.8	-6.0	171.5	2.4	0.0	0.0	0.0	0.0	350.5	8.0	-3.8	171.5	10.7	6786.0	-276348.0	0.1	302.9	6.9	-4.9	171.5	1.3	0.0	0.0	0.0					
0.1	245.6	5.6	-6.2	171.5	2.4	0.0	0.0	0.0	0.0	359.3	8.2	-3.6	171.5	10.7	6786.0	-261794.6	0.1	301.2	6.8	-4.9	171.5	1.3	0.0	0.0	0.0					
0.1	252.2	5.7	-6.0	171.5	2.4	0.0	0.0	0.0	0.0	364.9	8.3	-3.5	171.5	10.7	6869.5	-255750.1	0.1	308.3	7.0	-4.8	171.5	1.3	0.0	0.0	0.0					
0.1	256.5	5.8	-5.9	171.5	2.4	0.0	0.0	0.0	0.0	363.8	8.3	-3.5	171.5	10.7	6869.5	-257091.0	0.1	301.7	6.9	-4.9	171.5	1.3	0.0	0.0	0.0					
0.1	267.6	6.1	-5.7	171.5	2.4	0.0	0.0	0.0	0.0	361.3	8.2	-3.6	171.5	10.7	6869.5	-261949.6	0.1	293.2	6.7	-5.1	171.5	1.3	0.0	0.0	0.0					
0.1	236.9	5.4	-6.4	171.5	2.4	0.0	0.0	0.0	0.0	366.4	8.3	-3.4	171.5	10.8	6869.5	-253584.8	0.1	290.4	6.6	-5.2	171.5	1.3	0.0	0.0	0.0					
0.1	235.8	5.4	-6.4	171.5	2.4	0.0	0.0	0.0	0.0	373.3	8.5	-3.3	171.5	10.8	6869.5	-241999.7	0.1	297.0	6.7	-5.0	171.5	1.3	0.0	0.0	0.0					
0.1	235.9	5.4	-6.4	171.5	2.4	0.0	0.0	0.0	0.0	385.8	8.8	-3.0	171.5	10.8	6869.5	-221071.7	0.1	293.1	6.7	-5.1	171.5	1.3	0.0	0.0	0.0					
0.1	238.9	5.4	-6.3	171.5	2.4	0.0	0.0	0.0	0.0	385.5	8.8	-2.9	171.5	10.8	6869.5	-216587.1	0.1	287.7	6.5	-5.2	171.5	1.3	0.0	0.0	0.0					
0.1	217.6	4.9	-6.8	171.5	2.4	0.0	0.0	0.0	0.0	396.5	9.0	-2.8	171.5	10.8	6869.5	-204446.5	0.1	297.0	6.7	-5.0	171.5	1.3	0.0	0.0	0.0					
0.1	217.6	4.9	-6.8	171.5	1.3	0.0	0.0	0.0	0.0	394.9	9.0	-2.8	171.5	10.9	6914.9	-209234.1	0.1	288.3	6.6	-5.2	171.5	1.3	0.0	0.0	0.0					
0.1	191.8	4.4	-7.4	171.5	1.3	0.0	0.0	0.0	0.0	406.0	9.2	-2.5	171.5	10.9	6914.9	-191089.4	0.1	295.5	6.7	-5.0	171.5	1.3	0.0	0.0	0.0					
0.1	235.4	5.3	-6.4	171.5	1.3	0.0	0.0	0.0	0.0	408.4	9.3	-2.5	171.5	10.9	6914.9	-187275.5	0.1	288.9	6.6	-5.2	171.5	1.3	0.0	0.0	0.0					
0.1	226.0	5.1	-6.6	171.5	2.4	0.0	0.0	0.0	0.0	421.0	9.6	-2.2	171.5	10.9	7011.6	-167891.3	0.1	299.2	6.8	-5.0	171.5	1.3	0.0	0.0	0.0					
0.1	218.2	5.0	-6.4	171.5	2.4	0.0	0.0	0.0	0.0	420.0	9.5	-2.2	171.5	10.9	7011.6	-169930.3	0.1	295.3	6.7	-5.1	171.5	1.3	0.0	0.0	0.0					
0.1	218.2	5.0	-6.8	171.5	2.4	0.0	0.0	0.0	0.0	424.6	9.6	-2.1	171.5	10.9	7011.6	-161930.8	0.1	295.8	6.7	-5.0	171.5	1.3	0.0	0.0	0.0					
0.1	204.0	4.6	-7.1	171.5	2.4	0.0	0.0	0.0	0.0	424.2	9.6	-2.1	171.5	10.9	7011.6	-162512.5	0.1	291.1	6.6	-5.1	171.5	1.3	0.0	0.0	0.0					
0.1	179.0	4.1	-7.7	171.5	2.4	0.0	0.0	0.0	0.0	436.9	9.9	-1.8	171.5	10.9	7011.6	-140529.9	0.1	294.1	6.7	-5.1	171.5	1.3	0.0	0.0	0.0					
0.1	229.7	5.2	-6.5	171.5	2.4	0.0	0.0	0.0	0.0	433.5	9.8	-1.9	171.5	10.9	6966.2	-145644.3	0.1	296.9	6.7	-5.0	171.5	1.3	0.0	0.0	0.0					
0.1	218.3	5.0	-6.8	171.5	2.4	0.0	0.0	0.0	0.0	441.3	10.0	-1.7	171.5	10.9	6966.2	-132181.2	0.1	289.5	6.6	-5.2	171.5	1.3	0.0	0.0	0.0					
0.1	228.8	5.2	-6.6	171.5	2.4	0.0	0.0	0.0	0.0	443.3	10.1	-1.7	171.5	10.9	6966.2	-138708.3	0.1	288.9	6.6	-5.2	171.5	1.3	0.0	0.0	0.0					
0.1	229.6	5.2	-6.5	171.5	2.4	0.0	0.0	0.0	0.0	446.7	10.2	-1.6	171.5	11.0	7011.6	-123595.0	0.1	286.0	6.5	-5.3	171.5	1.3	0.0	0.0	0.0					
0.1	193.6	4.4	-7.4	171.5	2.4	0.0	0.0	0.0	0.0	445.2	10.1	-1.6	171.5	11.0	7011.6	-126351.9	0.1	295.2	6.7	-5.1	171.5	1.3	0.0	0.0	0.0					
0.0	239.2	5.4	-6.3	171.5	2.4	0.0	0.0	0.0	0.0	451.4	10.3	-1.5	171.5	11.0	6914.9	-113916.5	0.1	289.4	6.6	-5.2	171.5	1.3	0.0	0.0	0.0					
0.0	208.0	4.7	-7.0	171.5	2.4	0.0	0.0	0.0	0.0	454.5	10.3	-1.4	171.5	11.0	6914.9	-108516.1	0.1	289.9	6.6	-5.2	171.5	1.3	0.0	0.0	0.0					
0.0	197.9	4.5	-7.3	171.5	2.4	0.0	0.0	0.0	0.0	453.6	10.3	-1.5	171.5	11.0	6914.9	-110145.6	0.1	289.1	6.6	-5.2	171.5	1.3	0.0	0.0	0.0					
0.0	217.8	4.9	-6.8	171.5	2.4	0.0	0.0	0.0	0.0	437.2	9.9	-1.8	171.5	11.0	6914.9	-138540.3	0.1	290.3	6.6	-5.2	171.5	1.3	0.0	0.0	0.0					
0.0	214.7	4.9	-6.9	171.5	2.4	0.0	0.0	0.0	0.0	447.4	10.2	-1.6	171.5	11.0	6914.9	-120889.5	0.1	281.6	6.4	-5.4	171.5	1.3	0.0	0.0	0.0					
0.0	212.9	4.8	-6.9	171.5	2.4	0.0	0.0	0.0	0.0	444.6	10.1	-1.7	171.5	11.0	6914.9	-125685.9	0.1	281.4	6.4	-5.4	171.5	1.3	0.0	0.0	0.0					
0.0	219.4	5.0	-6.8	171.5	2.4	0.0	0.0	0.0	0.0	441.4	10.0	-1.7	171.5	11.0	6831.4	-129861.5	0.1	276.6	6.3	-5.5	171.5	1.3	0.0	0.0	0.0					
0.0	225.5	5.1	-6.6	171.5	1.3	0.0	0.0	0.0	0.0	439.0	10.0	-1.8	171.5	11.0	6734.7	-132001.3	0.1	276.9	6.3	-5.5	171.5	1.3	0.0	0.0	0.0					
0.0	216.7	4.9	-6.8	171.5	1.3	0.0	0.0	0.0	0.0	431.6	9.8	-2.0	171.5	11.0	6734.7	-141174.5	0.1	270.6	6.1	-5.6	171.5	1.3	0.0	0.0	0.0					
0.0	184.4	4.2	-7.6	171.5	1.3	0.0	0.0	0.0	0.0	433.6	9.9	-1.9	171.5	11.0	6734.7	-144544.2	0.1	272.1	6.2	-5.6	171.5	1.3	0.0	0.0	0.0					
0.0	227.9	5.2	-6.6	171.5	2.4	0.0	0.0	0.0	0.0	423.6	9.6	-2.1	171.5	11.0	6815.8	-160009.6	0.1	264.0	6.0	-5.8	171.5	1.3	0.0	0.0	0.0					
0.0	217.1	4.9	-6.8	171.5	2.4	0.0	0.0	0.0	0.0	424.9	9.7	-2.1	171.5	11.0	6554.6	-151850.9	0.1	268.1	6.1	-5.7	171.5	1.3	0.0	0.0	0.0					
0.0	188.8	4.3	-7.5	171.5	2.4	0.0	0.0	0.0	0.0	422.8	9.6	-2.2	171.5	11.0	6678.1	-158184.2	0.0	264.2	6.0	-5.8	171.5	1.3	0.0	0.0	0.0					
0.0	192.6	4.4	-7.4	171.5	2.4	0.0	0.0	0.0	0.0	424.5	9.6	-2.1	171.5	11.0	6890.0	-160488.4	0.0	262.9	6.0	-5.8	171.5	1.3	0.0	0.0	0.0					
0.0	192.2	4.4	-7.4	171.5	2.4	0.0	0.0	0.0	0.0	415.9	9.4	-2.3	171.5	11.0	3958.2	-151667.1	0.0	259.8	5.9	-5.9	171.5									

