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March 29, 2018

Dr. Joe Ghiold, Ph.D., Project Manager
Facility Management Branch
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NC Department of Environmental Quality
1646 Mail Service Center
Raleigh, NC 27699-1646

Re: STORMWATER SAMPLING REPORT
Chemours Fayetteville Works
Fayetteville, North Carolina
EPA ID No. NCD 047 368 642

Dear Dr. Ghiold:

Enclosed, please find a PDF copy of the *Stormwater Sampling Report* for the Chemours Fayetteville Works. This document presents the results from a stormwater sampling program completed on 16 and 29 January 2018. This program assessed the effect of rainfall and resultant stormwater runoff on HFPO-DA (i.e. Dimer Acid) concentrations in nearby creeks, groundwater wells adjacent to the Cape Fear River, and the Site drainage network ditches leading to Outfall 002.

If you have any questions or need any additional information, please feel free to contact me at Personal Phone / Ex. 6

Respectfully submitted,

Kevin Garon
Project Director
Chemours Corporate Remediation Group

cc: Christel Compton – Chemours Fayetteville Works
File

Enclosures

Geosyntec consultants

engineers | scientists | innovators

STORMWATER SAMPLING REPORT

Prepared for

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Prepared by

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EXECUTIVE SUMMARY

A stormwater sampling program was implemented to assess stormwater runoff on HFPO-DA (i.e. hexafluoropropylene oxide dimer acid) concentrations at the Chemours Fayetteville Works site in Fayetteville, North Carolina (NC, the Site). HFPO-DA stormwater related concentrations were evaluated in the Site drainage network, in on-Site groundwater wells adjacent to the Cape Fear River (the river) and in nearby tributaries (i.e. creeks) to the river. A rainwater sample was also collected which is being reported separately to the North Carolina Department of Environmental Quality (NCDEQ); additional rainwater samples have been collected separately from the stormwater sampling program. The sampling program consisted of a dry-weather (dry) event on 16 January 2018 and a wet-weather (wet) event on 29 January 2018 at the Site. The sampling program workplan was developed by Geosyntec Consultants (Geosyntec), with the field effort completed by Parsons of North Carolina Inc., (Parsons).

The Site contains four chemical manufacturing areas: the Chemours-operated Polymer Processing Aid Area (PPA Area) and Monomers IXM Area; the Dow-DuPont-Leased Area (Dow-DuPont Area); and the Kuraray America-Leased Area (Kuraray Area). Only the PPA and Monomers IXM Areas manufacture or use HFPO-DA. Both the PPA and Monomers IXM Areas have emission stacks that emit HFPO-DA to air which is subsequently deposited to the ground surface. Additionally, on 6 October 2017, a scrubber upset incident occurred in the Monomers IXM Area at the Vinyl Ethers South (VES) emission stack. The scrubber upset incident resulted in water mist with potentially elevated HFPO-DA concentrations being released to a localized zone in the southwest portion of the Monomers IXM Area. During rainfall events some of the HFPO-DA deposited from air emissions and the scrubber upset incident is likely carried into stormwater runoff which transports HFPO-DA into the Site drainage network.

The Site drainage network also conducts water from the manufacturing areas. The Site uses between 15 and 25 million gallons water per day (gpd) from the river for manufacturing purposes. This water is used on-Site and then: a) non-process water is released back to the Site drainage network and flows to Outfall 002, after applying appropriate treatments; or b) water used in Chemours processes is sent off-Site for treatment and disposal. Water flows continuously through the four primary ditches / water pathways in the Site drainage network. The four primary ditches / water pathways are: (a) the Cooling Water Channel from the Monomers IXM Area; (b) the Wood Lined Trench; (c) the Wastewater Treatment Plant (WWTP) Discharge Outlet; and (d) the Open Channel to Outfall 002. All ditches connect to the Open Channel that leads to Outfall 002, which then discharges to the river.

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Using data for 16 January 2018 from indicative flow gauges at the Site (dry event), approximately sixty percent (60%) of the collected river water was unprocessed and used as non-contact cooling water (NCCW). This water is released directly to the Site drainage network immediately after use. Thirty percent (30%) of collected water exceeded Site requirements for that day and was consequently released back to the Site drainage network. The remaining approximately ten percent (10%) of the collected water was processed to yield filtered and demineralized water for use in chemical processes and Site sanitary systems (i.e. sinks, toilets, etc.,). After use, this filtered and demineralized water is sent to the WWTP for treatment and then released to the Site drainage network. The process of creating filtered and demineralized water also produces about 70,000 gpd of wastewater, about 0.4% of flow at Outfall 002; this wastewater is sent directly to the WWTP. The entire fraction of filtered and demineralized water used in Chemours processes, approximately 55,000 gpd, is sent off-Site for treatment and disposal. For the wet event on 29 January 2018, the increase in flow volume from stormwater run-off could not be assessed quantitatively, but relative flow volumes in the drainage network are expected to be reasonably similar to the dry event.

The Site drainage network sampling data showed that HFPO-DA concentrations were lower during the dry event (40 to 220 nanograms per liter [ng/L]) compared to the wet event (140 to 4,300 ng/L). There was no strong trend in dry event concentrations with respect to location within the drainage network. For the wet event, drainage pathways with only stormwater (i.e., no water was present during the dry event) had the highest concentrations of HFPO-DA (1,200 to 4,300 ng/L). This suggested that some of the aerially deposited HFPO-DA was transported in stormwater runoff as it flowed overland into the ditches. Where NCCW and excess river water was also present, the HFPO-DA concentrations were lower. For example, in the Wood Lined Trench, which drains the PPA and Kuraray Areas, after addition of NCCW and excess river water to the trench, concentrations declined from between 1,200 to 3,300 ng/L to a concentration of 140 ng/L.

The measured Outfall 002 HFPO-DA concentration during the wet event was 750 ng/L compared to a dry event value of 75 ng/L. The HFPO-DA concentration during the wet event was dominated by HFPO-DA mass flux from the Monomers IXM Area. The sample collected from the Cooling Water Channel had a HFPO-DA concentration of 3,600 ng/L. This sample was unique as compared to other samples on-Site. It had a relatively high concentration and its volume was a combination of stormwater and all the NCCW used in the Monomers IXM Area, representing about 30% of all intake river water. By contrast, at the Wood Lined Trench the combined stormwater NCCW sample had a concentration of 140 ng/L. Additionally, the inputs prior to the Cooling Water Channel into the Open Channel were 140 and 210 ng/L. Therefore, the mass flux of HFPO-DA from the

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Monomers IXM Area is most likely the primary source of HFPO-DA that increased Outfall 002 concentrations to 750 ng/L. The observed concentration trends in the wet sample event seem to confirm that the elevated Monomers IXM Area mass flux is somehow related to the 6 October 2017 scrubber upset incident.

Groundwater and surface water sample results were also evaluated and compared to stormwater results. Data from the groundwater wells adjacent to the river showed no change in HFPO-DA concentrations between the dry and wet sampling events. The surface water tributaries, Willis Creek, Georgia Branch Creek, and the Former Outfall 002 all had increases in flow during the wet event. The creeks had the largest increase--about 5-fold--while the Former Outfall 002 had a 2-fold flow increase. HFPO-DA concentrations increased in the creeks during the wet event. The highest Georgia Branch creek concentration increased from 1,100 to 2,000 ng/L and Willis Creek had an increase of 310 to 560 ng/L. These data suggested that stormwater runoff into the creeks likely carried aerially deposited HFPO-DA, which then increased the concentrations. The Former Outfall 002 had higher concentrations of HFPO-DA than the creeks (8,400 ng/L) in the dry event and its concentration decreased with the addition of stormwater runoff (5,700 ng/L).

The stormwater sampling program, in addition to other focused investigations around the VES emissions stack, have supported determining that the cause of elevated Outfall 002 concentrations during rainfall since 9 October 2017 are related to the 6 October 2017 scrubber upset incident. Based on this determination, Chemours is taking several actions. Chemours has completed excavating shallow soils adjacent the Cooling Water Channel that were impacted by the scrubber upset incident. Chemours has also removed from the Monomers IXM area two roll-off bins that contained spent carbonate; water in the roll-off bins had elevated levels of HFPO-DA. Chemours has also excavated soil from under these roll-off bins. Additional actions in progress include washing equipment and structures around the scrubber upset incident area. Additionally, Chemours plans to reduce emissions to air from the PPA and Monomer IXM areas by installing emissions reduction equipment in May 2018.

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1 INTRODUCTION AND OBJECTIVES

This report presents results and observations from a stormwater sampling program performed at the Chemours Company FC, LLC's (Chemours) Fayetteville Works site in Fayetteville, North Carolina (the Site). In mid- to late 2017, observations of HFPO-DA (i.e. hexafluoropropylene oxide dimer acid) concentrations in Outfall 002 samples suggested increased concentrations after rainfall events. Stormwater runoff on-Site in the drainage network is directed to Outfall 002 and then towards the Cape Fear River (the river). The objective of the sampling program was to evaluate the effect of rainfall and stormwater runoff on HFPO-DA concentrations in Site drainage network ditches. During the sampling program, HFPO-DA concentrations were also measured in nearby surface water tributaries (i.e. creeks) flowing into the river, groundwater wells adjacent the river and in rainfall.[1] The stormwater sampling program was conducted over two events--a dry-weather (dry) event and a wet-weather (wet) event--to compare the changes in HFPO-DA concentrations between these conditions.

The remainder of this report is organized into the following sections:

- Section 2: Site Background
- Section 3: Stormwater Sampling Program Scope and Methods
- Section 4: Results and Observations
- Section 5: Conclusions
- Section 7: References

2 SITE BACKGROUND

This section presents key aspects of the Site that supported both the design and interpretation of the stormwater sampling program, including the chemical production areas at the Site, where HFPO-DA is used and emitted to air, how HFPO-DA is transported into the Site drainage network, a 6 October 2017 scrubber upset incident, and Site water use and the drainage network.

[1] Note, rainfall HFPO-DA data are being reported to North Carolina Department of Environmental Quality (NCDEQ) in data submittals separate from this report and are not presented, described or discussed in this report.

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2.1 Site Areas

The Site is located about 15 miles south of Fayetteville, North Carolina (Figure 1). There are four chemical production areas on-Site. These areas are shown in Figure 2 and are listed below:

- Chemours Monomers IXM Area – often referred to by sub-areas Vinyl Ethers North [VEN] and Vinyl Ethers South [VES]);
- Chemours Polymer Processing Aid Area (PPA Area);
- Kuraray America Leased Area (Kuraray Area); and
- Dow-DuPont Leased Area (DuPont-Dow Area).

HFPO-DA is manufactured in the PPA Area and used in processes in the Monomers IXM and PPA Areas. Neither the Kuraray nor the Dow-DuPont areas manufacture, store or use HFPO-DA.

Presently, and historically, all wastewater and run-off water from the PPA Area is collected and sent off-Site for treatment and disposal. The PPA Area currently contributes emissions to air from building leaks (ERM, 2018) and from emissions stacks (Weston Solutions, 2018). These emissions are currently being addressed with the North Carolina Division of Air Quality (NCDAQ) and are not a subject of this report.

Presently all Monomers IXM Area waste is shipped off-Site for treatment and disposal. Prior to mid-2017 wastewater from the Monomers IXM Area was sent to the On-Site WWTP and subsequently discharged to Outfall 002. The Monomers IXM Area currently contributes HFPO-DA emissions to air from building leaks (ERM, 2018) and from emissions stacks (Weston Solutions, 2018).

2.2 HFPO-DA Use and Emissions to Air at Site

HFPO-DA is produced and used in the PPA and Monomers IXM Areas. Emissions stacks in both areas release HFPO-DA as air emissions. Some of this emitted HFPO-DA is deposited locally, with higher deposition loads expected closer to the emissions stacks. During rainfall events some of this deposited HFPO-DA will be mobilized in stormwater runoff and be directed into the Site drainage network. Chemours is taking action to substantially reduce HFPO-DA emissions to air with installation of emission reduction equipment planned for May 2018.

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2.3 6 October 2017 Scrubber Upset Incident

On 6 October 2017 a scrubber upset incident occurred at the VES emissions stack (Parsons, 2018a). The incident resulted in scrubber water containing HFPO-DA being emitted from the VES emissions stack and deposited locally to soils, buildings and equipment around the VES emissions stack via water droplets.

Rainfall then occurred at the Site on the following days:

- 1.84 inches rainfall; 7 October 2017
- 1.14 inches rainfall; 8 October 2017
- 0.08 inches rainfall; 9 October 2017

The Outfall 002 3-day composite sample collected on 9 October 2017 had the highest HFPO-DA concentration (3,700 ng/L) observed since 12 July 2017[2] (Figure 3). Following 6 October 2017 there have been no additional incidents. To date, Outfall 002 HFPO-DA concentrations still increase after rainfall and in one case following snow melt (22 January 2018). Notably, the HFPO-DA concentrations in Outfall 002 after rainfall events have been diminishing over time.

These observations suggest that increased Outfall 002 concentrations after rainfall are related to HFPO-DA released during the scrubber upset incident that is washed into the Site drainage network by on-Site rainfall. The stormwater sampling program and results that are described in the following sections further build upon and examine these observations.

2.4 Site Water Use, Water Balance and Drainage Network

The Site uses water from the river in chemical processes to cool equipment and as sanitary water. Between 15 and 25 million gallons of water per day (gpd) are collected from the river intake at the North East boundary of the Site and is then transferred to the Site. After being used on Site, the collected water is then treated and then released via the Site drainage network back to the river (note, all Chemours process water used in the PPA and Monomer IXM areas is sent off-Site for treatment and disposal). The Site drainage network consists of four primary drainage ditches that direct flow to Outfall 002. These ditches are depicted on Figure 4 and listed below:

[2] In late June 2017 the facility took initial corrective actions to stop process-based HFPO-DA releases to Outfall 002 (Chemours, 2017).