Cont.	September 25 - Baseflow							October 25 - Post-storm Day 2							October 27 - Post-storm Day 4									
	Distance (km)	CO2 aq. (ppm)	CO2 aq. (mol m ⁻³)	Delta(CO2) (mol m ⁻³)	Width of channel (m)	k CO ₂ (m d ⁻¹)	Surface Area (m ²)	Flux Co2 (mol)	Distance (km)	CO2 aq. (ppm)	CO2 aq. (mol m ⁻³)	Delta(CO2) (mol m ⁻³)	Width of channel (m)	k CO ₂ (m d ⁻¹)	Surface Area (m ²)	Flux Co2 (mol)	Distance (km)	CO2 aq. (ppm)	CO2 aq. (mol m ⁻³)	Delta(CO2) (mol m ⁻³)	Width of channel (m)	k CO ₂ (m d ⁻¹)	Surface Area (m ²)	Flux Co2 (mol)
0.0	121.3	2.8	-9.0	171.5	2.5	0.0	0.0	0.0	401.0	9.1	-2.6	171.5	11.3	22.4	-670.8	0.0	258.0	5.9	-5.9	171.5	1.3	0.0	0.0	0.0
0.0	-176.3	-4.0	-15.8	171.5	2.5	0.0	0.0	0.0	397.5	9.0	-2.7	171.5	11.3	704.8	-21789.9	0.0	247.6	5.6	-6.1	171.5	1.3	0.0	0.0	0.0
0.0	252.5	5.7	-6.0	171.5	2.5	0.0	0.0	0.0	396.6	9.1	-2.7	171.5	11.3	1755.8	-53786.5	0.0	257.5	5.9	-5.9	171.5	1.3	0.0	0.0	0.0
0.0	254.8	5.8	-6.0	171.5	2.5	0.0	0.0	0.0	396.6	9.0	-2.7	171.5	11.4	2967.2	-92554.9	0.0	260.7	5.9	-5.8	171.5	1.3	0.0	0.0	0.0
0.0	264.1	6.0	-5.8	171.5	2.5	0.0	0.0	0.0	396.1	9.0	-2.8	171.5	11.4	3606.5	-113057.6	0.0	254.2	5.8	-6.0	171.5	1.3	0.0	0.0	0.0
0.0	244.1	5.5	-6.2	171.5	2.5	0.0	0.0	0.0	393.5	8.9	-2.8	171.5	11.4	4000.0	-128001.1	0.0	255.1	5.8	-6.0	171.5	1.3	0.0	0.0	0.0
0.0	238.9	5.4	-6.3	171.5	2.5	0.0	0.0	0.0	396.4	9.0	-2.8	171.5	11.4	4388.0	-137179.8	0.0	255.3	5.8	-6.0	171.5	1.3	0.0	0.0	0.0
0.0	59.2	1.3	-10.4	171.5	2.5	0.0	0.0	0.0	393.7	8.9	-2.8	171.5	11.4	4944.9	-158026.6	0.0	260.2	5.9	-5.8	171.5	1.3	0.0	0.0	0.0
0.0	10.4	0.2	-11.5	171.5	2.5	0.0	0.0	0.0	394.4	9.0	-2.8	171.5	11.4	4856.4	-154456.8	0.1	257.7	5.9	-5.9	171.5	1.3	0.0	0.0	0.0
0.0	216.9	4.9	-6.8	171.5	2.5	0.0	0.0	0.0	388.3	8.8	-2.9	171.5	11.4	6104.3	-203789.6	0.1	261.0	5.9	-5.8	171.5	1.3	0.0	0.0	0.0
0.0	195.4	4.4	-7.3	171.5	2.5	0.0	0.0	0.0	392.4	8.9	-2.8	171.5	11.4	6293.5	-20383.6	0.1	253.0	5.7	-6.0	171.5	1.3	0.0	0.0	0.0
0.0	220.0	5.0	-6.8	171.5	2.5	0.0	0.0	0.0	387.4	8.8	-3.0	171.5	11.4	6293.5	-211525.4	0.1	250.0	5.7	-6.1	171.5	1.3	0.0	0.0	0.0
0.0	207.9	4.7	-7.0	171.5	2.5	0.0	0.0	0.0	389.0	8.8	-2.9	171.5	11.4	6293.5	-208811.5	0.2	252.0	5.7	-6.0	171.5	1.3	0.0	0.0	0.0
0.0	171.1	3.9	-7.9	171.5	2.5	0.0	0.0	0.0	381.7	8.7	-3.1	171.5	11.4	6293.5	-220752.8	0.3	249.1	5.7	-6.1	189.0	1.3	54944.0	-335177.9	0.0
0.0	203.4	4.6	-7.1	171.5	2.5	0.0	0.0	0.0	384.9	8.7	-3.0	171.5	10.6	6293.5	-200325.8	0.4	231.4	5.3	-6.5	189.0	1.3	81015.8	-523117.0	0.0
0.0	147.0	3.3	-8.4	171.5	1.3	0.0	0.0	0.0	381.4	8.7	-3.1	171.5	10.5	6503.4	-212113.8	0.6	253.8	5.8	-6.0	189.0	1.3	116769.1	-699924.6	0.0
0.0	1.3	0.0	-11.7	171.5	1.3	0.0	0.0	0.0	386.7	8.8	-3.0	171.5	10.5	6503.4	-20441.0	0.7	263.8	6.0	-5.8	189.0	1.3	136695.8	-788239.5	0.0
0.0	-27.1	-0.6	-12.4	171.5	1.3	0.0	0.0	0.0	383.5	8.7	-3.0	171.5	10.5	7091.2	-227010.2	1.0	279.4	6.3	-5.4	189.0	1.3	136695.8	-738819.9	0.0
0.0	-259.1	-5.9	-17.6	171.5	2.5	0.0	0.0	0.0	384.9	8.7	-3.0	171.5	10.5	7091.2	-224110.5	1.0	291.5	6.6	-5.1	189.0	1.3	182912.0	-939506.1	0.0
0.0	29.9	0.7	-11.1	171.5	2.5	0.0	0.0	0.0	382.7	8.7	-3.1	171.5	10.5	7091.2	-227873.6	1.2	304.3	6.9	-4.8	189.1	1.3	218975.6	-1086108.6	0.0
0.0	-348.2	-7.9	-19.7	171.5	2.5	0.0	0.0	0.0	384.4	8.8	-2.9	171.5	10.5	7444.4	-226794.9	1.3	309.5	7.0	-4.7	193.8	1.3	258379.6	-1212132.4	0.0
0.0	-186.5	-4.2	-16.0	171.5	2.5	0.0	0.0	0.0	388.4	8.8	-2.9	171.5	10.5	7444.4	-228437.2	1.5	321.2	7.3	-4.5	197.0	1.3	291615.6	-1300851.8	0.0
0.0	128.6	2.9	-8.8	171.5	2.5	0.0	0.0	0.0	395.8	9.0	-2.8	171.5	10.4	7444.4	-215059.3	1.6	328.7	7.5	-4.3	194.3	1.3	316232.2	-1357055.8	0.0
0.0	124.4	2.8	-8.9	171.5	2.5	0.0	0.0	0.0	396.5	9.0	-2.8	171.5	10.4	7490.8	-214960.3	1.8	333.8	7.6	-4.2	194.3	1.3	316232.2	-1320251.1	0.0
0.0	-163.9	-3.7	-15.5	171.5	2.5	0.0	0.0	0.0	399.3	9.1	-2.7	171.5	10.4	7490.8	-210016.9	1.8	338.2	7.7	-4.1	194.3	1.3	316232.2	-1289047.2	0.0
0.0	254.1	5.8	-6.0	171.5	2.5	0.0	0.0	0.0	402.7	9.2	-2.6	171.5	10.4	7490.8	-203945.5	1.8	340.7	7.7	-4.0	194.3	1.3	316232.2	-1270644.8	0.0
0.0	69.5	1.6	-10.2	171.5	2.5	0.0	0.0	0.0	408.0	9.3	-2.5	171.5	10.4	7571.0	-196608.1	1.8	344.2	7.8	-3.9	194.3	1.3	316232.2	-1245841.7	0.0
0.0	47.0	1.1	-10.7	171.5	2.5	0.0	0.0	0.0	411.9	9.4	-2.4	171.5	10.4	7571.0	-189561.3	1.8	344.2	7.8	-3.9	194.1	1.3	354874.1	-1398076.8	0.0
0.0	143.7	3.3	-8.5	171.5	2.5	0.0	0.0	0.0	413.2	9.4	-2.4	171.5	10.4	7571.0	-187164.6	2.6	350.0	8.0	-3.8	206.9	1.3	545784.6	-2078389.7	0.0
0.0	126.4	2.9	-8.9	171.5	2.5	0.0	0.0	0.0	417.3	9.5	-2.3	171.5	10.4	7571.0	-179826.3	2.6	342.7	7.8	-4.0	206.9	1.3	545784.6	-2168147.7	0.0
0.0	-383.4	-8.7	-20.5	171.5	2.5	0.0	0.0	0.0	415.3	9.4	-2.3	171.5	10.4	7571.0	-183475.0	2.7	348.0	7.9	-3.9	209.2	1.3	568623.0	-2191256.1	0.0
0.0	66.0	1.5	-10.3	171.5	2.5	0.0	0.0	0.0	420.8	9.6	-2.2	171.5	10.4	7571.0	-173882.8	2.8	350.2	8.0	-3.8	213.8	1.3	608939.0	-2315804.8	0.0
0.0	102.3	2.3	-9.4	171.5	2.5	0.0	0.0	0.0	418.1	9.5	-2.3	171.5	10.4	7571.0	-178479.0	3.1	353.0	8.0	-3.7	236.1	1.3	729049.6	-2726473.1	0.0
0.0	84.8	1.9	-9.8	171.5	2.5	0.0	0.0	0.0	423.2	9.6	-2.1	171.5	10.4	7571.0	-169286.3	3.1	352.3	8.0	-3.8	236.1	1.3	729049.6	-2737540.5	0.0
0.0	88.3	2.0	-9.8	171.5	2.5	0.0	0.0	0.0	423.5	9.6	-2.1	171.5	10.4	7713.2	-172238.9	3.3	356.6	8.1	-3.7	232.0	1.3	767266.9	-2805334.9	0.0
0.0	99.2	2.3	-9.5	171.5	1.3	0.0	0.0	0.0	428.9	9.7	-2.0	171.5	10.4	7901.9	-166198.9	3.5	355.6	8.1	-3.7	228.2	1.3	800452.6	-2944898.1	0.0
0.0	103.2	2.3	-9.4	171.5	1.3	0.0	0.0	0.0	425.6	9.7	-2.1	171.5	10.4	7901.9	-173412.5	3.7	356.5	8.1	-3.7	225.2	1.3	825866.4	-3021880.3	0.0
0.0	106.3	2.4	-9.3	171.5	1.3	0.0	0.0	0.0	432.7	9.8	-1.9	171.5	10.4	7901.9	-159146.5	3.8	355.8	8.1	-3.7	222.1	1.3	850341.6	-3136290.3	0.0
0.0	96.1	2.2	-9.6	171.5	2.5	0.0	0.0	0.0	427.0	9.7	-2.1	171.5	10.4	7901.9	-169796.6	4.0	356.8	8.1	-3.7	220.1	1.3	871129.8	-3182881.7	0.0
0.0	86.1	2.0	-9.8	171.5	2.5	0.0	0.0	0.0	439.5	10.0	-1.8	171.5	10.4	7901.9	-146408.2	4.1	357.3	8.1	-3.6	231.5	1.3	960348.9	-3496716.3	0.0
0.0	83.4	1.9	-9.9	171.5	2.5	0.0	0.0	0.0	436.0	9.9	-1.9	171.5	10.5	7901.9	-152969.4	4.3	359.3	8.2	-3.6	242.7	1.3	1045550.7	-3759327.5	0.0
0.1	103.7	2.4	-9.4	171.5	2.5	0.0	0.0	0.0	442.9	10.1	-1.7	171.5	10.4	7901.9	-139934.6	4.5	360.3	8.2	-3.6	263.0	1.3	1180147.4	-4216403.0	0.0
0.1	85.5	1.9	-9.8	171.5	2.5	0.0	0.0	0.0	439.8	10.0	-1.8	171.5	10.4	7948.3	-140590.8	4.7	362.9	8.2	-3.5	274.1	1.3	1275565.7	-4483083.1	0.0
0.1	81.1	1.8	-9.9	171.5	2.5	0.0	0.0	0.0	444.8	10.1	-1.7	171.5	10.4	7948.3	-137141.5	4.8	366.1	8.3	-3.4	331.9	1.3	1608902.5	-5336573.2	0.0
0.1	71.6	1.6	-10.1	171.5	2.5	0.0	0.0	0.0	443.7	10.1	-1.7	171.5	10.4	8032.1	-140659.7	5.0	355.2	8.1	-3.7	332.7	1.3	1669577.0	-6159339.3	0.0
0.1	74.4	1.7	-10.1	171.5	2.5	0.0	0.0	0.0	448.7	10.2	-1.6	171.5	10.4	8032.1	-131114.2	5.0	352.3	8.0	-3.8	332.7	1.3	1669577.0	-6269168.7	0.0
0.1	68.6	1.6	-10.2	171.5	2.5	0.0	0.0	0.0	445.7	10.1	-1.6	171.5	10.4	8032.1	-136763.1	5.0	353.9	8.0	-3.7	332.7	1.3	1669577.0	-6210029.8	0.0
0.1	76.8	1.7	-10.0	171.5	2.5	0.0	0.0	0.0	451.7	10.3	-1.5	171.5	10.4	8032.1	-125279.1	5.0	354.9	8.1	-3.7	332.7	1.3	1669577.0	-6172011.9	0.0
0.1	72.9	1.7	-10.1	171.5	2.5	0.0	0.0	0.0	453.2	10.3	-1.5	171.5	10.4	8032.1	-125233.9	5.6	355.5	8.1	-3.7	449.5	1.3	2520808.2	-8689493.3	0.0
0.1	61.1	1.4	-10.4	171.5	2.5	0.0	0.0	0.0	455.7	10.4	-1.4	171.5	10.4	8032.1	-117649.2	5.6	362.3	8.2	-3.5	449.5	1.3	2520808.2	-8891835.	