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- the Wood Lined Trench,
- the Monomers IXM Area Cooling Water Channel,
- the Wastewater Treatment Plant (WWTP) Discharge outlet (Outfall 001), and
- the Open Channel to Outfall 002

The first three drainage ditches listed above discharge into the Open Channel to Outfall 002, which in turn discharges into the river. Four types of discharged water enter the drainage network:

- excess river water,
- NCCW,
- treated wastewater, and
- stormwater runoff (from rainfall).

The two largest uses of intake river water are NCCW and unused excess river water--these two sources account for about ninety percent (90%) of intake river water. NCCW river water is used to regulate temperatures in equipment at the Kuraray and Monomers IXM Areas. NCCW, as the name implies, does not come into contact and is not used by the chemical production processes.

The remaining fraction of intake river water, about ten percent (10%)--not used as NCCW or released as excess river water--is processed into filtered and demineralized water. This water is used on-Site in chemical processes, as a higher grade (i.e. low sediment) NCCW and as a sanitary water source (i.e. sinks and toilets). After use, the filtered and demineralized water is sent to the WWTP for treatment before it is released to the Open Channel to Outfall 002. The process of producing the filtered and demineralized water also produces about 70,000 gpd of wastewater, equivalent to 0.4% of flow at Outfall 002; this wastewater is sent to the WWTP. All Chemours process wastewater from the PPA and Monomers IXM Areas where HFPO-DA is produced or used is sent off-Site for treatment and disposal. The volume of wastewater sent off-Site is approximately 55,000 gpd.

During rainfall events, stormwater runoff flows into the Site drainage network and contributes to the volume of water discharged at Outfall 002. The flow direction of Site ditches guiding stormwater flow runoff is depicted in Figure 5.

During the 24-hour period of 16 January 2018 corresponding to the dry event, 17.2 million gallons were released to Outfall 002. This is equivalent to 12,000 gallons per minute (gpm). There are gauges at the Site that provide indicative measurements of flow.

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Using data from these gauges, the approximate breakdown of where intake river water was used and discharged at Site for 16 January 2018 was as follows:

- 30% - Excess river water not used; released to Wood Lined Trench;
- 30% - Kuraray Area NCCW; released to Wood Lined Trench;
- 30% - Monomers IXM Area NCCW; released to Cooling Water Channel; and
- 10% - WWTP treated water; released to Open Channel to Outfall 002.

Excess river water and Kuraray Area NCCW both contribute flow to the Wood Lined Trench making it the with the largest flow, about 60% of the total flow. The next largest flow is from the Monomers IXM Area NCCW Cooling Water Channel with 30% of the flow. The smallest flow quantified here comes from the WWTP treated water discharge.

The location and magnitude of excess river water and NCCW contributions to the Site drainage network flow are depicted in Figure 6. Based on these data, water coming from the Wood Lined Trench contributes approximately 60% of the flow observed at Outfall 002 and the Monomers IXM Area NCCW contributes approximately 30% of flow, with the remaining approximate 10% coming from the WWTP.

During the 24-hour period of 29 January 2018 corresponding to the wet sampling event, 20.44 million gallons of water were released to Outfall 002. This is equivalent to 14,200 gpm, which is somewhat higher than the dry event. The relative contributions of water volume from river water intake and stormwater runoff could not be assessed using Site gauge data. However, the use of river water on-Site is expected to be similar to the dry event. Further, the relative distribution of water volume from stormwater is expected to be generally similar to the dry conditions since the Cooling Water Channel (~30% of flow) captures stormwater flow from a slightly smaller area than the Wood Lined Trench (~60% of flow) based on catchment areas plotted in Figure 7.

3 STORMWATER SAMPLING PROGRAM SCOPE AND METHODS

The stormwater sampling program workplan document (Chemours 2018) was developed by Geosyntec Consultants (Geosyntec) and submitted to NCDEQ by Chemours. The sampling program field effort was completed by Parsons of North Carolina Inc. (Parsons). The stormwater sampling plan incorporated data collection and sampling during dry- and wet conditions. This includes the following:

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- 11 surface water sampling locations in the Site drainage network;
- 5 groundwater sampling locations from the Long Term Wells (LTW) adjacent to the river;
- 1 rain water sampling location collected along the access road to the river water intake[3];
- 2 surface water sampling locations in Willis Creek (tributary);
- 2 surface water sampling locations in Georgia Branch Creek (tributary);
- 1 surface water sampling location in Former Outfall 002 Channel (tributary); and
- 3 tributary flow measurement locations; one location per tributary.

Site drainage network sample locations are shown on Figures 4, 5, and 6. The location of the nearby tributary and groundwater samples and tributary flow measurement locations are shown on Figure 8. The following subsections provide details of specific sampling activities.

3.1 Sampling Event Timing

The dry-weather sampling event occurred on 16 January 2018. The last recorded rainfall prior to the dry event was 0.22-inches of precipitation[4] four days prior on 12 January 2018.

The wet-weather sampling event occurred on Monday 29 January 2018. Rainfall began Sunday 28 January 2018 at 9:15 am and lasted until Monday 29 January 2018 at 6:00 pm with a total rainfall amount of 2.1-inches over the 32-hours of rainfall.

Figures 9 and 10 plot the amount of rain falling during the sampling period in 15-minute intervals along with the sample collection times during the wet and dry events and the flow gauging times during the wet event. The figures show no rainfall during the dry event and rainfall during the wet event with samples collected near the end of the 32-hour rainfall period.

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[3] Note, rainfall HFPO-DA data are being reported to North Carolina Department of Environmental Quality (NCDEQ) in data submittals separate from this report and are not presented, described or discussed in this report.

[4] Precipitation data used in this report are from the USGS W.O. Huske station at the W.O. Huske Dam (Figure 2) located between 0.5 and 1.25 miles from manufacturing areas at Site.

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3.2 Site Drainage Network Sampling

Site drainage network samples were collected from locations shown on Figures 4, 5 and 6. The stormwater catchment areas for each sample location are presented on Figure 7. Samples were collected by attaching a sample bottle to the end of an aluminum rod using a nylon zip tie and immersing the bottle into the flow of water to fill the bottle. Each sample location is described below:

- Location 1: Site drainage network surface water sample from the Open Channel just before entering the pipe to Outfall 002 at the river. This sample represents the combined flow of all sources released to Outfall 002. This includes stormwater runoff, treated wastewater, NCCW and excess river water.
- Location 2: Site drainage network surface water sample representing water flow from the eastern section of the Site as shown in light blue on Figure 7. This sample represents water from Monomers IXM Area NCCW and stormwater runoff from the entire light blue catchment area. This also includes water from the dark blue areas that drain into the light blue area on Figure 7.
- Location 3: Site drainage network surface water sample representing stormwater runoff only from the dark blue catchment area underneath the label for sample location 3 on Figure 7. The sample was collected from the inlet to the south end culvert at the east side of roadway ditch just north of Avenue B, capturing surface stormwater flow from the eastern green-field area.
- Location 4: Site drainage network surface water sample representing stormwater runoff and all Monomers IXM Area NCCW from the dark blue catchment area underneath the label for sample location 4 on Figure 7. The sample was collected from the Cooling Water Channel inlet culvert located before the Cooling Water Channel becomes buried and leads to the Open Channel to Outfall 002.
- Location 5: Site drainage network surface water sample representing stormwater runoff only from the medium green catchment area underneath the label for sample location 5 on Figure 7. The sample was collected from the Wood Lined Trench. The catchment area for location 5 also includes the dark green catchment area, which drains into the medium green catchment area.
- Location 6: Site drainage network surface water sample representing stormwater runoff only from the medium green catchment area underneath the label for sample location 6 on Figure 7. The sample was collected from the inlet east end

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culvert entering the Wood Lined Trench from the roadway ditch south of Fourth Street, prior to where the water mixes with the Wood Lined Trench flow.

- Location 7: Site drainage network surface water sample representing stormwater runoff, NCCW and excess river water from the western portion of the Site represented by the light green catchment area underneath the label for sample location 7 on Figure 7. The sample was collected from the Wood Lined Trench. The stormwater catchment area for location 7 also includes the medium and dark green catchment areas that drain into the Wood Lined Trench.
- Locations 8 and 9: Surface water sample from Outfall 001 WWTP discharge to main collection trench and Open Channel to Outfall 002. This sample represents treated water being released from the WWTP. During the dry event both samples were collected on 16 January 2018. During the dry event the sample for Location 8 was collected on 29 January 2018 and Location 9 was collected at the same physical location but 24 hours later on 30 January 2018. A period of 24 hours represents the average hydraulic residence time of river water used as sanitary, filtered or demineralized water to reach, be treated by and then discharged by the WWTP.
- Location A: Site drainage network surface water sample taken from the Open Channel about 1,500 feet before the Outfall 002 pipe to the river. This sample represents the combined flow from all of the Site except the stormwater overflow pond area south of the Open Channel. Water captured by this sample includes stormwater runoff, treated wastewater, NCCW and excess river water.
- Location B: Site drainage network surface water sample representing stormwater runoff only from the dark green catchment area underneath the label for sample location B on Figure 7. The sample was collected from the north-facing headwall immediately upstream of the beginning of the southward-flowing Wood Lined Trench. This location captures stormwater runoff from the PPA Area, a part of the Kuraray Area and some wooded area.

3.3 Groundwater Sampling (LTW Wells)

The LTW groundwater wells sampled are shown on Figure 8. The wells were sampled using low-flow sampling methods consistent with Site practices. Field parameter data collected during sampling are presented in Appendix B.

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3.4 Nearby Tributary Surface Water Sampling

Off-Site tributary surface water samples were collected by attaching a sample bottle to the end of an aluminum rod using a nylon zip tie and immersing the bottle into the flow at the middle of each tributary sampling location to fill the bottle with surface water. Samples were collected at locations depicted on Figure 8 and listed below:

- SW-WC-04 in Willis Creek;
- SW-WC-05 in Willis Creek;
- SW-GB-03 in Georgia Branch Creek;
- SW-GB-04 in Georgia Branch Creek along with duplicate sample; and
- SW-002OLD-01, near the discharge point of the Former Outfall 002 channel mouth to the river.

3.5 Tributary Flow Gauging

Tributary volumetric water flows were estimated for each tributary by calculating the volume of water flowing through the stream based on: a) point velocity measurements made using a Marsh McBirney Flow Mate Model 2000 portable flow meter; and b) the cross-sectional area of the stream measured using a survey tape. Flow volume measurements were taken at locations SW-WC-05, SW-GB-04, and SW-002OLD-01 depicted on Figure 8.

3.5.1 Volumetric Discharge Calculations

Each tributary's discharge was calculated using the Mean Section Method (Rantz, 1982). In this method, the tributary cross section is divided into cells by the number of measurement points. Discharge values were calculated for each cell and summed to obtain the total stream discharge. The discharge, Q (cubic feet per second; ft^3/s), is calculated from the calculated area between two vertical measurement points, A_i (square feet; ft^2), and the average stream velocity, $\bar{v}$ (feet per second; ft/s), of the two measurement points as shown below:

$$Q = \sum A_i \bar{v} \qquad \textbf{Equation 1}$$

$$Q = \sum A_i \left(\frac{v_i + v_{i+1}}{2}\right) \qquad \textbf{Equation 2}$$

The calculations assume a trapezoidal shape area for each cell. The only exception to this are the edge cells in Willis Creek since the culvert cross section shape is circular. In this

instance, the edge cells were assumed to have a triangular area. Using the depth measurements of the water surface and the tributary bottom at each measurement point, the water column depth, d_i (feet; ft), is calculated. The discharge is then calculated using the water column depths and the width of the cell, Δx (ft):

$$Q = \sum \frac{\Delta x(d_i + d_{i+1})}{2}\left(\frac{v_i + v_{i+1}}{2}\right) \qquad \textbf{Equation 3}$$

Appendix A provides the detailed tables outlining these calculations, a conceptual schematic of how flow was gauged, and photographs of the three flow gauging locations.

3.6 General Field Procedures

All equipment was inspected by Parson's Site Supervisor and calibrated daily prior to use in the field according to the manufacturer's recommended guidelines. Calibration information was recorded in a field logbook. All sampling was conducted in accordance with the requirements listed in the Perfluorinated Compounds (PFCs) Sampling Checklist provided in the Stormwater Sampling Plan (Chemours, 2018).

All sampling equipment was decontaminated between sample locations in the following manner:

- Tap water rinse;
- Scrub with tap water containing non-phosphate detergent (i.e. Alconox®);
- Tap water rinse;
- De-ionized water rinse; and
- Air dry.

After decontamination, field equipment was used at the next sampling location. Disposable equipment (e.g. gloves, tubing, etc.) were not reused. New sample containers were used for collecting each sample.

3.7 Analytical Methods

All samples were analyzed for HFPO-DA by TestAmerica of Denver, Colorado (TestAmerica), a North Carolina-certified laboratory using an approved United States Environmental Protection Agency (USEPA) method. All collected surface water, groundwater and rainfall samples were analyzed for HFPO-DA by EPA method 8321A.

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3.8 Quality Control Samples

The following quality control (QC) samples were collected during each stormwater sampling program event:

- One equipment blank for groundwater sampling equipment and methods;
- One equipment blank for Site drainage network and surface water sampling equipment and methods;
- One nearby tributary surface water sample field duplicate; and
- Two matrix spikes (MS).