Cont.	September 25 - Baseflow												October 25 - Post-storm Day 2												October 27 - Post-storm Day 4											
	Distance (km)	CO2 aq (ppm)	CO2 aq (mol m ⁻³)	Delta(CO2) Width of channel (m ²)	k CO ₂ (m d ⁻¹)	Surface Area (m ²)	Flux CO2 (mol)	Distance (km)	CO2 aq (ppm)	CO2 aq (mol m ⁻³)	Delta(CO2) Width of channel (m ²)	k CO ₂ (m d ⁻¹)	Surface Area (m ²)	Flux CO2 (mol)	Distance (km)	CO2 aq (ppm)	CO2 aq (mol m ⁻³)	Delta(CO2) Width of channel (m ²)	k CO ₂ (m d ⁻¹)	Surface Area (m ²)	Flux CO2 (mol)															
1.3	76.2	1.7	10.0	193.8	2.0	257897.5	-5270587.8	0.0	481.4	10.9	-0.8	171.5	10.4	8210.2	-70462.7	7.8	454.1	10.3	-1.4	310.9	1.1	2439254.4	-3518445.7													
1.5	92.4	2.1	-9.7	197.2	2.0	289564.8	-5610524.5	0.0	482.1	11.0	-0.8	171.5	10.4	8210.2	-68965.3	8.7	463.9	10.5	-1.2	331.5	1.1	2889634.8	-3524711.1													
1.6	94.4	2.1	-9.6	194.6	2.0	312912.7	-6097747.4	0.0	470.1	10.7	-1.1	171.5	10.4	8210.2	-92379.7	8.9	472.4	10.7	-1.0	331.5	1.1	2889634.8	-3524711.1													
1.8	91.7	2.1	-9.7	194.2	2.0	356229.8	-6880229.6	0.0	470.6	10.7	-1.1	171.5	10.4	8210.2	-91525.9	9.9	525.0	11.9	0.2	325.7	1.1	2891496.1	-483939.5													
1.8	92.5	2.1	-9.7	194.2	2.0	356229.8	-6880229.6	0.0	460.5	10.5	-1.3	171.5	10.4	8210.2	-111024.5	9.0	473.0	10.7	-1.0	383.1	1.1	3468015.3	-3510701.6													
2.1	97.1	2.2	-9.6	198.3	2.0	429186.3	-8171236.2	0.0	453.4	10.3	-1.5	171.5	10.4	8210.2	-124899.7	9.2	528.7	12.0	0.3	426.1	1.1	3911094.1	988508.8													
2.2	97.9	2.2	-9.5	198.3	2.0	429186.3	-8160105.5	0.0	451.8	10.3	-1.5	171.5	10.4	8210.2	-127934.9	9.3	512.4	11.6	-0.1	436.9	1.1	4057988.7	-473367.5													
2.3	97.9	2.2	-9.5	222.0	1.8	504455.5	-8712662.9	0.0	444.2	10.1	-1.7	171.5	10.4	8205.4	-142728.1	9.3	512.8	11.7	-0.1	436.9	1.0	4057988.7	-473367.5													
2.3	105.7	2.4	-9.4	222.0	1.0	504455.5	-4549272.8	0.0	429.0	9.7	-2.0	171.5	10.4	8205.4	-172187.7	9.3	505.9	11.5	-0.3	436.9	1.0	4057988.7	-1079129.0													
2.3	107.1	2.4	-9.3	222.0	1.0	504455.5	-4533285.0	0.0	424.5	9.6	-2.1	171.5	10.4	8205.4	-181005.3	9.4	501.3	11.4	-0.4	427.9	1.0	4025946.1	-1488237.0													
2.3	112.6	2.6	-9.2	222.0	1.0	504455.5	-4473023.3	0.0	415.4	9.4	-2.3	171.5	10.4	8205.4	-198426.8	9.4	491.8	11.2	-0.6	427.9	1.0	4025946.1	-2354053.3													
2.7	110.5	2.5	-9.3	209.4	1.9	570547.8	-10092902.8	0.0	414.0	9.4	-2.4	171.5	10.4	8205.4	-201181.8	9.5	499.6	11.4	-0.4	435.5	1.0	4154104.8	-1693267.3													
2.9	120.5	2.7	-9.0	215.1	1.9	614051.6	-10358021.4	0.1	401.4	9.1	-2.6	171.5	10.4	8348.6	-229669.8	9.5	501.2	11.4	-0.4	435.5	1.0	4154104.8	-1546122.7													
3.1	125.5	2.9	-8.9	236.0	1.7	730237.5	-11279955.7	0.1	402.4	9.1	-2.6	171.5	10.4	8794.8	-239711.3	9.7	507.2	11.5	-0.2	472.1	0.9	4568630.8	-1076213.1													
3.3	139.2	3.2	-8.6	231.8	1.8	768399.3	-11570116.4	0.1	395.8	9.0	-2.8	171.5	10.4	8779.2	-252868.0	9.7	506.6	11.6	-0.2	472.1	0.9	4568630.8	-925944.5													
3.3	135.8	3.1	-8.7	231.8	1.7	768399.3	-11661044.4	0.1	400.6	9.1	-2.7	171.5	10.4	8779.2	-242990.5	9.9	511.1	11.6	-0.1	395.6	0.9	3930948.6	-577968.8													
3.6	144.2	3.3	-8.5	227.4	1.8	807266.3	-12178226.0	0.1	393.4	8.9	-2.8	171.5	10.4	8779.2	-258031.3	10.1	514.1	11.7	-0.1	376.3	0.9	3784224.6	-297815.3													
3.7	151.9	3.5	-8.3	225.0	1.8	826908.2	-12327174.0	0.1	394.1	9.0	-2.8	171.5	10.4	8732.7	-255366.5	10.3	529.3	12.0	0.3	361.9	1.0	3712127.9	994573.6													
3.8	154.3	3.5	-8.3	222.0	1.8	851343.0	-12753628.0	0.1	383.4	8.7	-3.0	171.5	10.4	8732.7	-277495.6	10.5	529.5	12.0	0.3	298.5	1.0	3127939.7	845968.7													
4.0	161.3	3.7	-8.1	220.5	1.8	874192.3	-14442613.6	0.1	380.1	8.6	-3.1	171.5	10.4	8732.7	-284147.1	10.7	538.4	12.2	0.5	300.4	0.9	3210198.4	1517987.7													
4.2	168.7	3.8	-7.9	232.7	2.0	969609.0	-1547466.8	0.1	371.2	8.4	-3.3	171.5	10.4	8732.7	-302827.2	10.7	538.8	12.2	0.5	300.4	1.0	3210198.4	1550476.2													
4.3	169.4	3.8	-7.9	244.6	1.9	1058174.1	-16165171.7	0.1	382.5	8.7	-3.1	171.5	10.4	8869.4	-315502.1	10.7	552.3	12.5	0.8	300.4	1.0	3210198.4	253255.8													
4.5	169.5	3.9	-7.9	263.4	1.8	1183938.8	-16989409.6	0.1	379.2	8.6	-3.1	171.5	10.4	11558.1	-37862.4	10.7	561.0	12.7	1.0	300.4	1.0	3210198.4	3166783.1													
4.6	175.1	4.0	-7.8	273.3	1.8	1267926.9	-17375151.8	0.1	380.0	8.6	-3.1	171.5	10.4	13176.6	-427978.2	11.5	565.9	12.9	1.1	315.9	0.9	3625711.5	3980307.9													
4.7	173.6	3.9	-7.8	332.7	1.5	1611287.6	-19285205.4	0.1	370.2	8.4	-3.3	171.5	10.4	13176.6	-458471.2	11.5	569.8	12.9	1.2	315.9	0.8	3625711.5	4301378.2													
5.0	173.6	3.9	-7.8	332.7	1.5	1671800.8	-19489154.4	0.1	372.5	8.5	-3.3	171.5	10.4	13176.6	-451410.1	11.7	581.1	13.2	1.4	420.8	0.8	409935.7	707961.9													
5.0	166.8	3.8	-8.0	332.7	1.5	1671800.8	-19989152.4	0.1	372.2	8.5	-3.3	171.5	10.4	13176.6	-452344.0	11.9	586.1	13.3	1.6	420.8	0.8	409935.7	778758.8													
5.2	159.3	3.6	-8.1	347.3	1.4	1800437.3	-21125345.0	0.1	372.5	8.5	-3.3	189.0	11.9	19233.1	-752996.0	12.0	582.5	13.2	1.5	428.6	0.8	5137159.1	7576212.5													
5.2	152.0	3.5	-8.3	347.3	0.8	1800437.3	-21300252.2	0.5	369.8	8.4	-3.4	189.0	11.4	85413.2	-3263120.5	12.2	550.5	12.5	0.7	658.1	0.8	8047771.5	6024930.0													
5.2	143.0	3.2	-8.5	347.3	0.8	1800437.3	-2157904.9	0.5	371.2	8.4	-3.3	189.0	9.9	85413.2	-2819343.2	12.2	532.2	11.9	0.1	658.1	0.8	8047771.5	1036308.3													
5.2	147.6	3.6	-8.6	347.3	0.8	1800437.3	-2174426.5	0.6	383.9	8.7	-3.0	189.0	9.8	110040.6	-3281444.8	12.5	493.9	11.2	-0.5	638.1	0.8	7945282.5	-4263823.9													
5.6	128.0	2.9	-8.9	450.5	1.0	252936.2	-2653879.9	0.8	385.4	8.8	-3.0	189.0	9.7	144836.8	-4209301.2	12.7	475.8	10.8	-0.9	591.8	0.5	7497063.2	-7115132.0													
5.8	124.1	2.8	-8.9	476.3	1.0	2759321.7	-23804623.1	1.0	400.1	9.1	-2.7	189.0	9.9	180762.0	-4799431.8	12.9	453.7	10.3	-1.5	570.7	0.5	7338467.4	-10640902.8													
5.9	111.5	2.5	-9.2	493.9	0.9	2920930.7	-25209019.2	1.2	406.2	9.2	-2.5	189.0	9.8	221548.3	-5471126.8	13.0	448.1	10.2	-1.6	525.5	0.5	6819312.8	-10768052.0													
6.0	108.2	2.5	-9.3	508.8	0.9	3062049.7	-25980967.2	1.3	417.1	9.5	-2.3	192.3	9.2	249373.0	-5248275.2	13.2	436.1	9.9	-1.8	487.1	0.5	6453294.3	-11937135.4													
6.1	99.9	2.3	-9.5	562.9	0.8	3548727.7	-28215998.5	1.5	426.9	9.7	-2.1	197.3	9.1	291073.0	-5430037.7	13.2	427.6	9.7	-2.0	487.1	0.4	6453294.3	-13194354.7													
6.2	99.3	2.3	-9.5	602.9	0.8	3548727.7	-28267164.9	1.6	438.3	10.0	-1.8	194.1	8.9	332795.3	-5339268.1	13.5	424.8	9.7	-2.1	477.7	0.4	6452385.8	-13060627.8													
6.3	92.9	2.1	-9.7	562.9	0.8	3548727.7	-28703053.1	1.8	446.5	10.1	-1.6	194.1	8.7	378822.2	-5305615.2	13.6	419.9	9.5	-2.2	483.2	0.4	6386480.0	-14616155.6													
6.5	91.1	2.1	-9.6	695.3	0.7	4492243.4	-30260800.8	2.1	462.8	10.5	-1.2	194.1	8.6	440256.6	-4691120.1	13.8	419.1	9.5	-2.2	447.9	0.4	6189590.7	-13845373.2													
6.6	96.3	2.2	-9.6	644.0	0.7	4233929.7	-27387294.5	2.2	466.3	10.6	-1.2	197.2	8.5	463987.6	-4586326.6	14.0	429.4	9.8	-2.0	429.8	0.4	6004860.0	-12839628.2													
6.7	100.4	2.3	-9.5	592.3	0.7	3977946.5	-27342111.8	2.3	475.9	10.8	-0.9	228.5	8.4	504323.0	-3999821.8	14.0	423.5	9.6	-2.1	429.8	0.4	6004860.0	-11274755.6													
6.9	114.9	2.6	-9.1	521.7	0.8	3617611.3	-26747171.6	2.5	484.6	11.0	-0.7	212.7	8.2	562693.1	-3467594.2	14.0	434.9	9.9	-1.9	429.8	0.4	6004860.0	-9755461.9													
6.9	114.9	2.6	-9.1	521.7	0.8	3617611.3	-26681146.7	2.6	492.9	11.2	-0.6	206.8	8.1	596939.3	-2718444.9	14.0	446.1	10.1	-1.6	429.8	0.4	6004860.0	-9755461.9													
7.2	127.4	2.9	-8.9	418.4	0.9	315736.7	-25984486.4	2.8	498.5	11.3	-0.4	206.8	8.0	658487.6	-2277672.0	14.8	499.1	10.4	-1.3	474.5	0.5	7006667.4	-930861.5													
7.3	139.7	3.2	-8.6	433.2	0.9	3168324.2	-25679709.0	2.8	512.9	11.7	-0.1	206.8	8.0	658487.6	-560483.4	14.8	480.9	10.9	-0.8	474.5	0.5	7006667.4														