TestAmerica provided all analytical data to Chemours' data validation contractor, AECOM's in-house Analytical Data Quality Management (ADQM) group. Laboratory analytical reports are included in Appendix C. The data package contained raw data that was reviewed by ADQM for compliance with the laboratory standard operating procedures (SOPs) and usability. TestAmerica also delivered the analytical data electronically for upload to the Chemours Locus EIM™ database.

All data were reviewed using the Data Verification Module (DVM). The DVM is an internal review process used to assist with the determination of data usability. The electronic data deliverables received from TestAmerica were loaded into the Locus EIM™ database and processed through a series of data quality checks, which are a combination of software (the DVM) and manual reviewer evaluations. The data are evaluated against the following data usability checks:

- Field and laboratory blank contamination
- USEPA hold time criteria
- Missing QC samples
- MS/MSD recoveries and the relative percent differences (RPDs) between these spikes
- Laboratory control sample(LCS)/control sample duplicate (LCSD) recoveries and the RPD between these spikes
- Surrogate spike recoveries for organic analyses
- RPD between field duplicate sample pairs

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The DVM applies the following data evaluation qualifiers to analysis results, as warranted:

- R - Unusable result. Analyte may or may not be present in the sample.
- B – Not detected substantially above the level reported in the laboratory or field blanks.
- J – Analyte present. Reported value may not be accurate or precise.
- UJ – Not detected. Reporting limit may not be accurate or precise.

The individual DVM narrative report for each lot entered into the EIM database summarized which samples were qualified (if any), the specific reasons for the qualification, and the potential bias in reported results. In addition, laboratory results greater than the method detection limit (MDL) but less than the reporting limit (RL) were qualified "J" and should be considered estimated values.

The DVM review process described above was performed on 100% of the data generated for the sampling events. The DVM review process was supplemented by a manual review of the instrument-related QC results for calibration standards, blanks, and recoveries to evaluate the overall review process to be consistent with Stage 2b of the USEPA Guidance for Labelling Externally Validated Laboratory Analytical Data for Superfund Use (EPA-540-R-08-005 2009).

4 RESULTS AND OBSERVATIONS

HFPO-DA concentration data from the dry and wet sampling events are presented in Tables 1 and 2, respectively. The results are described below.

4.1 Data Validation

The data collected during the dry and wet sampling events were considered usable. The laboratory reports and data verification are documented in Appendix C. Two samples had qualifiers applied:

- Ditch Location 7 during the dry event (FAY-DRY01-SW-DCH-07) had a B qualifier applied to the result, 40 B ng/L. An equipment blank had a detection that was at least 20% of the analyzed value, suggesting a potential high bias.
- Willis Creek location (FAY-WET01-SW-WC-05-012918) had a J qualifier applied to the result, 506 J ng/L. The surrogate standard recovery was below criterion, suggesting a potential low bias.

ED_002011_00000012-00019

4.2 Site Drainage Network Sample Results

Dry-weather Site drainage network surface water HFPO-DA sample concentrations are provided in Table 1 and posted on Figure 11, which shows the drainage network. The highest HFPO-DA sample concentration in this event was 220 ng/L at Location 8, the WWTP. The lowest sample concentration was 40 ng/L at Location 7, the downstream sampling point along the Wood Lined Trench. Three sample locations, B, 3 and 6 (Figure 6), were dry during the dry event. These locations were upstream of NCCW or excess river water sources. Overall, sample concentrations were relatively similar across the drainage network for the dry event. The median concentration was 110 ng/L. No spatial concentration or mass flux trend was apparent in the data, suggesting no location dominated HFPO-DA mass flux to Outfall 002 during this sampling event.

Wet-weather Site drainage network surface water HFPO-DA sample concentrations are provided in Table 2 and posted on Figure 11. The highest HFPO-DA sample concentration was 4,300 ng/L at Location 3, representing stormwater run-off from the green-field to the south of the Monomers IXM Area (Figures 6 and 11). The lowest sample concentration was 140 ng/L at Location 7 at the end of the Wood Lined Trench. The median concentration was 2,050 ng/L.

Below are notable observations from the dry and wet event sampling data:

- The wet event water samples that are primarily stormwater runoff (e.g. samples B, 5, 6, and 3 that were up-channel of NCCW and excess river water sources) have elevated HFPO-DA concentrations likely related to aerial deposition.
- NCCW and excess river water entering the Wood Lined Trench from the Kuraray Area reduce HFPO-DA concentrations. Location 7 (140 ng/L) was a combination of stormwater flow, NCCW and excess river water. Samples that were primarily stormwater (Locations B, 5 and 6) upstream of Location 7 ranged from 1,200 to 3,300 ng/L, while the NCCW and excess river water HFPO-DA concentrations are much lower, typically between 20 and 50 ng/L based on samples collected near the river intake. Therefore, the concentration of 140 ng/L observed at Location 7 suggests that the higher stormwater concentrations up-gradient in the ditch (1,200 to 3,300 ng/L) were diluted by the much larger volumes of NCCW and excess river water which had much lower HFPO-DA concentrations.
- The dry and wet event concentrations at Location 7, the end of the Wood Lined Trench were relatively similar, 40 and 140 ng/L. This suggests that stormwater runoff into the Wood Lined Trench does not greatly affect HFPO-DA concentrations.

ED_002011_00000012-00020

- WWTP concentrations (Locations 8 and 9) show minimal concentration differences between dry and wet events (220 and 150 ng/L vs. 210 and 280 ng/L). The WWTP discharge does not contain stormwater runoff. Treated water coming from the WWTP is originally from filtered and demineralized river water.
- The highest wet event concentration (4,300 ng/L) was at Location 3 which is often down-wind of the Monomer IXM Area emission stacks and on 6 October 2017 was downwind of the VES stack where the scrubber upset incident occurred (wind was blowing north to south). These observations suggest aerial deposition of HFPO-DA from the emissions stacks and the scrubber upset incident contributed to concentrations observed at Location 3.
- HFPO-DA mass flux in the Monomers IXM Area increased during the wet event. The sample at Location 4, with a concentration of 3,600 ng/L, was taken in the Cooling Water Channel which contains stormwater runoff and NCCW with a combined flow rate of around 4,000 gpm. The dry event Cooling Water Channel sample had a concentration of 110 ng/L. The increase from 110 to 3,600 ng/L suggests Monomers IXM Area stormwater runoff increased the Cooling Water Channel HFPO-DA concentrations, and that Monomers IXM Area stormwater runoff has much higher concentrations than Wood Lined Trench captured runoff.
- HFPO-DA mass flux from the Monomers IXM Area during rainfall events contributes most of the HFPO-DA mass observed at Outfall 002. The Outfall 002 concentration was measured as 750 ng/L during the wet event. Initially the Wood Lined Trench at 140 ng/L, the WWTP at 210 ng/L empty into the Open Channel. Then the Monomers IXM Area Cooling Water Channel joins the Open Channel with a concentration of 2,900 ng/L. The increase in concentration from around 140 to 210 ng/L in the Open Channel to 750 ng/L after the Cooling Water Channel joined the flow suggests stormwater runoff from the Monomers IXM Area via the Cooling Water Channel supplied the majority of the HFPO-DA observed at Location 1.
- The HFPO-DA concentration at Location A (220 ng/L) is inconsistent with the concentration observed at Location 1 (750 ng/L). Location A is immediately up-channel of Location 1 and no process or stormwater ditch flows join a channel between Locations 1 and A that would substantially increase or dilute the concentrations. The discrepancy between these results suggests some variability in water quality during the wet event, which is to be expected based on variability in rainfall and transport times within the drainage network.

ED_002011_00000012-00021

4.3 Groundwater Sampling Results

The dry and wet-weather LTW Well groundwater HFPO-DA concentration data are provided in Tables 1 and 2, respectively, and field parameter data measured during sampling are provided in Appendix B. Except for LTW-02 during the dry event groundwater sample concentrations were consistent with prior monitoring events in 2017 (Parsons, 2017 and 2018b) and showed no substantial change between the dry and wet events.

The sample concentration from LTW-02 during the dry event was 650 ng/L, while the wet event concentration 13 days later was 6,600 ng/L. For context the Additional Investigation event concentration of LTW-02 was 6,800 ng/L on 16 November 2017 and the Supplemental Groundwater Sampling event concentration was 9,700 ng/L. These data suggest that the LTW-02 dry event result was not representative of typical conditions at that location.

4.4 Nearby Tributary Sampling and Flow Measurements

The dry and wet-weather nearby tributary surface water HFPO-DA sample concentrations are provided in Tables 1 and 2, respectively. The dry event Former Outfall 002 sample had the highest HFPO-DA concentration at 8,400 ng/L. HFPO-DA concentrations from Georgia Branch Creek samples were between 980 and 1,100 ng/L and from Willis Creek samples were between 83 and 310 ng/L. The wet event Former Outfall 002 sample concentrations declined to 5,700 ng/L while Georgia Branch Creek and Willis Creek sample concentrations both increased, with 1,110 to 2,700 ng/L for Georgia Branch Creek and 97 to 560 ng/L for Willis Creek.

The flow measurement data for the three nearby tributaries at measurement locations shown on Figure 8 are were as follows:

- Willis Creek dry event: 2,650 gpm; wet event: 12,980 gpm;
- Georgia Branch Creek dry event: 140 gpm; wet event: 850 gpm; and
- Former Outfall 002 dry event Event: 425 gpm; wet event: 865 gpm.

The detailed calculations supporting these values are provided in Appendix A. Notable observations from the nearby tributary concentration and flow data are provided below:

- Willis Creek and Georgia Branch Creek have larger flow volume increases during the wet event, approximately 5-fold increases, compared to the Former Outfall 002, which had a 2-fold increase. Field observations indicated the Former Outfall 002 channel was in a wooded area with sandy soils, likely leading to faster

infiltration of rainfall and proportionally less runoff being generated as compared to the other tributaries.

- The Former Outfall 002 sample concentrations decreased by a factor of two in the wet event, which is inversely proportionate to the increased flow volume and maintains the same mass flux. This suggests that the increased rainfall-related flow had much lower HFPO-DA concentrations than the dry-weather surface water.
- Willis Creek and Georgia Branch Creek sample concentrations increased, suggesting infiltration of surface water brought HFPO-DA into the creeks. Similar to the on-Site areas, this surface water runoff may have carried aerially deposited HFPO-DA into these creeks, contributing to both the higher flow volumes and HFPO-DA concentrations.

5 CONCLUSIONS

Outfall 002 HFPO-DA concentrations increase during and immediately after rainfall events. These concentration increases are primarily the result of continued flushing of HFPO-DA released in the Monomers IXM Area during the 6 October 2017 scrubber upset incident. Stormwater runoff from other areas of the Site (e.g. Kuraray and PPA) show elevated concentrations of HFPO-DA, but these are diluted in the Site drainage network with the addition of NCCW and excess river water.

Groundwater wells show no substantial HFPO-DA concentration changes between dry and wet events. Flow and concentrations increased in nearby creeks during the wet event suggesting stormwater runoff increased HFPO-DA concentrations; meanwhile the mass flux from the Former Outfall 002 stayed relatively constant suggesting the base flow from groundwater contributes the majority of the observed HFPO-DA concentrations.

Since investigating and determining that the cause of elevated Outfall 002 HFPO-DA concentrations during rainfall since 9 October 2017 are related to the 6 October 2017 scrubber upset incident, Chemours has taken action. Actions completed to date include excavating shallow soils adjacent the Cooling Water Channel that were impacted by the scrubber upset incident, removing spent carbonate roll-off bins, and excavating shallow soils underneath the removed roll-off bins. Water in the roll-off bins had elevated levels of HFPO-DA. Actions in progress include power washing equipment and structures around the scrubber upset incident area. The full scope of these investigations and actions will be reported to NCDEQ in a separate document. Additionally, Chemours is taking action to reduce HFPO-DA emissions to air. Chemours is planning to install emissions reduction equipment in the PPA and Monomers IXM Areas in May 2018.