Cont.	September 25 - Baseflow												October 25 - Post-storm Day 2												October 27 - Post-storm Day 4											
	CO2 aq. (km)	CO2 aq. (ppm)	CO2 aq. (mol m ⁻³)	DeltaCO2 (mol m ⁻³)	Width of channel (m)	k CO ₂ (m d ⁻¹)	Surface Area (m ²)	Flux CO ₂ (mol)	Distance (km)	CO2 aq. (ppm)	CO2 aq. (mol m ⁻³)	DeltaCO2 (mol m ⁻³)	Width of channel (m)	k CO ₂ (m d ⁻¹)	Surface Area (m ²)	Flux CO ₂ (mol)	Distance (km)	CO2 aq. (ppm)	CO2 aq. (mol m ⁻³)	DeltaCO2 (mol m ⁻³)	Width of channel (m)	k CO ₂ (m d ⁻¹)	Surface Area (m ²)	Flux CO ₂ (mol)												
10.1	536.4	12.2	0.4	374.8	1.0	3775868.3	1688990.8	5.6	579.6	13.2	1.4	448.8	6.4	1658730.8	15056863.0	16.5	845.6	19.2	7.5	442.6	1.0	7288541.7	29335298.1	10.1	536.4	12.2	0.4	374.8	1.0	3775868.3	1688990.8					
10.3	537.6	12.2	0.5	359.9	0.6	3694301.5	930749.9	6.3	580.1	13.2	1.4	448.8	6.2	1964352.5	17190018.2	16.7	871.2	19.8	8.0	316.0	1.0	5279020.5	22906149.3	10.3	537.6	12.2	0.5	359.9	0.6	3694301.5	930749.9					
10.3	535.3	12.2	0.4	359.9	0.6	3694301.5	822999.0	6.3	582.7	13.2	1.5	648.2	6.2	1964352.5	17900835.0	16.8	896.8	20.4	8.6	295.4	1.0	4970924.3	23131551.3	10.3	535.3	12.2	0.4	359.9	0.6	3694301.5	822999.0					
10.3	540.1	12.3	0.5	359.9	0.6	3694301.5	1054922.4	6.4	586.9	13.3	1.6	711.1	6.1	202678.8	19505767.1	16.9	928.0	21.1	9.3	356.3	1.0	6095930.7	30414365.1	10.3	540.1	12.3	0.5	359.9	0.6	3694301.5	1054922.4					
10.3	535.5	12.2	0.4	359.9	0.6	3694301.5	850174.2	6.6	586.7	13.3	1.6	648.3	5.5	2089993.3	18114096.6	17.1	961.4	21.8	10.1	474.1	1.0	8092473.9	44066668.8	10.3	535.5	12.2	0.4	359.9	0.6	3694301.5	850174.2					
10.9	544.0	12.4	0.6	302.4	0.7	3303831.2	1354159.0	6.7	587.8	13.4	1.6	588.7	5.5	2167648.4	18906101.7	17.2	985.9	22.4	10.6	496.3	1.0	8532705.1	49031792.3	10.9	544.0	12.4	0.6	302.4	0.7	3303831.2	1354159.0					
11.0	545.2	12.4	0.6	303.4	0.7	3349411.5	1426056.5	6.9	590.8	13.4	1.7	529.3	5.4	2262807.9	20337679.8	17.3	1015.9	23.1	11.3	767.6	1.0	13292785.0	81288381.6	11.0	545.2	12.4	0.6	303.4	0.7	3349411.5	1426056.5					
11.2	550.5	12.5	0.7	304.8	0.7	3414256.8	1728781.8	7.1	591.9	13.4	1.7	501.7	5.4	2331084.6	21102057.4	17.5	1042.7	23.7	11.9	783.4	1.0	13700221.2	88272737.7	11.2	550.5	12.5	0.7	304.8	0.7	3414256.8	1728781.8					
11.3	559.0	12.7	0.9	306.2	1.3	3464784.6	4285733.2	7.3	595.8	13.5	1.8	435.1	5.3	2451786.5	23033716.5	17.6	1071.6	24.3	12.6	731.4	1.0	12885209.9	87600340.3	11.3	559.0	12.7	0.9	306.2	1.3	3464784.6	4285733.2					
11.5	563.6	12.8	1.0	319.7	1.3	3671394.4	4871839.1	7.4	596.2	13.5	1.8	416.3	5.2	2510530.8	23523999.3	17.8	1099.5	25.0	13.2	643.7	1.0	11442756.6	87100355.3	11.5	563.6	12.8	1.0	319.7	1.3	3671394.4	4871839.1					
11.7	576.0	13.1	1.3	420.8	1.0	4912748.2	6525420.0	7.6	600.5	13.6	1.9	368.4	5.2	2604142.2	25482542.6	17.9	1130.6	25.7	13.9	571.3	1.0	10244656.2	77005131.1	11.7	576.0	13.1	1.3	420.8	1.0	4912748.2	6525420.0					
11.9	571.8	13.0	1.2	420.8	1.1	5001117.8	6680790.7	7.8	602.2	13.7	1.9	325.2	5.1	2717557.1	26796844.2	18.1	1144.0	26.0	14.2	547.8	1.0	9908887.7	7613892.9	11.9	571.8	13.0	1.2	420.8	1.1	5001117.8	6680790.7					
12.0	588.4	13.4	1.6	466.9	1.0	5614309.8	8979699.0	8.1	602.3	13.7	1.9	201.3	5.1	2855384.5	27781164.4	18.2	1167.4	26.5	14.8	569.5	1.0	10393069.1	8267434.0	12.0	588.4	13.4	1.6	466.9	1.0	5614309.8	8979699.0					
12.2	586.4	13.3	1.7	658.5	0.7	8056849.8	9080865.3	8.2	600.6	13.6	1.9	193.2	5.0	2912187.5	27619724.9	18.5	1179.6	26.8	15.0	592.2	1.0	11008559.3	9429402.4	12.2	586.4	13.3	1.7	658.5	0.7	8056849.8	9080865.3					
12.4	604.1	13.7	2.0	663.4	0.7	8193598.2	11534806.0	8.4	612.2	13.9	2.2	179.3	5.0	3010292.0	32217190.2	18.6	1194.1	27.1	15.4	592.2	1.0	11008559.3	91846471.1	12.4	604.1	13.7	2.0	663.4	0.7	8193598.2	11534806.0					
12.6	604.3	13.7	2.0	610.8	0.8	7674328.7	11921685.2	8.5	610.7	13.9	2.1	334.3	4.9	3106189.9	32425537.0	18.6	1207.5	27.4	15.7	592.2	1.0	11008559.3	93189534.5	12.6	604.3	13.7	2.0	610.8	0.8	7674328.7	11921685.2					
12.7	617.6	14.0	2.3	583.6	0.8	7419924.0	13829292.8	8.7	616.1	14.0	2.2	334.3	4.9	3211904.5	35112264.5	18.6	1216.4	27.6	15.9	592.2	1.0	11008559.3	94392776.8	12.7	617.6	14.0	2.3	583.6	0.8	7419924.0	13829292.8					
12.9	632.3	14.4	2.6	568.1	0.8	7308992.9	15988814.7	8.7	616.8	14.0	2.3	334.3	4.9	3211904.5	35350342.0	18.6	1228.6	27.9	16.2	592.2	1.0	11008559.3	96047235.0	12.9	632.3	14.4	2.6	568.1	0.8	7308992.9	15988814.7					
13.0	641.1	14.6	2.8	524.4	0.9	6809041.9	17176680.1	8.7	627.0	14.2	2.5	334.3	4.9	3211904.5	39000864.0	19.4	1235.3	28.1	16.3	569.7	1.0	11078968.3	97569741.6	13.0	641.1	14.6	2.8	524.4	0.9	6809041.9	17176680.1					
13.2	658.6	15.0	3.2	486.7	1.0	6451391.9	19801581.4	8.7	616.8	14.0	2.1	323.9	4.9	3211904.5	35350342.0	19.4	1243.1	28.2	16.5	569.7	1.0	11078968.3	98629512.3	13.2	658.6	15.0	3.2	486.7	1.0	6451391.9	19801581.4					
13.3	670.2	15.2	3.5	486.7	1.0	6451391.9	21390706.8	8.9	623.8	14.2	2.4	323.9	4.9	3304022.0	39145464.6	19.4	1246.4	28.3	16.6	569.7	1.0	11078968.3	99803414.1	13.3	670.2	15.2	3.5	486.7	1.0	6451391.9	21390706.8					
13.5	693.6	15.8	4.0	478.0	1.0	6459626.8	25112072.1	9.2	714.2	16.2	4.5	390.4	4.8	3479963.3	41649902.2	19.6	1250.9	28.4	16.7	469.4	1.0	9204307.6	8206230.9	13.5	693.6	15.8	4.0	478.0	1.0	6459626.8	25112072.1					
13.5	711.5	16.2	4.4	478.0	0.5	6459626.8	14227615.0	9.3	718.5	16.2	4.6	473.3	6.1	3479963.3	94341277.6	19.8	1255.4	28.5	16.8	395.3	1.0	7814777.8	70746680.8	13.5	711.5	16.2	4.4	478.0	0.5	6459626.8	14227615.0					
13.5	742.7	16.9	5.1	478.0	0.5	6459626.8	16514625.7	9.2	714.7	16.2	4.5	473.3	6.0	3545527.8	93425972.8	20.0	1264.3	28.7	17.0	382.3	1.0	7636705.4	69967344.8	13.5	742.7	16.9	5.1	478.0	0.5	6459626.8	16514625.7					
13.5	764.9	17.4	5.6	478.0	0.5	6459626.8	18140036.8	9.2	719.0	16.3	4.6	473.3	5.3	3479963.3	81897775.5	20.1	1263.1	28.7	16.9	388.0	1.0	7809126.4	71440370.2	13.5	764.9	17.4	5.6	478.0	0.5	6459626.8	18140036.8					
14.1	786.1	17.9	6.1	417.0	0.9	5868293.4	33339459.7	9.2	714.6	16.2	4.5	473.3	6.0	3479963.3	96040187.3	20.3	1267.6	28.8	17.0	396.4	1.0	8057765.3	74155356.6	14.1	786.1	17.9	6.1	417.0	0.9	5868293.4	33339459.7					
14.3	808.1	18.4	6.6	413.9	0.9	5908029.9	36531296.9	9.3	724.0	16.5	4.7	473.3	5.2	3479963.3	80628124.2	20.3	1264.3	28.7	17.0	396.4	1.0	8057765.3	73812508.7	14.3	808.1	18.4	6.6	413.9	0.9	5908029.9	36531296.9					
14.4	814.5	18.5	6.7	420.6	0.9	6050325.1	37763884.6	9.4	717.5	16.3	4.5	427.7	5.1	3545527.8	84282330.4	20.5	1264.3	28.7	17.0	430.5	1.0	8836057.3	80955783.3	14.4	814.5	18.5	6.7	420.6	0.9	6050325.1	37763884.6					
14.6	830.4	18.9	7.1	455.1	0.9	6838093.2	40897315.0	9.5	721.1	16.4	4.6	427.7	5.0	3617966.8	82618785.8	20.6	1260.9	28.7	16.9	429.1	1.0	8894666.6	80807130.1	14.6	830.4	18.9	7.1	455.1	0.9	6838093.2	40897315.0					
14.7	828.4	18.8	7.1	463.9	0.8	6880524.6	40204254.1	9.5	714.9	16.2	4.5	440.5	5.0	3696638.5	85544307.5	20.8	1272.1	28.9	17.1	548.8	1.0	11401931.9	105554734.3	14.7	828.4	18.8	7.1	463.9	0.8	6880524.6	40204254.1					
14.9	831.9	18.9	7.1	463.6	0.8	6900698.8	39442373.1	9.7	719.6	16.4	4.6	473.6	4.4	3696638.5	72480390.8	20.9	1279.8	29.1	17.3	575.0	1.0	12015234.2	112381566.7	14.9	831.9	18.9	7.1	463.6	0.8	6900698.8	39442373.1					
14.9	824.6	18.7	7.0	463.6	0.8	6900698.8	38589813.8	9.9	719.8	16.4	4.6	396.4	4.4	3782344.8	75786852.0	21.0	1292.1	29.4	17.6	603.2	1.0	12680237.7	120507207.2	14.9	824.6	18.7	7.0	463.6	0.8	6900698.8	38589813.8					
14.9	826.9	18.8	7.0	463.6	0.8	6900698.8	389071119																													