ED_002011_00000012-00023

6 REFERENCES

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ED_002011_00000012-00024

Tables

TABLE 1
HFPO-DA RESULTS DURING DRY-WEATHER SAMPLING EVENT
Chemours Fayetteville Works, North Carolina

Sample Name	Sample Type	Sample Date and Time	Result (ng/L)
FAY-DRY01-LTW-01	LTW	1/16/2018 4:18 PM	22,000
FAY-DRY01-LTW-02	LTW	1/16/2018 3:28 PM	650
FAY-DRY01-LTW-03	LTW	1/16/2018 2:40 PM	7,400
FAY-DRY01-LTW-04	LTW	1/16/2018 10:10 AM	18,000
FAY-DRY01-LTW-05	LTW	1/16/2018 11:15 AM	37,000
FAY-DRY01-EB-011618	QA/QC - LTW	1/16/2018 4:45 PM	12
FAY-DRY01-SW-DCH-01	Drainage Network	1/16/2018 4:12 PM	75
FAY-DRY01-SW-DCH-02	Drainage Network	1/16/2018 3:40 PM	150
FAY-DRY01-SW-DCH-04	Drainage Network	1/16/2018 4:30 PM	110
FAY-DRY01-SW-DCH-05	Drainage Network	1/16/2018 11:43 AM	110
FAY-DRY01-SW-DCH-07	Drainage Network	1/16/2018 2:15 PM	40 B
FAY-DRY01-SW-DCH-08	Drainage Network	1/16/2018 3:10 PM	220
FAY-DRY01-SW-DCH-09	Drainage Network	1/16/2018 3:20 PM	150
FAY-DRY01-SW-DCH-A	Drainage Network	1/16/2018 4:03 PM	62
FAY-DRY01-EQ-A	QA/QC D. Network	1/16/2018 5:00 PM	<10
FAY-DRY01-SW-002OLD-01	Former Outfall 002	1/16/2018 9:38 AM	8,400
FAY-DRY01-SW-GB-03	Georgia Branch Creek	1/16/2018 10:05 AM	1,100
FAY-DRY01-SW-GB-04	Georgia Branch Creek	1/16/2018 8:48 AM	1,100
FAY-DRY01-SW-GB-04-D	Georgia Branch Creek	1/16/2018 8:48 AM	980
FAY-DRY01-SW-WC-04	Willis Creek	1/16/2018 10:30 AM	83
FAY-DRY01-SW-WC-05	Willis Creek	1/16/2018 10:55 AM	310

Notes:
B - analyte detected in equipment blank at concentration 20% or more than sample result.
D. Network - Drainage Network
HFPO-DA - hexafluoropropylene oxide dimer acid, or Dimer Acid
LTW - Long Term Wells
ng/L - nanogram per liter
QA/QC - quality assuarance/quality control

TABLE 2
HFPO-DA RESULTS DURING WET-WEATHER SAMPLING EVENT
Chemours Fayetteville Works, North Carolina

Sample Name	Sample Type	Sample Date and Time	Result (ng/L)
FAY-WET01-EB-012918	QA/QC	1/29/2018 4:00 PM	<10
FAY-WET01-LTW-01-012918	LTW	1/29/2018 8:24 AM	25,000
FAY-WET01-LTW-02-012918	LTW	1/29/2018 9:09 AM	6,600
FAY-WET01-LTW-03-012918	LTW	1/29/2018 3:29 PM	9,900
FAY-WET01-LTW-04-012918	LTW	1/29/2018 11:20 AM	16,000
FAY-WET01-LTW-05-012918	LTW	1/29/2018 10:42 AM	41,000
FAY-D-EB-012918-1	QA/QC - LTW	1/29/2018 4:00 PM	15
FAY-WET01-SW-DCH-01	Drainage Network	1/29/2018 3:10 PM	750
FAY-WET01-SW-DCH-02	Drainage Network	1/29/2018 11:20 AM	2,900
FAY-WET01-SW-DCH-03	Drainage Network	1/29/2018 8:52 AM	4,300
FAY-WET01-SW-DCH-04	Drainage Network	1/29/2018 9:40 AM	3,600
FAY-WET01-SW-DCH-05	Drainage Network	1/29/2018 11:32 AM	2,900
FAY-WET01-SW-DCH-06	Drainage Network	1/29/2018 8:37 AM	1,200
FAY-WET01-SW-DCH-07	Drainage Network	1/29/2018 1:55 PM	140
FAY-WET01-SW-DCH-08	Drainage Network	1/29/2018 4:12 PM	210
FAY-WET01-SW-DCH-09	Drainage Network	1/30/2018 2:00 PM	280
FAY-WET01-SW-DCH-A	Drainage Network	1/29/2018 2:35 PM	220
FAY-WET01-SW-DCH-B	Drainage Network	1/29/2018 8:23 AM	3,300
FAY-WET01-EB-012918	QA/QC - D. Network	1/29/2018 4:00 PM	<10
FAY-WET01-SW-002OLD-01-012918	Former Outfall 002	1/29/2018 10:20 AM	5,700
FAY-WET01-SW-GB-03-012918	Georgia Branch	1/29/2018 11:05 AM	2,000
FAY-WET01-SW-GB-04-012918	Georgia Branch	1/29/2018 10:36 AM	1,100
FAY-WET01-SW-GB-04-D-012918	Georgia Branch	1/29/2018 10:36 AM	1,100
FAY-WET01-SW-WC-04-012918	Willis Creek	1/29/2018 9:40 AM	97
FAY-WET01-SW-WC-05-012918	Willis Creek	1/29/2018 9:05 AM	560 J

Notes:

D. Network - Drainage Network

HFPO-DA - hexafluoropropylene oxide dimer acid, or Dimer Acid

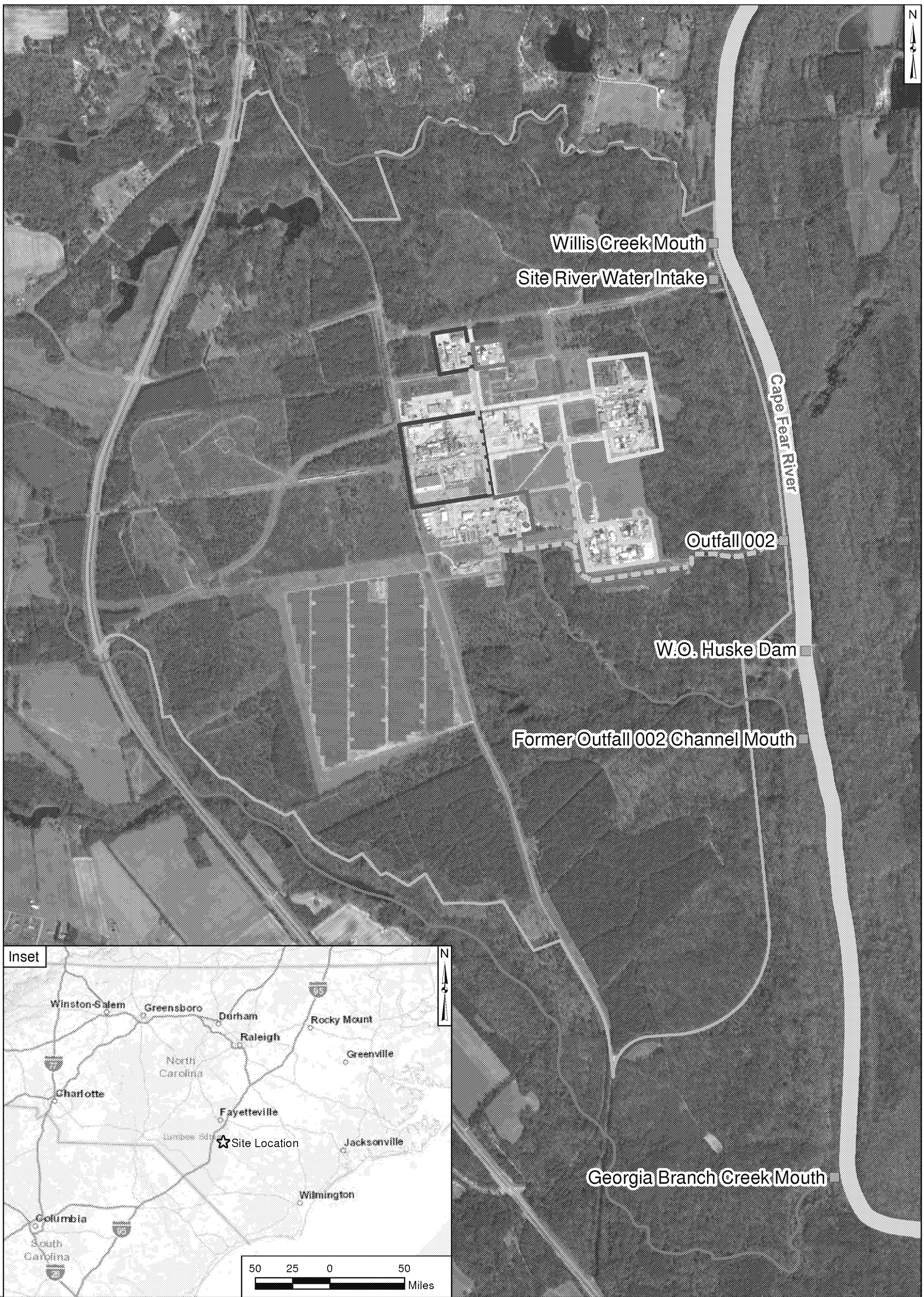
J - sample result estimated

LTW - Long Term Wells

ng/L - nanogram per liter

QAQC - quality assuarance/quality control

Figures



Legend

- Site Features
- Cape Fear River
- Nearby Tributaries
- Drainage Network
- Site Boundary

Areas at Site

- Chemours Monomers IXM Area
- Chemours PPA Area
- Dupont / Dow Leased Area
- Kuraray America Leased Areas
- Wastewater Treatment Plant

1,400 700 0 1,400 Feet

Site Location

Chemours Fayetteville Works, North Carolina

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Figure 1

Notes: Basemap Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community, Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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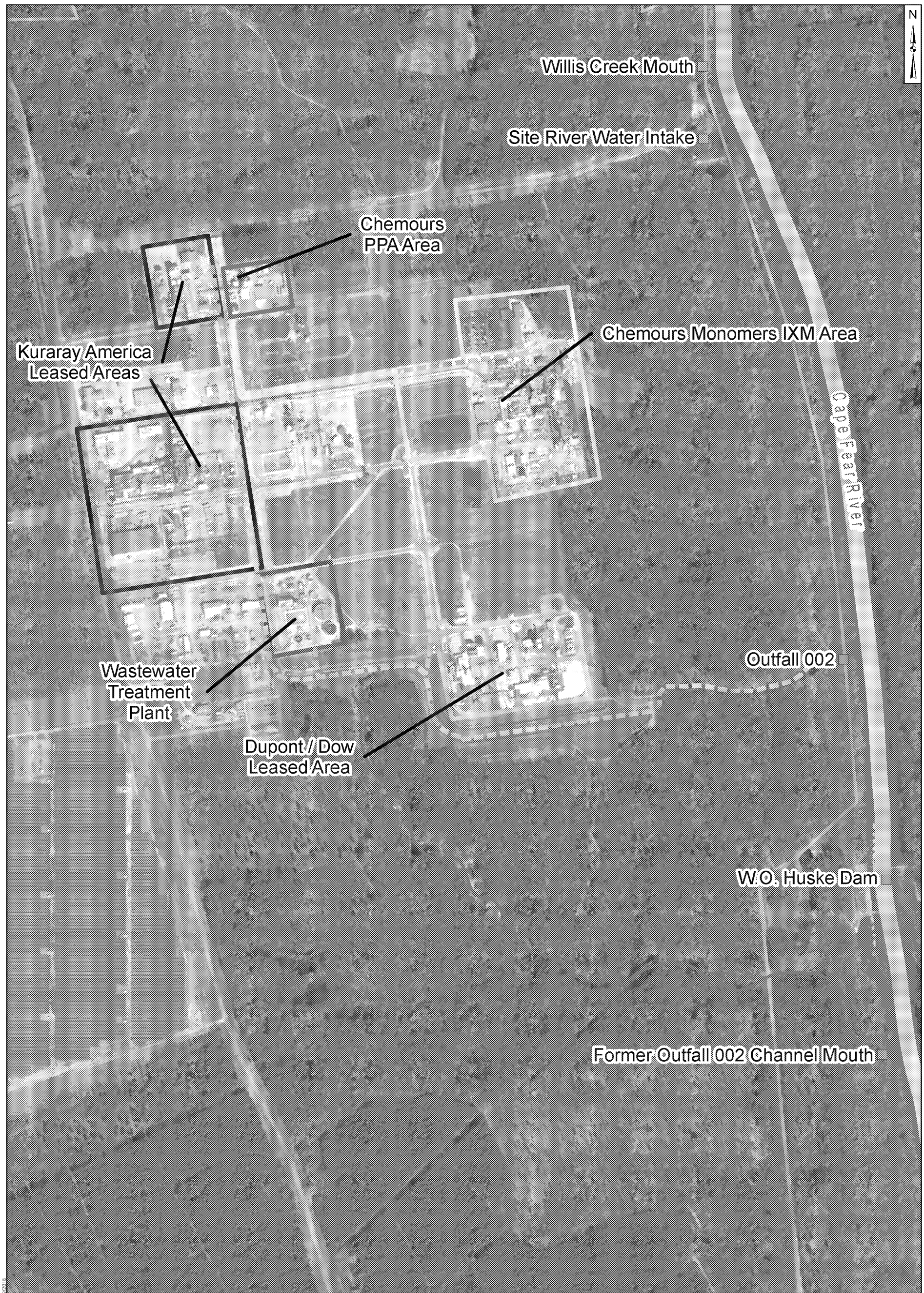

Legend

- Site Features
- Cape Fear River
- Nearby Tributaries
- Drainage Network
- Site Boundary

Areas at Site

- Chemours Monomers IXM Area
- Chemours PPA Area
- Dupont / Dow Leased Area
- Kuraray America Leased Areas
- Wastewater Treatment Plant