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Cont.	September 25 - Baseline										October 25 - Post-storm Day 2										October 27 - Post-storm Day 4									
	Distance (km)	CO2 aq (ppm)	CO2 aq (mol m ⁻³)	DeltaCO2 (mol m ⁻³)	Width of channel (m)	k CO2 (m d ⁻¹)	Surface Area (m ²)	Flux CO2 (mol)	Distance (km)	CO2 aq (ppm)	CO2 aq (mol m ⁻³)	DeltaCO2 (mol m ⁻³)	Width of channel (m)	k CO2 (m d ⁻¹)	Surface Area (m ²)	Flux CO2 (mol)	Distance (km)	CO2 aq (ppm)	CO2 aq (mol m ⁻³)	DeltaCO2 (mol m ⁻³)	Width of channel (m)	Surface Area (m ²)	Flux CO2 (mol)							
27.1	10.8	0.2	-11.5	716.9	1.0	19430747.3	-223755565.8	23.1	1825.5	41.5	29.7	643.7	1.0	13928010.9	371630535.7															
27.2	5.5	0.1	-11.6	716.9	1.0	19509976.8	-226992901.0	23.2	1834.4	41.7	29.9	643.7	1.0	14287446.0	385920407.9															
27.4	7.2	0.2	-11.6	716.9	1.0	19624305.1	-227583269.5	23.4	1846.6	42.0	30.2	669.4	1.0	14287446.0	390981234.9															
27.6	4.2	0.1	-11.7	716.9	1.0	19753343.1	-230399151.6	23.5	1857.8	42.2	30.5	640.3	1.0	14615952.8	403299137.7															
27.8	7.6	0.2	-11.6	716.9	1.0	19927354.3	-230891018.9	23.6	1864.4	42.4	30.6	612.0	1.0	15380568.1	446189335.9															
28.0	3.4	0.1	-11.7	814.4	1.0	22765690.7	-265960818.0	23.9	1875.6	42.6	30.9	532.6	1.0	15380568.1	446967625.5															
28.0	4.3	0.1	-11.7	814.4	1.0	22765690.7	-265494261.0	24.0	1881.1	42.7	31.0	517.5	1.0	15708874.8	460482909.0															
28.0	8.4	0.2	-11.6	814.4	1.0	22765690.7	-263374594.7	24.3	2020.3	45.9	34.1	713.8	1.0	16003559.8	473575151.6															
28.0	7.4	0.2	-11.6	814.4	1.0	22765690.7	-263904511.2	24.4	2025.9	46.0	34.3	692.6	1.0	16238758.9	482589422.9															
28.5	7.1	0.2	-11.6	877.7	1.0	25045552.7	-290478880.6	24.6	2077.0	46.1	34.3	647.6	1.0	16338294.3	488854462.2															
28.7	5.3	0.1	-11.6	877.7	1.0	25166786.3	-292948317.3	24.7	2023.7	46.0	34.2	534.2	1.0	16595828.1	501178887.6															
28.8	8.6	0.2	-11.6	877.7	1.0	25301691.5	-292604573.9	24.9	2031.5	46.2	34.4	699.6	1.0	16798791.2	511558461.0															
29.0	5.4	0.1	-11.6	961.6	1.0	27860809.7	-324229202.0	25.0	2032.6	46.2	34.4	699.6	1.0	16929098.0	51806523.2															
29.1	10.6	0.2	-11.5	972.8	1.0	28327915.4	-326318777.6	25.3	2025.9	46.0	34.3	699.6	1.0	17244299.0	532105895.4															
29.3	11.3	0.3	-11.5	972.8	1.0	28467067.4	-327467960.2	25.5	1952.4	44.4	32.6	699.6	1.0	17440032.0	540351870.4															
29.4	16.7	0.4	-11.4	972.8	1.0	28602717.8	-325496846.0	25.6	1937.9	44.0	32.3	699.6	1.0	17682936.5	551457061.0															
29.5	21.7	0.5	-11.3	972.8	1.0	28740221.6	-323796687.5	25.6	1952.4	44.4	32.6	699.6	1.0	17702234.6	556089857.6															
29.7	24.3	0.6	-11.2	972.8	1.0	28875901.4	-323644941.0	25.6	1947.9	44.3	32.5	699.6	1.0	17758544.2	599195273.8															
29.8	30.5	0.7	-11.1	972.8	1.0	29014071.9	-321104710.4	25.6	1946.8	44.2	32.5	699.6	1.0	17758544.2	600093894.1															
30.0	31.4	0.7	-11.0	972.8	1.0	29155982.9	-322040865.7	26.4	1942.4	44.1	32.4	699.6	1.0	17767168.6	604880609.1															
30.1	36.8	0.8	-10.9	1197.5	1.0	30086757.6	-394155234.9	26.4	1930.1	43.9	32.1	699.6	1.0	17775238.9	607404025.1															
30.3	36.0	0.8	-10.9	1197.5	1.0	36234845.7	-396517109.8	26.5	1929.0	43.8	32.1	699.6	1.0	17782343.6	607196891.2															
30.4	41.7	0.9	-10.8	1197.5	1.0	36407915.2	-393620977.6	26.7	1930.1	43.9	32.1	699.6	1.0	17919295.5	614140144.4															
30.5	40.2	0.9	-10.8	1197.5	1.0	36583129.1	-396811117.0	26.8	1931.2	43.9	32.1	699.6	1.0	18140013.3	622163670.8															
30.7	46.2	1.0	-10.7	1197.5	1.0	36758089.0	-393686775.2	27.0	1931.2	43.9	32.1	716.9	1.0	18347778.5	627896916.0															
30.8	41.1	0.9	-10.8	1197.5	1.0	36933735.7	-399866517.8	27.1	1947.9	44.3	32.5	716.9	1.0	18566327.0	638664310.2															
30.8	51.7	1.2	-10.6	1197.5	1.0	36933735.7	-390899119.7	27.4	1951.3	44.3	32.6	716.9	1.0	18772636.4	646236127.4															
30.8	48.8	1.1	-10.7	1197.5	1.0	36933735.7	-393418723.4	27.5	1964.7	44.6	32.9	716.9	1.0	19179105.3	657317051.9															
30.8	53.6	1.2	-10.5	1197.5	1.0	36933735.7	-389400532.7	27.8	1970.2	44.8	33.0	716.9	1.0	19349289.3	630838885.4															
31.4	55.3	1.3	-10.5	1168.0	1.0	36723795.2	-385700441.1	28.1	1986.9	45.1	33.4	877.7	1.0	19547582.7	630874314.9															
31.6	54.7	1.2	-10.5	1136.2	1.0	35919787.0	-377801439.0	28.3	2005.9	45.6	33.8	877.7	1.0	19547582.7	63703786.3															
31.8	60.7	1.4	-10.4	1033.3	1.0	32835040.6	-340870210.6	28.5	2017.0	45.8	34.1	877.7	1.0	19547582.7	635325487.4															
31.9	62.0	1.4	-10.4	908.1	1.0	28989757.9	-300071033.8	28.7	2030.3	46.1	34.4	877.7	1.0	19547582.7	634839912.7															
32.1	69.0	1.6	-10.2	949.3	1.0	30438160.4	-310211608.4	28.8	2047.0	46.5	34.8	877.7	1.0	20606569.9	667137304.0															
32.3	78.9	1.8	-10.0	1063.0	1.0	34338217.4	-342226916.4	29.0	2056.0	46.7	35.0	972.8	1.0	20606569.9	661402253.5															
32.4	80.8	1.8	-9.9	1216.2	1.0	39459536.7	-391570584.3	29.2	2067.1	47.0	35.2	972.8	1.0	20835999.8	668239015.9															
32.6	80.5	1.8	-9.9	1148.0	1.0	37419772.6	-371613330.4	29.2	2069.3	47.0	35.3	972.8	1.0	21032365.8	675068881.2															
32.7	82.2	1.9	-9.9	1031.6	1.0	33780451.1	-334189442.6	29.2	2086.0	47.4	35.6	972.8	1.0	21237067.6	682176446.9															
32.9	86.6	2.0	-9.8	1005.8	1.0	33090724.8	-324017068.6	29.2	2096.0	47.6	35.9	972.8	1.0	21443960.5	68822255.7															
								30.0	2108.3	47.9	36.1	972.8	1.0	21610089.0	702360006.7															
								30.0	2116.1	48.1	36.3	972.8	1.0	21997884.7	716633653.1															
								30.1	2126.1	48.3	36.5	1197.5	1.0	22258305.7	731875396.4															
								30.3	2135.0	48.5	36.8	1197.5	1.0	22638698.5	747247009.4															
								30.5	2155.1	49.0	37.2	1197.5	1.0	23004378.6	768497726.7															
								30.6	2158.4	49.0	37.3	1197.5	1.0	23135114.1	788450513.3															
								30.8	2168.4	49.3	37.5	1197.5	1.0	23654025.2	805896241.0															
								30.9	2172.9	49.4	37.6	1197.5	1.0	23912686.1	821969055.4															
								31.1	2186.2	49.7	37.9	1197.5	1.0	24164086.4	839781286.8															
								31.3	2199.6	50.0	38.2	1269.9	1.0	24413553.9	853392611.1															
								31.4	2217.4	50.4	38.6	1172.9	1.0	24662800.2	868345140.1															
								31.6	2221.9	50.5	38.7	1143.2	1.0	25025356.1	937067843.4															
								31.8	2227.4	50.6	38.9	1050.1	1.0	25025356.1	941659417.8															
								31.9	2240.8	50.9	39.2	905.5	1.0	26157206.3	956036915.3															
								32.1	2250.8	51.1	39.4	943.8	1.0	26429336.5	971332704.9															
								32.3	2322.1	52.8	41.0	1055.0	1.0	26679315.0	992670201.9															
								32.4	2323.2	52.8	41.0	1217.7	1.0	26928690.4	1003992809.4															
								32.6	2329.9	52.9	41.2	1142.3	1.0	27180184.0	1019558531.1															
								32.8	2331.0	53.0	41.2	1005.8	1.0	27433195.1	1031825613.6															
								33.0	2334.3	53.0	41.3	1005.8	1.0	27687819.6	1049809000.9															