Notes:
Basemap Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

750 375 0 750 Feet

Site Features

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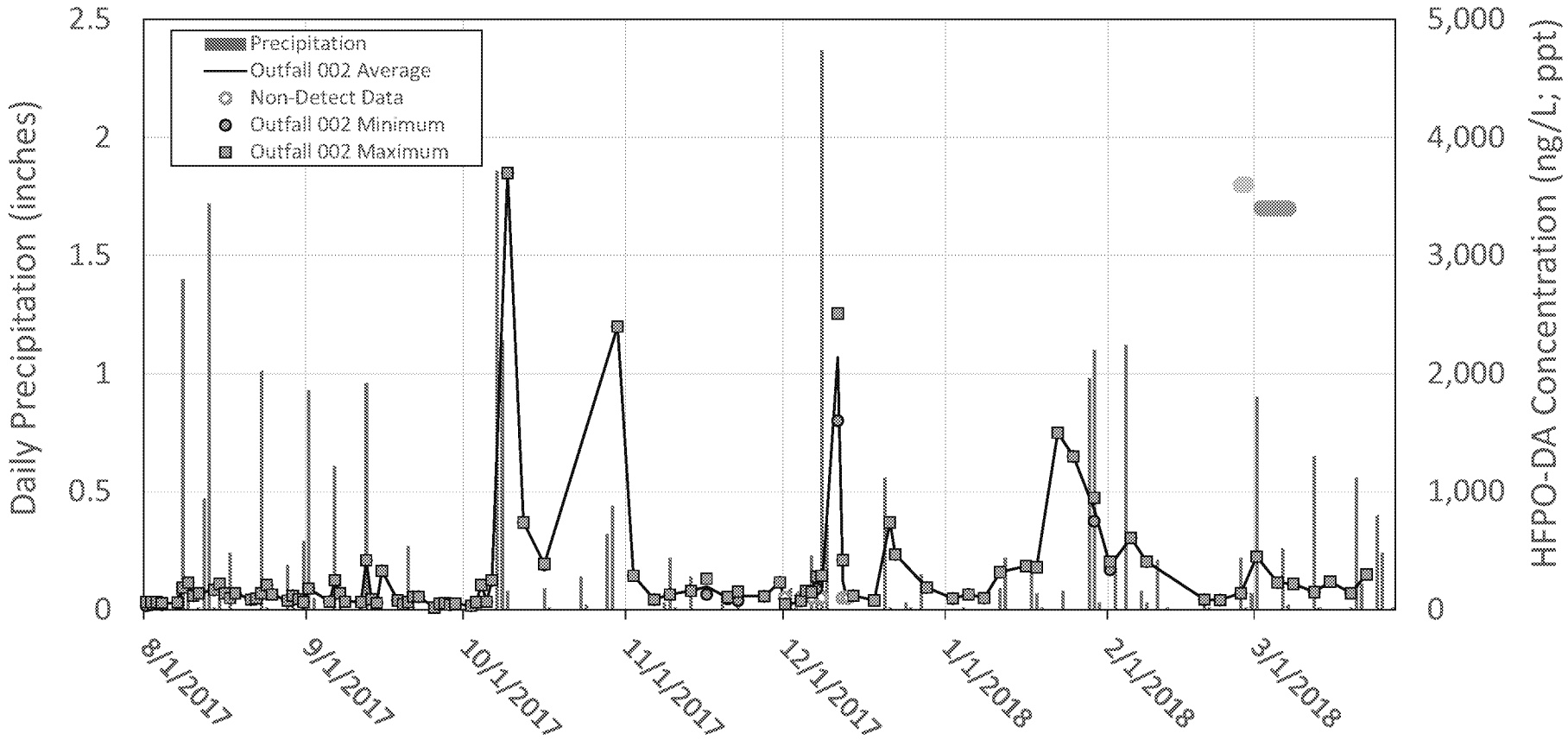
Figure 2



Notes:
- Outfall 002 samples are a combination of 1-day and 3-day composite and grab samples.
- Outfall 002 sample results are from analyses at the on-Site laboratory and Test America.
- Precipitation data plotted is the 24-hour rainfall amount for each day.
- Precipitation data obtained from USGS rain gauge at W.O. Huske Dam.

Acronyms:
- HFPO-DA: Hexafluoropropylene oxide dimer acid; or dimer acid
- ng / L: nanograms per litre
- ppt: parts per trillion
- USGS: United States Geological Survey

- Spent Carbonate Roll-Off Bins Removed
- Soils Excavated Near Cooling Water Channel

Precipitation Data and Outfall 002 HFPO-DA Concentrations
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Figure 3

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Legend

Ditch Types

- Wood Lined Trench
- Waste Water Treatment Plant Discharge
- Cooling Water Channel†
- Open Channel to Outfall 002

●—1 Sample location and sample name

Notes:
†Cooling Water Channel is open until Sample Location 4, then runs to Open Channel as a buried pipe.

N

500 250 0 500 Feet

Primary Ditches in Site Drainage Network
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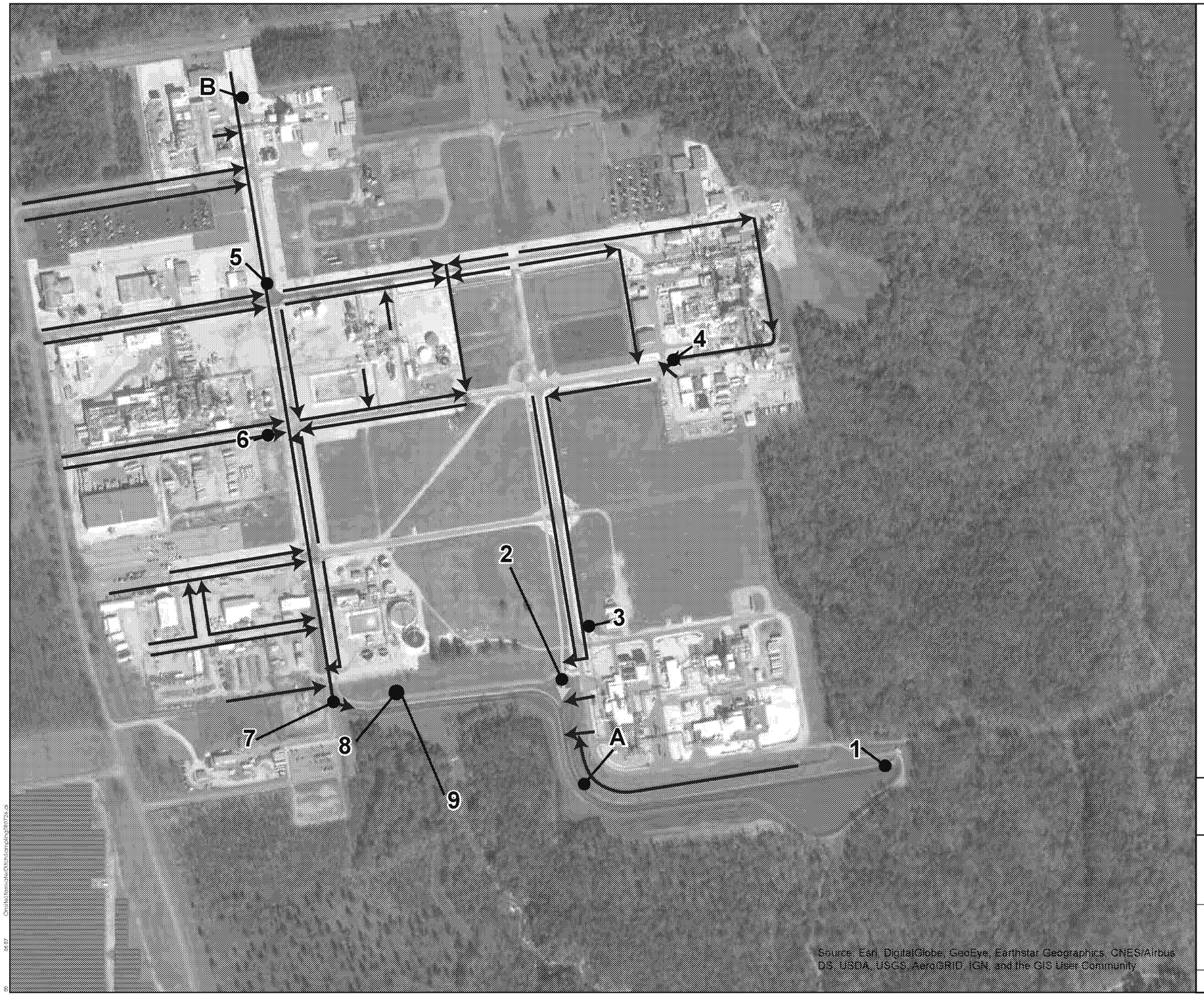
Figure 4



Legend

Overall Stormwater Flow

Surface trench / culvert

Buried pipe

1 Sample location and sample name

N

500 250 0 500 Feet

Stormwater Ditch Flow Directions

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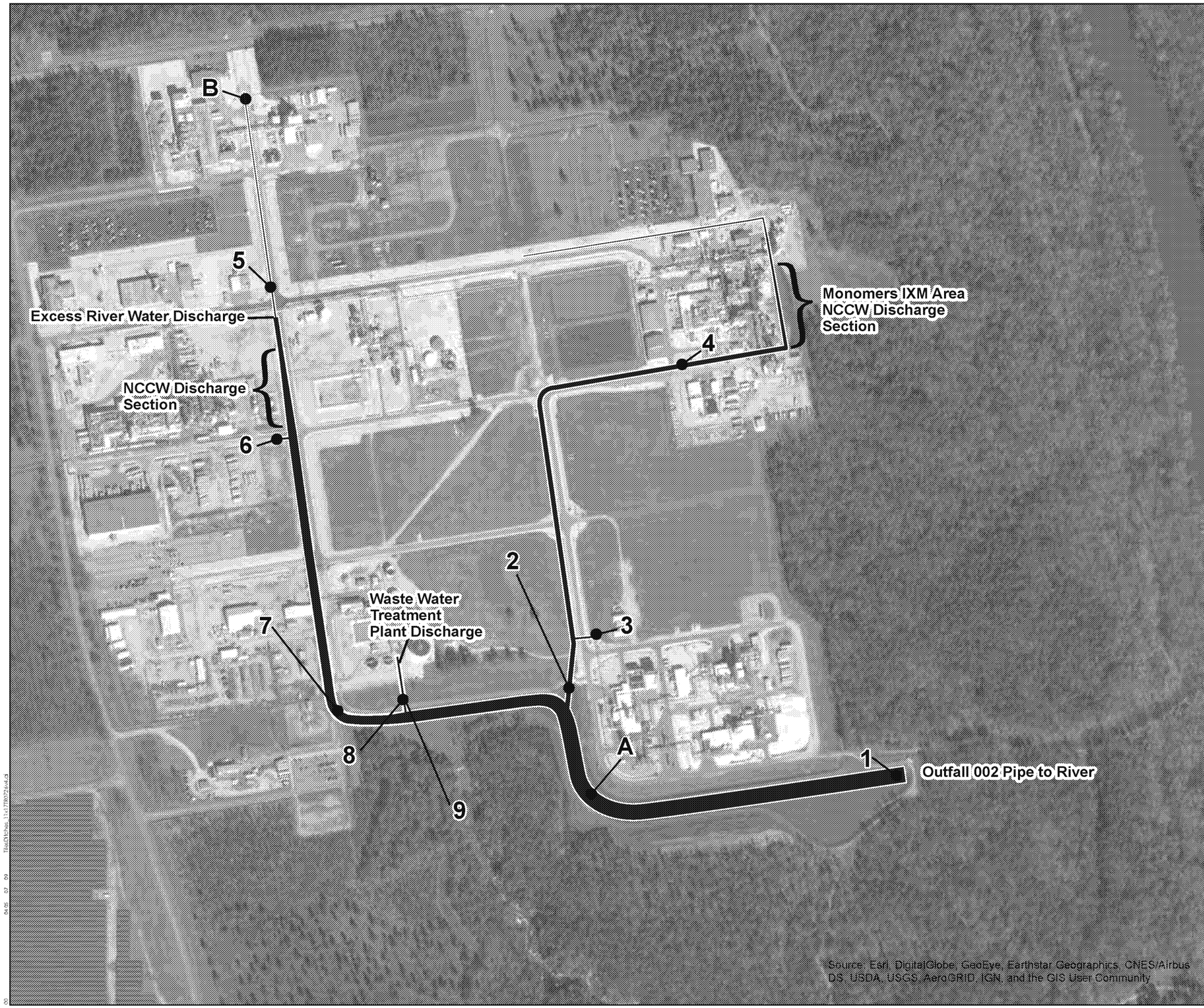
Figure 5



Legend

Relative Flow Volume

Minimal or Dry — 100%

1 Sample location and sample name

NCCW - non-contact cooling water.

Note: The blue lines represent the approximate relative volume of water in the Site drainage network during regular Site operations under dry weather conditions. On 16 January 2018 during the stormwater sampling dry event, i.e. no rainfall, the recorded flow at Outfall 002 was 17.2 mega gallons, or an average of 12,000 gallons per minute.

N

500 250 0 500 Feet

Relative Flow Volumes Along Primary Ditches During Dry-Weather

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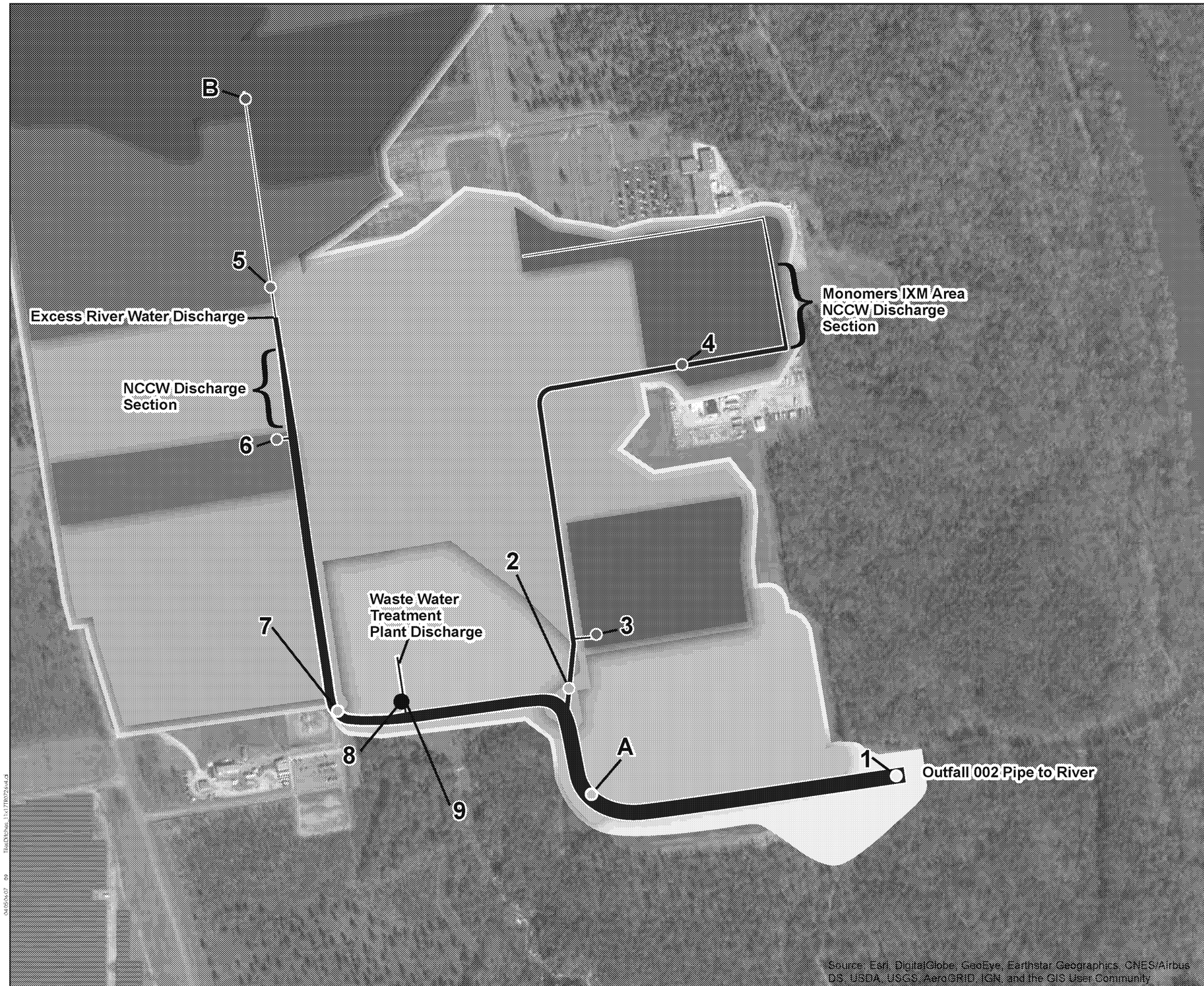
Figure 6



Legend

Relative Flow Volume

Minimal or Dry — 100%

1 Sample location and sample name

NCCW - non-contact cooling water.

Notes:
The colored tiles represent stormwater capture areas for the sample points. Each sample point label is placed over the tile it represents. Locations 8 and 9, which were collecting waste water treatment plant samples, do not have a corresponding tile.

Site features obscured by tiles, including chemical manufacturing areas, are depicted in Figure 2.

N

500 250 0 500 Feet

Sample Location Stormwater Capture Areas
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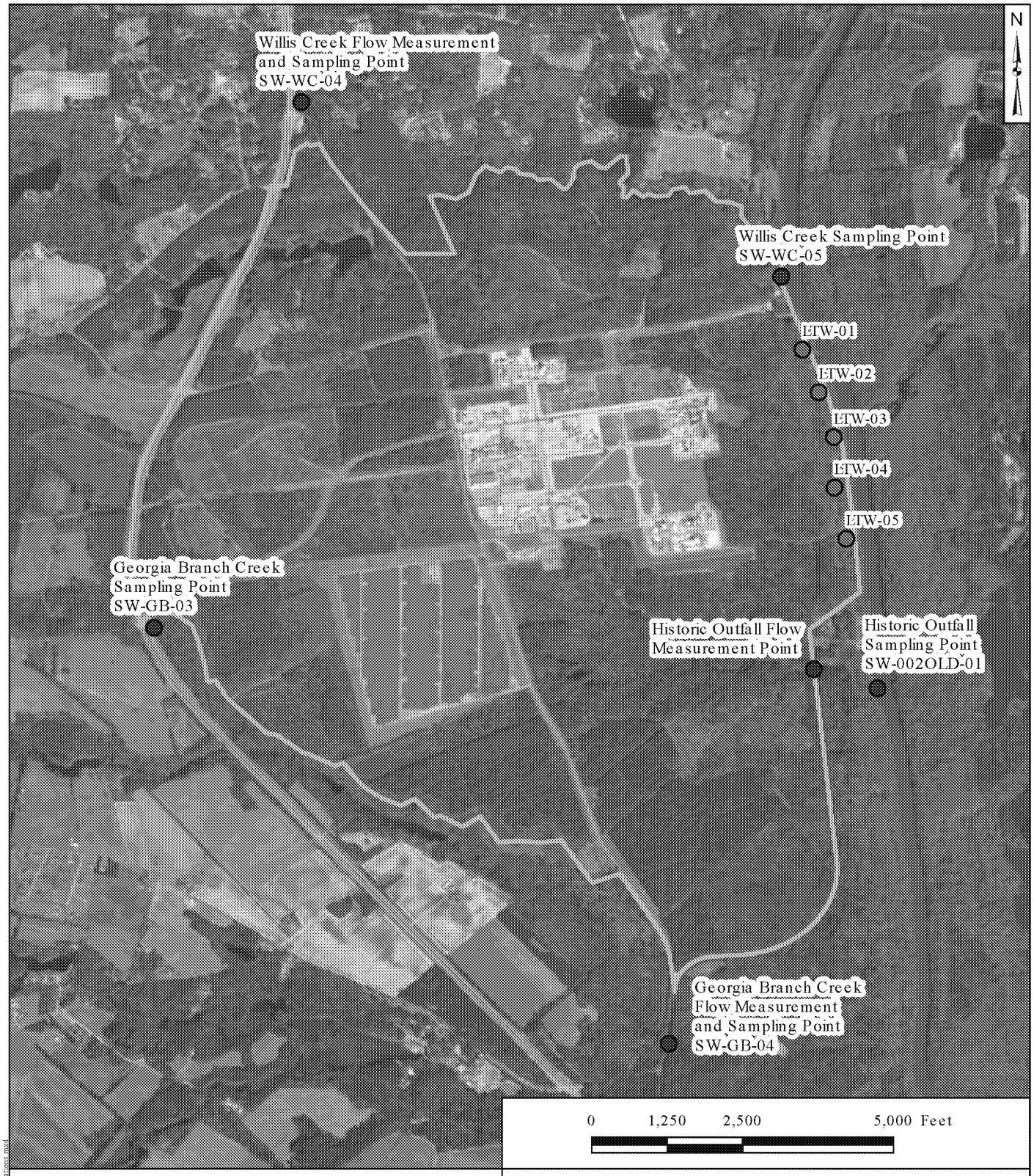
Figure 7



Legend

- Nearby Tributary Flow Measurement Points and/or Surface Water Sampling Points
- Groundwater Sampling Points
- Site Boundary

Basemap source: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Groundwater and Nearby Tributaries Sampling Locations

Chemours Fayetteville Works, North Carolina

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Figure 8

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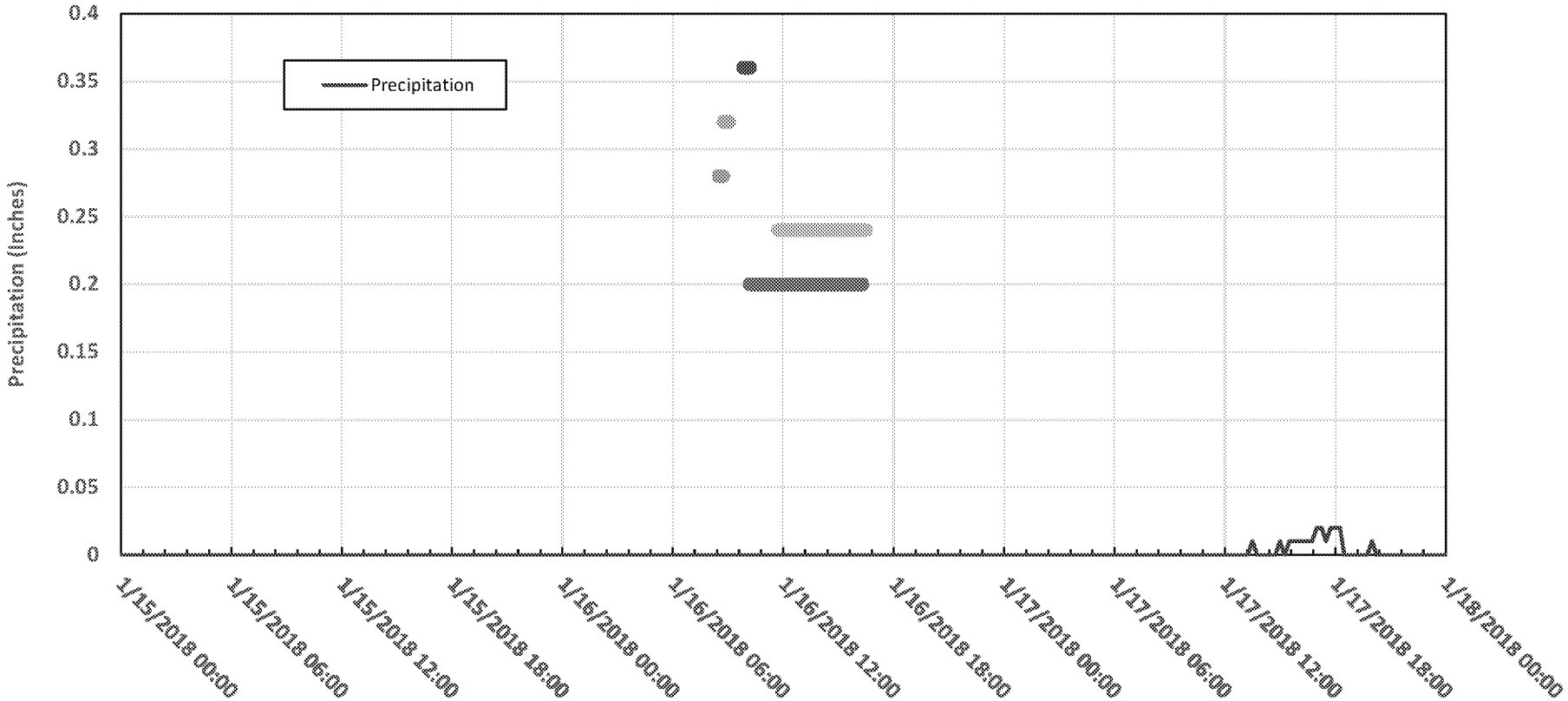

Sampling Legend:

- Historic Outfall Flow Measurements and Sample Collection
- Georgia Branch Flow Measurements and Sample Collection
- Willis Creek Flow Measurements and Sample Collection
- Site Drainage Network Sample Collection
- LTW Wells Sample Collection

Notes:

- Sampling bars represent the dates and times of sample collection.
- Precipitation data are measured on a 15 minute interval.
- Precipitation data obtained from USGS rain gauge at W.O. Huske Dam.

https://waterdata.usgs.gov/nwis/uv?site_no=02105500

Dry-Weather Precipitation Data and Sample Collection Timing

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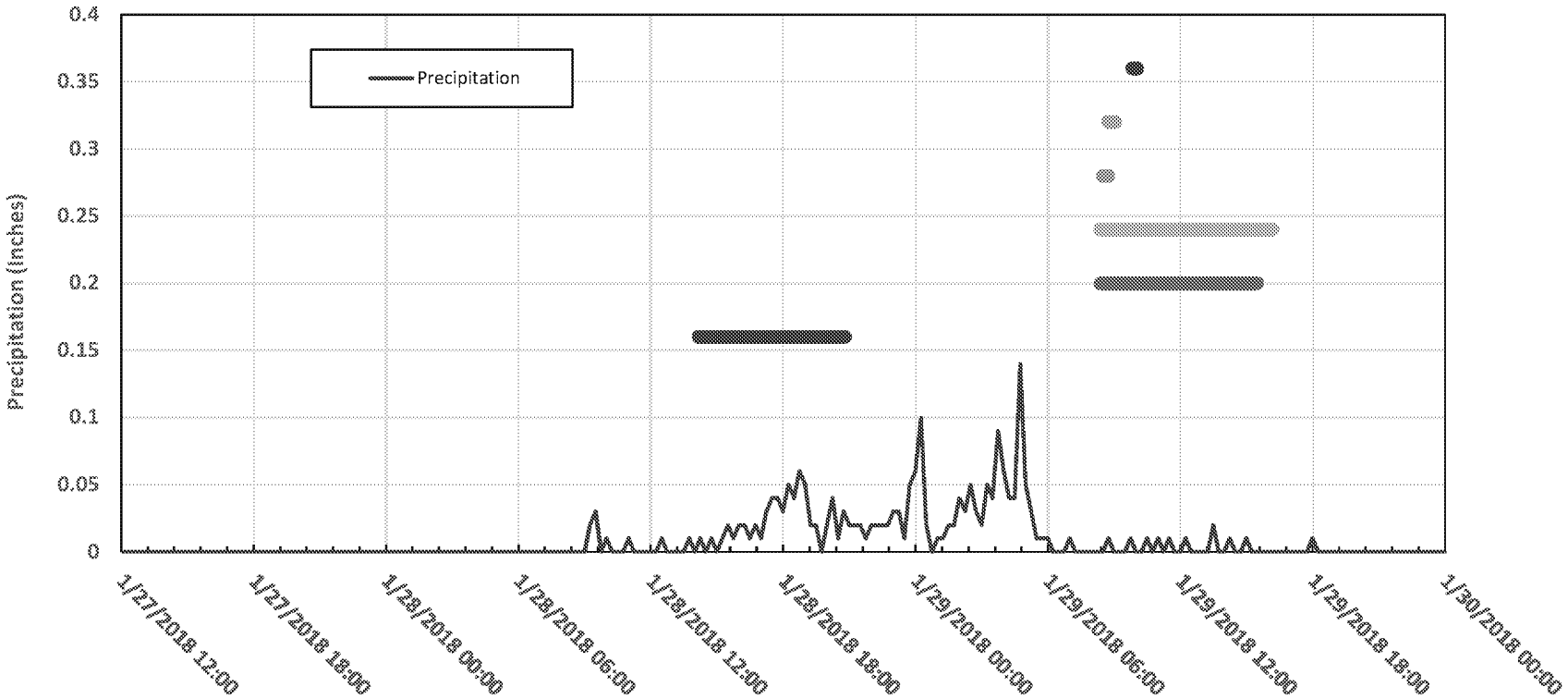
Figure 9

http://projectsites.geosyntec.com/1/Cont_Investigation/Shared Documents/FW/CSM/Geosyntec working files/Stormwater Sampling/Stormwater Sampling Event 1 Report/Figures/[Precipitation and