Table A.3. Grab sample data for DOC, BDOC, DIC, SUVA, d13IC, and d13OC in surface water versus distance downstream from the Allisonia stream gauge to the Radford stream gauge in the ROR system.

Data are water quality parameters at baseflow (September 25), and high flow days 1 through 5 (October 24 - October 28).

	Allisonia (0 km)						New River (7 km)					
Date	DOC	BDOC	DIC	SUVA	δ13 IC	δ13 OC	DOC	BDOC	DIC	SUVA	δ13 IC	δ13 OC
	(mg L ⁻¹)	(mg L ⁻¹)	(mg L ⁻¹)	(L mg ⁻¹ *m ⁻¹)			(mg L ⁻¹)	(mg L ⁻¹)	(mg L ⁻¹)	(L mg ⁻¹ *m ⁻¹)		
25-Sep	1.41	0.10	9.54	4.00	-11.2	-27.8	1.42		9.38	4.00	-11.1	-28.0
24-Oct	7.09	1.09	3.3	3.81	-8.2	-28.2						
25-Oct	3.63	0.95	3.73	4.10	-6.8	-28.5	4.07	1.06	4.43	3.98	-7.0	-28.0
26-Oct	2.34	0.50	4.33	4.57	-4.6	-27.6	2.09	0.48	8.23	3.92	-6.3	-28.0
27-Oct	2.98	0.54	5.49	3.96	-6.0	-27.4	3.12	0.24	5.47	4.04	-6.3	-28.3
28-Oct	1.63	0.24	4.83	4.11	-3.4	-30.3						
Std. Dev.	1.90	0.354	2.06	0.236	2.53	0.971	1.01	0.345	2.00	0.0433	2.00	0.130
	River - Reservoir Transition (15 km)						Claytor Lake (above) (30 km)					
Date	DOC	BDOC	DIC	SUVA	δ13 IC	δ13 OC	DOC	BDOC	DIC	SUVA	δ13 IC	δ13 OC
	(mg L ⁻¹)	(mg L ⁻¹)	(mg L ⁻¹)	(L mg ⁻¹ *m ⁻¹)			(mg L ⁻¹)	(mg L ⁻¹)	(mg L ⁻¹)	(L mg ⁻¹ *m ⁻¹)		
25-Sep	1.68	0.21	8.96	3.80	-9.40	-28.8	1.32	0.000	10.1	3.10	-9.00	-29.3
24-Oct	3.56	2.70	6.53	4.33	-7.37	-27.6	1.94	0.000	9.4	3.35	-6.94	-27.4
25-Oct	4.09	0.92	4.47	3.91	-7.04	-28.2	1.79	0.255	9.7	3.30	-6.67	-27.4
26-Oct	2.09	0.48	8.23	3.92	-6.30	-28.0	1.83	0.390	9.1	3.72	-6.90	-27.6
27-Oct	2.33	0.13	8.46	3.35	-6.80	-28.5	2.01	0.090	9.3	3.33	-7.20	-27.6
28-Oct	2.33	0.26	8.38	3.52	-7.34	-27.7	2.06	0.267	8.9	3.54	-7.88	-29.8
Std. Dev.	0.852	0.896	1.55	0.313	0.975	0.429	0.245	0.147	0.401	0.195	0.798	0.978
	DS Claytor Lake Impoundment (35 km)						Radford (42 km)					
Date	DOC	BDOC	DIC	SUVA	δ13 IC	δ13 OC	DOC	BDOC	DIC	SUVA	δ13 IC	δ13 OC
	(mg L ⁻¹)	(mg L ⁻¹)	(mg L ⁻¹)	(L mg ⁻¹ *m ⁻¹)			(mg L ⁻¹)	(mg L ⁻¹)	(mg L ⁻¹)	(L mg ⁻¹ *m ⁻¹)		
25-Sep	1.27	0.060	11.4	3.50	-11.6	-28.5	1.41	0.000	12.9	3.40	-11.1	-28.9
24-Oct	4.98	0.000	6.0	3.43	-7.6	-28.3	2.71	0.020	8.1	3.43	-7.2	-27.3
25-Oct	2.21	0.345	9.8	3.71	-7.6	-27.8	2.11	0.175	9.7	3.70	-7.7	-27.9
26-Oct	3.47	0.785	8.7	4.06	-8.2	-28.3	2.87	0.625	9.5	3.73	-7.9	-27.9
27-Oct	3.10	0.465	9.2	3.97	-9.4	-28.9	2.96	0.395	10.6	3.61	-8.6	-27.3
28-Oct	2.82	0.642	8.7	4.33	-8.6	-29.4	2.94	0.392	10.1	3.98	-9.0	-28.6
Std. Dev.	1.14	0.285	1.59	0.318	1.38	0.524	0.567	0.224	1.45	0.196	1.27	0.594

Table A.4. Fluxes of DOC, BDOC, and DIC (Mg d^{-1}) in surface water versus distance downstream from the Allisonia stream gauge to the Radford stream gauge in the ROR system. Data are water quality parameter fluxes at baseflow (September 25), and high flow days 1 through 5 (October 24 - October 28).

	Allisonia (0 km)				River - Reservoir Transition (15 km)			
Date	Q	DOC Flux	BDOC Flux	DIC Flux	Q	DOC Flux	BDOC Flux	DIC Flux
	(cms)	(Mg d^{-1})	(Mg d^{-1})	(Mg d^{-1})	(cms)	(Mg d^{-1})	(Mg d^{-1})	(Mg d^{-1})
25-Sep	27.3	3.32	0.24	22.5	57.1	8.29	1.04	44.2
24-Oct	620.1	379.9	58.4	176.8				
25-Oct	313.2	98.2	25.7	100.9	273.1	94.7	21.2	103.5
26-Oct	140.5	28.4	6.01	52.5				
27-Oct	98.0	25.2	4.57	46.5	81.7	16.4	0.92	59.7
28-Oct	83.0	11.7	1.70	34.6				
Std. Dev.	202.4	132.7	20.7	52.8	96.6	39.0	9.53	25.1
	DS Claytor Lake Dam (35 km)				Radford (42 km)			
Date	Q	DOC Flux	BDOC Flux	DIC Flux	Q	DOC Flux	BDOC Flux	DIC Flux
	(cms)	(Mg d^{-1})	(Mg d^{-1})	(Mg d^{-1})	(cms)	(Mg d^{-1})	(Mg d^{-1})	(Mg d^{-1})
25-Sep	37.2	4.08	0.193	36.5	49.3	6.00	0.00	55.0
24-Oct	495.5	213.2	0.000	258.2	665.4	155.8	1.15	465.7
25-Oct	352.5	67.3	10.5	299.1	371.0	67.6	5.61	311.2
26-Oct	155.9	46.7	10.6	117.2	181.8	45.1	9.82	149.4
27-Oct	82.7	22.2	3.32	66.0	95.7	24.5	3.27	87.5
28-Oct	82.5	20.1	4.57	61.8	99.1	25.2	3.36	86.7
Std. Dev.	166.6	70.5	4.3	101.7	215.4	49.4	3.20	148.2

Table A.5. Summary of p-values from (a) Kruskal-Wallis and (b) Wilcoxon Rank Sum tests with Bonferroni's correction conducted on DOC, BDOC, and DIC fluxes to determine significant differences between upstream (Allisonia), downstream of the impoundment (DS), and downstream in the New River (Radford) from baseflow through high flow. (* indicates significance)

(a)

Parameter	Kruskal – Wallis p-value
DOC	0.970
BDOC	0.535
DIC	0.140

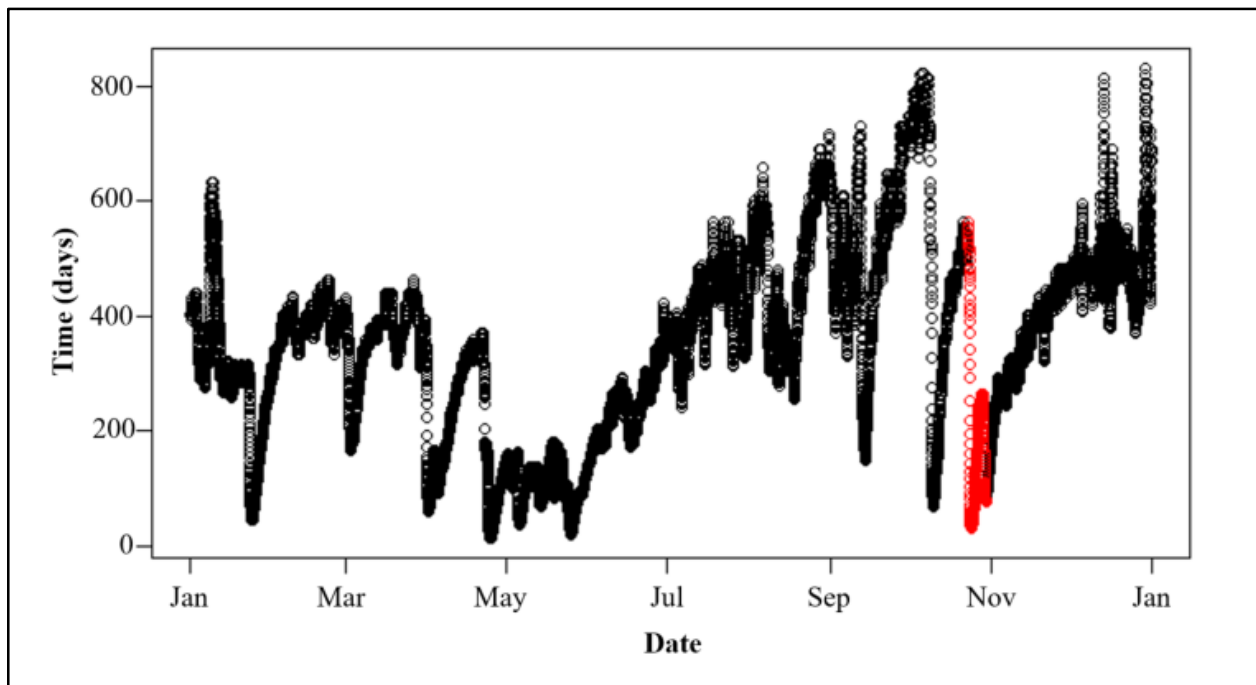
(b)

Parameter	Allisonia vs. DS Stormflow – Wilcoxon	Allisonia vs. Radford Stormflow – Wilcoxon	Radford vs. DS Stormflow – Wilcoxon
DOC	0.688	0.844	0.688
BDOC	0.563	0.563	0.219
DIC	0.031*	0.031*	0.031*

Table A.6. Summary of Kruskal-Wallis and Wilcoxon Rank Sum tests with Bonferroni's correction conducted on CO₂ evasion to determine significant differences between baseflow and high flow days 2 and 4.