Sampling Legend:

- Historic Outfall Flow Measurements and Sample Collection
- Georgia Branch Flow Measurements and Sample Collection
- Willis Creek Flow Measurements and Sample Collection
- Site Drainage Network Sample Collection
- LTW Wells Sample Collection
- Rain Water Sample Collection

Notes:

- Sampling bars represent the dates and times of sample collection.
- Precipitation data are measured on a 15 minute interval.
- Precipitation data obtained from USGS rain gauge at W.O. Huske Dam.
https://waterdata.usgs.gov/nwis/uv?site_no=02105500

Wet-Weather Precipitation Data and Sample Collection Timing
Chemours Fayetteville Works, North Carolina

Geosyntec consultants

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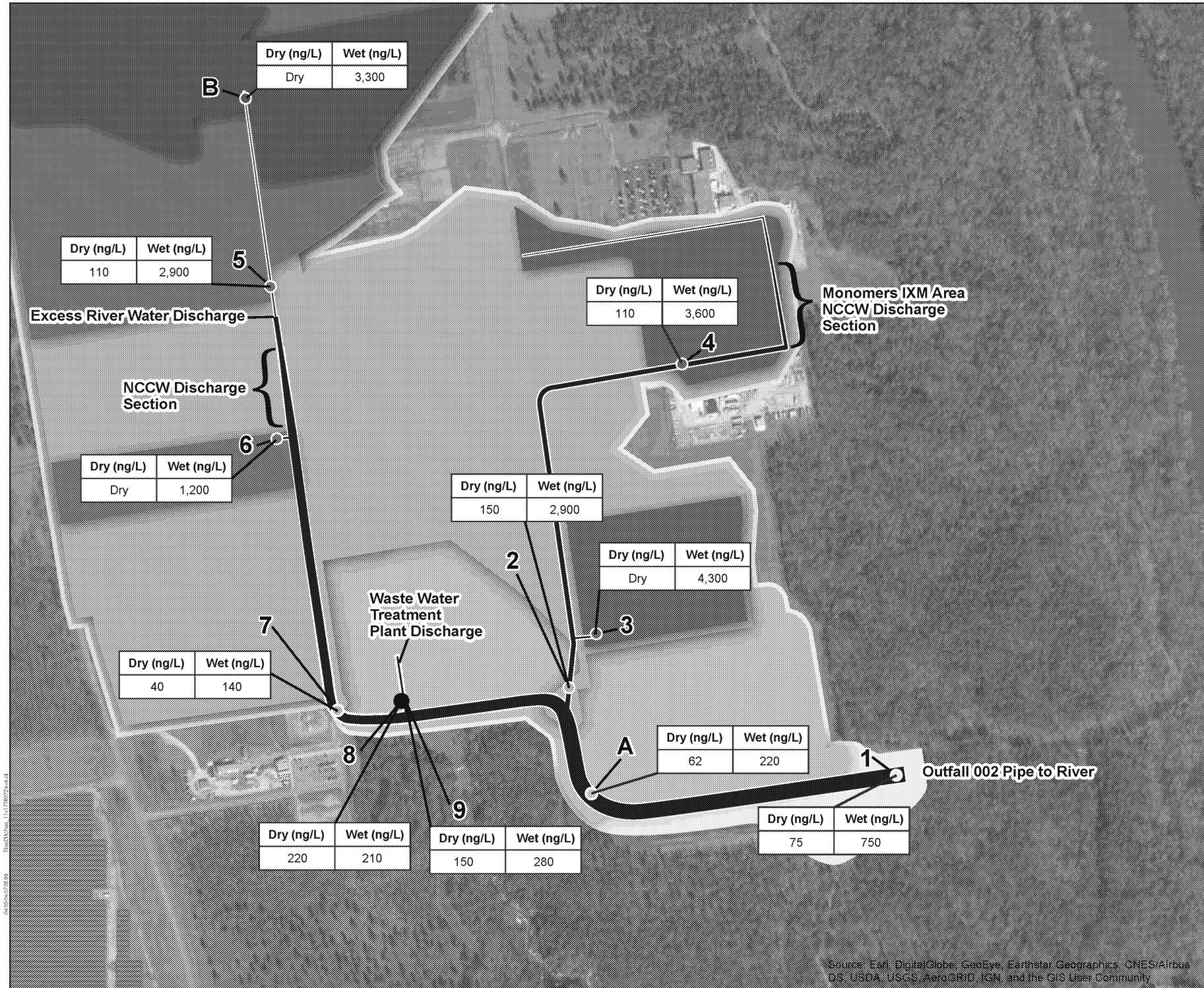
Figure 10

http://projectsites.geosyntec.com/1/Conf_Investigation/Shared Documents/FW/CSM/Geosyntec working files/Stormwater Sampling/Stormwater Sampling Event 1 Report/Figures/[Precipitation and S



Legend

Relative Flow Volume

Minimal or Dry — 100%

●—1 Sample location and sample name

NCCW - non-contact cooling water.
ng/L - nanograms per liter

Notes:
Data presented are the 16 January 2018 dry sampling event data and the 29 January 2018 wet sampling event data. Note, the wet sampling result from Location 9 was collected on 30 January 2018 representing the approximate 24 hour residence time of the Waste Water Treatment Plant.

Samples results reported as "Dry" indicate no water was present at this sampling location and thus a sample could not be collected.

N

500 250 0 500 Feet

Stormwater Sampling Program Dry and Wet-Weather Event HFPO-DA Concentrations

Chemours Fayetteville Works, North Carolina

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Figure 11

Appendix A
Nearby Tributaries Flow Measurements

TABLE A1
VOLUMETRIC DISCHARGE CALCULATIONS AT WILLIS CREEK DURING DRY-WEATHER SAMPLING EVENT
Chemours Fayetteville Works, North Carolina

Measurement Point	Distance Along Measured Cross Section (ft)	Measured Depth to Water (ft)	Measured Depth to Creek Bottom (ft)	Calculated Water Column Depth (ft)	Calculated Creek Cell Area (ft^2)	Measured Creek Velocity (ft/s)	Calculated Discharge Through Creek Cell Area (ft^3/s)
Culvert Edge	0	8.11	8.76	0.65	-	-	-
A	0.5	8.11	8.76	0.65	0.325	0.87	0.28
B	1	8.11	8.74	0.63	0.32	1.01	0.30
C	1.5	8.11	8.78	0.67	0.325	1.09	0.34
D	2	8.11	8.7	0.59	0.315	1.04	0.34
E	2.5	8.11	8.73	0.62	0.3025	1.05	0.32
F	3	8.11	8.8	0.69	0.3275	1	0.34
G	3.5	8.11	8.69	0.58	0.3175	1.12	0.34
H	4	8.11	8.7	0.59	0.2925	1.02	0.31
I	4.5	8.11	8.71	0.6	0.2975	1.16	0.32
J	5	8.11	8.75	0.64	0.31	1.1	0.35
K	5.5	8.11	8.73	0.62	0.315	1.13	0.35
L	6	8.11	8.72	0.61	0.3075	1.15	0.35
M	7	8.11	8.72	0.61	0.61	1.15	0.70
N	7.5	8.11	8.79	0.68	0.3225	1.2	0.38
O	8	8.11	8.85	0.74	0.355	1.28	0.44
Culvert Edge	8.5	8.11	8.85	0.74	0.37	-	0.47
					Total Volumetric Discharge		
					(ft^3/s)		5.93
					(gpm)		2,663

Associated Measurement Notes
Location: Chemours Fayetteville
Station: Willis Creek 04 (SW-WC-04)
Date: January 16, 2018
Initial depth to water: 8.11 ft
Final depth to water: 8.11 ft

Acronyms
-- - data not measured or calculated
ft - feet
ft^2 - square feet
ft^3/s - cubic feet per second
gpm - gallons per minute

Notes
- Discharge is calculated as product of creek velocity (feet per second) times the cross sectional area of each measurement cell.
- Measurement cells are calculated using data from previous measurement points. For example measurements from A and B form cell B.
- Measurement cell areas are calculated assuming a trapezoidal geometry.
- Data for culvert edge points are extrapolated from adjacent locations (A and O).

TABLE A2
VOLUMETRIC DISCHARGE CALCULATIONS AT GEORGIA BRANCH CREEK DURING WET-WEATHER SAMPLING EVENT
Chemours Fayetteville Works, North Carolina

Measurement Point	Distance Along Measured Cross Section (ft)	Measured Depth to Water (ft)	Measured Depth to Creek Bottom (ft)	Calculated Water Column Depth (ft)	Calculated Creek Cell Area (ft^2)	Measured Creek Velocity (ft/s)	Calculated Discharge Through Creek Cell Area (ft^3/s)
A	0.6	dry	11.52	dry	-	-	-
B	1.6	dry	11.75	dry	-	-	-
C	2.6	dry	11.83	dry	-	-	-
D	3.6	dry	12.08	dry	-	-	-
E	4.6	dry	12.48	dry	-	-	-
F	5.6	dry	12.93	dry	-	-	-
G	6.6	13.58	13.89	0.31	0.31	-0.1	-
H	7.6	13.58	14.1	0.52	0.415	-0.12	-
I	8.6	13.58	13.63	0.05	0.285	-0.11	-
J	9.6	13.58	13.76	0.18	0.115	-0.01	-
K	10.6	13.58	14.23	0.65	0.415	-0.05	-
L	11.6	13.58	14.82	1.24	0.945	-0.04	-
M	12.6	13.58	14.98	1.4	1.32	0	-
N	13.6	13.58	14.7	1.12	1.26	0.25	0.32
O	14.6	13.58	14.5	0.92	1.02	-0.02	-
P	15.6	13.58	14.42	0.84	0.88	0	-
Q	16.6	13.58	14.02	0.44	0.64	-0.08	-
R	17.6	dry	12.69	dry	-	-	-
S	18.6	dry	12.55	dry	-	-	-
T	19.6	dry	N/A	dry	-	-	-
					Total Volumetric Discharge		
					(ft^3/s)		0.32
					(gpm)		141

Associated Measurement Notes
Location: Chemours Fayetteville
Station: Georgia Branch 04 (SW-GB-04)
Date: January 16, 2018
Initial depth to water: 13.58 ft
Final depth to water: 13.58 ft

Acronyms
-- - data not measured or calculated
dry - no water present at measuring point
ft - feet
ft^2 - square feet
ft^3/s - cubic feet per second
gpm - gallons per minute

Notes
- Discharge is calculated as product of creek velocity (feet per second) times the cross sectional area of each measurement cell.
- Measurement cells are calculated using data from previous measurement points. For example measurements from F and G form cell G.
- Measurement cell areas are calculated assuming a trapezoidal geometry.
- Discharge calculations do not include values for cells where negative flows were measured.

TABLE A3
VOLUMETRIC DISCHARGE CALCULATIONS AT FORMER OUTFALL 002 DURING DRY-WEATHER SAMPLING EVENT
Chemours Fayetteville Works, North Carolina

Measurement Point	Distance Along Measured Cross Section (ft)	Measured Depth to Water (ft)	Measured Depth to Outfall Bottom (ft)	Calculated Water Column Depth (ft)	Calculated Stream Cell Area (ft^2)	Measured Stream Velocity (ft/s)	Calculated Discharge Through Outfall Cell Area (ft^3/s)
A	0.5	dry	10.37	dry	-	-	-
B	1	dry	10.92	dry	-	-	-
C	1.5	dry	11.4	dry	-	-	-
D	2	dry	11.85	dry	-	-	-
E	2.5	dry	12.19	dry	-	-	-
F	3	dry	12.39	dry	-	-	-
G	3.5	12.35	12.52	0.17	0.0425	0.16	0.01
H	4	12.35	12.67	0.32	0.1225	0.16	0.02
I	4.5	12.35	12.76	0.41	0.1825	0.38	0.05
J	5	12.35	12.7	0.35	0.19	0.45	0.08
K	5.5	12.35	12.89	0.54	0.2225	1.04	0.17
L	6	12.35	12.76	0.41	0.2375	1.03	0.25
M	7	12.25	12.69	0.44	0.425	0.5	0.33
N	7.5	dry	12.51	dry	0.11	-	0.05
O	8	dry	12.26	dry	-	-	-
P	8.5	dry	12.09	dry	-	-	-
Q	9	dry	11.98	dry	-	-	-
R	9.5	dry	11.68	dry	-	-	-
S	10	dry	11.62	dry	-	-	-
T	10.5	dry	11.62	dry	-	-	-
					Total Volumetric Discharge (ft^3/s)		0.95
					(gpm)		425

Associated Measurement Notes
Location: Chemours Fayetteville
Station: Former Outfall 002 (SW-002OLD-01)
Date: January 16, 2018
Initial depth to water: 12.35 ft
Final depth to water: 12.35 ft

Acronyms
-- - data not measured or calculated
dry - no water present at measuring point
ft - feet
ft^2 - square feet
ft^3/s - cubic feet per second
gpm - gallons per minute

Notes
- Discharge is calculated as product of creek velocity (feet per second) times the cross sectional area of each measurement cell.
- Measurement cells are calculated using data from previous measurement points. For example measurements from H and I form cell I.
- Measurement cell areas are calculated assuming a trapezoidal geometry, except cells G and N where a triangular geometry is assumed since N and G were dry measuremnt locations.