Parameter	Baseflow vs Storm Day 2 – Kruskal-Wallis	Baseflow vs Storm Day 2 – Kruskal-Wallis	Baseflow vs Storm Day 2 – Wilcoxon	Baseflow vs Storm Day 4 – Wilcoxon
CO ₂ Evasion	$3.24 \times 10^{-16*}$	$4.80 \times 10^{-10*}$	$4.4 \times 10^{-16*}$	$4.4 \times 10^{-16*}$

Figure A.1. Residence time of water in Claytor Lake, 2017. Points indicate residence time calculated from 15-minute data, red points indicate the high flow event studied in this experiment.



Appendix B: Additional code and calculations

B.1. Creating longitudinal profiles from sensor data

The following standard operating procedure (SOP) details the process used in R Studio and ArcGIS to create longitudinal profiles of sensor data. Longitudinal profiles were created using sensor data geotagged to GPS data points. Data matched to GPS coordinates were imported into ArcGIS and snapped to the NHD Flowline for the New River and Claytor Lake. Distance measurements were then created between each point and exported to excel. Data for each day of sampling were then compiled into one meta datasheet to create the longitudinal profiles (Table A.1 and Table A.2).

```
##### Data Code for Boat Analyses #####
## Created by Madeline Ryan and Tyler Keys
## 5/16/2018
# Open RStudio
rm(list = ls())
library(dplyr)
library(tidyr)
library(readxl)
library(lubridate)
#####
##### Part 1: Data Matching Code
#####
# Before you begin:
# Make sure that times are adjusted to proper time zone such that all instruments matchup
# Make sure times are in proper format (i.e. hh:mm:ss)
# Make sure that all .csv files have a column titled "Time"
#####
# Step 1: Setup Workspace
setwd("input work destination here")
library(data.table)
```

```
#####
# Step 2: Read in data and change timestamps from characters to numeric values
GPS <- read.csv(file="(file containing GPS data).csv", head=TRUE,sep=",")
GPS$Time <- as.POSIXct(GPS$Time,format="%H:%M:%S")
GPS2 <- data.table(GPS)
GPS2
Sensor <- read.csv(file="(file containing sensor data).csv", head=TRUE,sep=",")
Sensor$Time <- as.POSIXct(Scan$Time,format="%H:%M:%S")
Sensor2 <- data.table(Scan)
Sensor2
# Repeat sensor step for all sensor datasets
#####
# Step 3: Data matching
# Merge data based on closest GPS time data point
# Note: If two points are equidistant, the code will select the first time point.
setkey(GPS2,Time)
Combined_Sensor <-GPS2[Sensor2,roll="nearest"]
# Check to make sure that data looks correct
Combined_Sensor
#####
# Step 4: Exporting Data
# Create new .csv files with merged data
write.csv(Combined_Sensor, file = "Sensor_Location_MMDDYY_GIS_Input.csv")

#####
##### Part 2: ArcGIS Processing
#####
## In this part, we are going to:
## 1) Snap data points to NHD flowline
## 2) Convert gps points to UTM coordinates
## 3) Use Distance Along Route function in GIS
```

4) Export distance measurements to excel

#####

Step 1: Import data to Arcmap

Import .csv file into ArcGIS

- Click add data, select .csv file

- Right click on .csv dataset, select Display XY Data, set X Field as lon, Y Field as lat, Z Field as elev, and set coordinate system by selecting Edit > Geographic Coordinate Systems > World, WGS_1984 > OK (data points should appear)

Create point shapefile

- Right click data point layer in the Table of Contents, select data,

export data, and save file

- Add new shapefile to map

Add NHD flowline shapefile to arcmap

#####

Step 2: Snap data to NHD flowline

Search for Snap tool

- Input = use newly created shapefile of data

- Snap environment = NHD flowline shapefile

In table, specify snap by vertex or edge, then specify distance you want to # tool to search out to (i.e. 200m etc.)

Click "OK"

#####

Step 3: Convert lat/long to UTM (skip this step if GPS already in UTM)

Search for Project (data management) tool

Select Input layer (data that has been snapped to NHD)

- Note: Input Coordinate System is set automatically.

Specify output location and name.

Click the icon next to Output Coordinate System and

select Projected > UTM > NAD 1983 >UTM Zone 17N, OK.

Click "OK"

Now search for Add XY Coordinates tool

```

# Specify the projected layer (just created). OK
# When the tool finishes open the attribute table for the projected Layer
# It should now contain fields Point_X and Point_Y in UTM.
#####

## Step 4: Distance along route
# Search for Generate Near Table (analysis) tool
# Select Input layer (projected data)
# Select Near features (projected data)
# Click OK
# Table output should have distance output which can be added to projected
# data table to see distance in meters between points
#####

## Step 5: Export distance measurements to excel
# Right click on table or shapefile > Open attribute table
# Click Table options (top left icon that looks like a paper with lines)
# Table options > Export
# Export as text, then convert to csv in file explorer
#####

## Step 6: Convert distance measurements to km (in excel)
# use formula:
# Distance (km) = Distance (m) / 1000
#####

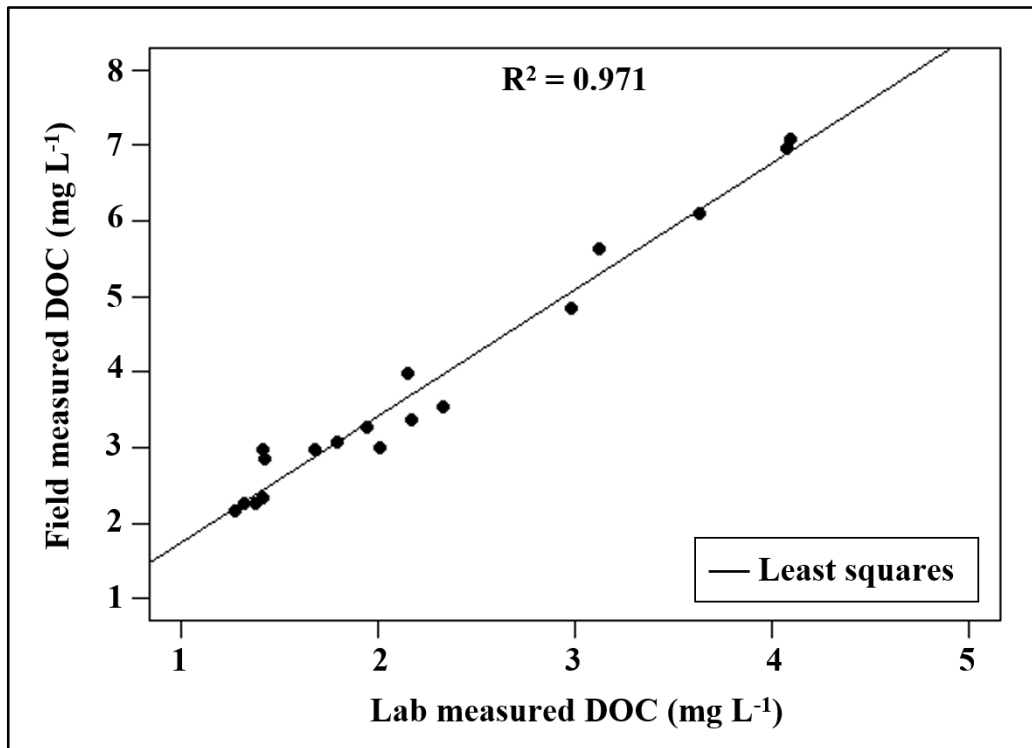
#Step 7: Correct distance to exclude points where boat is stopped
# To do this, assume that where the change in distance between points is =
# 0, then water sampling has been switched to low port and boat is stopped
# By removing these points, we assume all data used for longitudinal profiles
# is sampled from high port
# Again in excel:
# find distance for points, exclude points where boat is stopped
# use function =IF(AND(Delta Dist>-0.1,Delta Dist<0.1),0,Dist (km))

```

```
#####
#### Part 3: Plotting Data from Allisonia to Claytor
#####
## Step 1: Compile Data into one Mastersheet for day of sampling
# To do this, you will need to match up data in excel by time or location
# All data saved in mastersheet
#####
## Step 2: Plot multiple longitudinal profiles for each water quality parameter
setwd("input work destination here")
sensor_data <- read_excel("(file containing sensor data).xlsx")
distance <- sensor_data$Distance
parameter <- sensor_data$parameter
```

B.2. Validation of sensor data with lab measurements

Figure B.2.1. In-situ measurements of DOC concentration (mg L^{-1}) in the New River and Claytor Lake Reservoir were validated with laboratory measurements of DOC concentration measured by a Shimadzu TOC-V CPH analyzer. The R^2 value produced for the comparison was 0.971.



B.3. Stratification and water contribution from Claytor Lake Reservoir to downstream flow

Table B.3.1. Contribution of water from the epilimnion and hypolimnion of Claytor Lake Reservoir during high flow.

Claytor Lake SW					Claytor Lake DS
Time	Temperature (°C)	Total temp change for high flow	Time	Temperature (°C)	Total temp change for high flow
10/24/17 11:21			10/24/17 12:50		
10/25/17 10:15	17.8		10/25/17 14:37	15.2	
10/26/17 9:30	18.35		10/26/17 11:05	14.3	
10/27/17 11:16	19.89		10/27/17 15:30	16.49	
10/28/17 10:20	17.8	53.5	10/28/17 11:25	15.2	43.6
% SW water contributed	77.2				
% DW water contributed	22.8				