TABLE A4
VOLUMETRIC DISCHARGE CALCULATIONS AT WILLIS CREEK DURING WET-WEATHER SAMPLING EVENT
Chemours Fayetteville Works, North Carolina

Measurement Point	Distance Along Measured Cross Section (ft)	Measured Depth to Water (ft)	Measured Depth to Creek Bottom (ft)	Calculated Water Column Depth (ft)	Calculated Creek Cell Area (ft^2)	Measured Creek Velocity (ft/s)	Calculated Discharge Through Creek Cell Area (ft^3/s)
Culvert Edge	0	6.68	8.76	2.08	-	-	-
A	0.5	6.68	8.76	2.08	1.04	1.42	1.48
B	1	6.66	8.74	2.08	1.04	1.68	1.61
C	1.5	6.67	8.78	2.11	1.0475	1.56	1.70
D	2	6.67	8.7	2.03	1.035	1.84	1.76
E	2.5	6.67	8.73	2.06	1.0225	1.88	1.90
F	3	6.68	8.8	2.12	1.045	1.94	2.00
G	3.5	6.67	8.69	2.02	1.035	1.82	1.95
H	4	6.67	8.7	2.03	1.0125	1.8	1.83
I	4.5	6.67	8.71	2.04	1.0175	1.88	1.87
J	5	6.68	8.75	2.07	1.0275	1.63	1.80
K	5.5	6.67	8.73	2.06	1.0325	1.69	1.71
L	6	6.65	8.72	2.07	1.0325	1.44	1.62
M	7	6.65	8.72	2.07	2.07	1.28	2.82
N	7.5	6.67	8.79	2.12	1.0475	1.6	1.51
O	8	6.67	8.85	2.18	1.075	1.54	1.69
Culvert Edge	8.5	6.67	8.85	2.18	1.09	-	1.68
					Total Volumetric Discharge (ft^3/s)		28.92
					(gpm)		12,979

Associated Measurement Notes
Location: Chemours Fayetteville
Station: Willis Creek 04 (SW-WC-04)
Date: January 29, 2018
Initial depth to water: 6.68 ft
Final depth to water: 6.67 ft

Acronyms
-- - data not measured or calculated
dry - no water present at measuring point
ft - feet
ft^2 - square feet
ft^3/s - cubic feet per second
gpm - gallons per minute

Notes
- Discharge is calculated as product of creek velocity (feet per second) times the cross sectional area of each measurement cell.
- Measurement cells are calculated using data from previous measurement points. For example measurements from A and B form cell B.
- Measurement cell areas are calculated assuming a trapezoidal geometry.
- Data for culvert edge points are extrapolated from adjacent locations (A and O).

TABLE A5
VOLUMETRIC DISCHARGE CALCULATIONS AT GEORGIA BRANCH CREEK DURING WET-WEATHER SAMPLING EVENT
Chemours Fayetteville Works, North Carolina

Measurement Point	Distance Along Measured Cross Section (ft)	Measured Depth to Water (ft)	Measured Depth to Creek Bottom (ft)	Calculated Water Column Depth (ft)	Calculated Creek Cell Area (ft^2)	Measured Stream Velocity (ft/s)	Calculated Discharge Through Creek Cell Area (ft^3/s)
A	0.6	dry	11.52	dry	-	-	-
B	1.6	dry	11.75	dry	-	-	-
C	2.6	dry	11.83	dry	-	-	-
D	3.6	dry	12.08	dry	-	-	-
E	4.6	dry	12.48	dry	-	-	-
F	5.6	13.1	12.93	dry	-	-	-
G	6.6	13.25	13.89	0.64	0.64	-0.07	-
H	7.6	13.27	14.1	0.83	0.735	-0.1	-
I	8.6	13.25	13.63	0.38	0.605	-0.02	-
J	9.6	13.22	13.76	0.54	0.46	-0.07	-
K	10.6	13.2	14.23	1.03	0.785	0.25	0.20
L	11.6	13.24	14.82	1.58	1.305	0.46	0.46
M	12.6	13.22	14.98	1.76	1.67	0.31	0.64
N	13.6	13.23	14.7	1.47	1.615	0.22	0.43
O	14.6	13.22	14.5	1.28	1.375	-0.12	0.07
P	15.6	13.23	14.42	1.19	1.235	0.07	0.09
Q	16.6	13.23	14.02	0.79	0.99	-0.12	-
R	17.6	dry	12.69	dry	-	-	-
S	18.6	dry	12.55	dry	-	-	-
					Total Volumetric Discharge (ft^3/s)		1.89
					(gpm)		846

Associated Measurement Notes
Location: Chemours Fayetteville
Station: Georgia Branch 04 (SW-GB-04)
Date: January 29, 2018
Initial depth to water: 13.58 ft
Final depth to water: 13.58 ft

Acronyms
-- - data not measured or calculated
dry - no water present at measuring point
ft - feet
ft^2 - square feet
ft^3/s - cubic feet per second
gpm - gallons per minute

Notes
- Discharge is calculated as product of creek velocity (feet per second) times the cross sectional area of each measurement cell.
- Measurement cells are calculated using data from previous measurement points. For example measurements from G and H form cell H.
- Measurement cell areas are calculated assuming a trapezoidal geometry.
- Discharge calculations do not include values for cells where negative flows were measured.

TABLE A6
VOLUMETRIC DISCHARGE CALCULATIONS AT FORMER OUTFALL 002 DURING WET-WEATHER SAMPLING EVENT
Chemours Fayetteville Works, North Carolina

Measurement Point	Distance Along Measured Cross Section (ft)	Measured Depth to Water (ft)	Measured Depth to Outfall Bottom (ft)	Calculated Water Column Depth (ft)	Calculated Outfall Cell Area (ft^2)	Measured Outfall Velocity (ft/s)	Calculated Discharge Through Outfall Cell Area (ft^3/s)
A	0.5	dry	10.37	dry	-	-	-
B	1	dry	10.92	dry	-	-	-
C	1.5	dry	11.4	dry	-	-	-
D	2	dry	11.85	dry	-	-	-
E	2.5	dry	12.19	dry	-	-	-
F	3	12.23	12.39	0.16	0.04	-	-
G	3.5	12.23	12.52	0.29	0.1125	-0.15	-0.02
H	4	12.25	12.67	0.42	0.1775	0.75	0.05
I	4.5	12.26	12.76	0.5	0.23	1.44	0.25
J	5	12.28	12.7	0.42	0.23	1.26	0.31
K	5.5	12.28	12.89	0.61	0.2575	1.52	0.36
L	6	12.28	12.76	0.48	0.2725	1.41	0.40
M	7	12.3	12.69	0.39	0.435	0.48	0.41
N	7.5	12.37	12.51	0.14	0.1325	-	0.06
O	8	12.4	12.26	-0.14	0	-	-
P	8.5	dry	12.09	dry	-	-	-
Q	9	dry	11.98	dry	-	-	-
R	9.5	dry	11.68	dry	-	-	-
S	10	dry	11.62	dry	-	-	-
T	10.5	dry	11.62	dry	-	-	-
					Total Volumetric Discharge (ft^3/s)		1.85
					(gpm)		829

Associated Measurement Notes
Location: Chemours Fayetteville
Station: Former Outfall 002 (SW-002OLD-01)
Date: January 29, 2018
Initial depth to water: 12.3 ft
Final depth to water: 12.3 ft

Acronyms
-- - data not measured or calculated
dry - no water present at measuring point
ft - feet
ft^2 - square feet
ft^3/s - cubic feet per second
gpm - gallons per minute

Notes
- Discharge is calculated as product of creek velocity (feet per second) times the cross sectional area of each measurement cell.
- Measurement cells are calculated using data from previous measurement points. For example measurements from H and I form cell I.
- Measurement cell areas are calculated assuming a trapezoidal geometry, except cells G and N where a triangular geometry is assumed since N and G were dry measuremnt locations.
- Negative flow data from Measurement Point G is not included in discharge calucations. Water was too shallow at measurement point F to submerge flow meter.

Georgia Branch Creek
Flow Measurement Location

Chemours Fayetteville Works, North Carolina

Geosyntec consultants

Figure
A1

Guelph | March 2018

internal info: path, date revised, author

Former Outfall 002 Flow Measurement Location

Chemours Fayetteville Works, North Carolina

Geosyntec consultants

Figure **A2**

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internal info: path, date revised, author

Willis Creek Flow Measurement Location

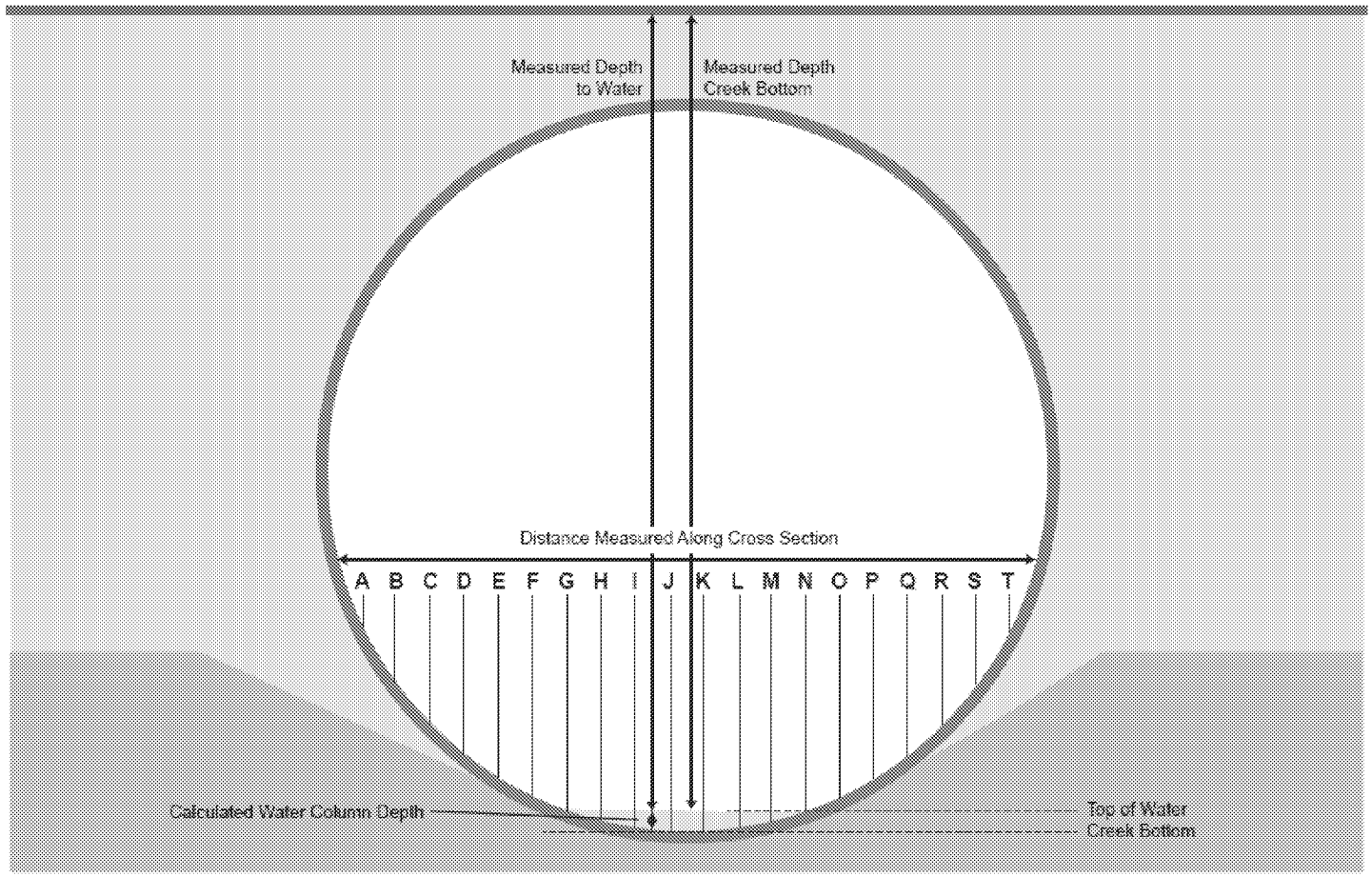
Chemours Fayetteville Works, North Carolina

Geosyntec consultants

Figure **A3**

Guelph | March 2018

internal info: path, date revised, author



Conceptual Schematic of Flow Measurement at Former Outfall 002

Chemours Fayetteville Works, North Carolina

Geosyntec consultants

Figure **A4**

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internal info: path, date revised, author

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Appendix B
LTW Well Field Parameter Data

Corporate Remediation Group - Field Book

Site: CHEMOURS FAY Event: LOW-FLOW GWS Date: 01.16.18 Time: 1550
Personnel: TD + CB Project Manager: TRACEY OUBEY
Well ID: LTW-01 Permit No: VO Vapors: PIDFID BZ: PIDFID CA:
Weather Conditions: ☒ Clear ☐ Cloudy ☐ Other ☐ Wind: Temp: 50 °F

Well Depth: 26' LNAPL: Purge Method: PERRY PUMP
Depth to Water: 17.39' DNAPL: Purge Start: 1604
Water Column: Casing Dia: 2" Purge Stop: 1615
Well Vol: Conv. Factor: Parameter Collection Time:
Well Vol (3x): Purge Rate: 200 Water Level Stable @: 17.45

Parameters	17.38 1606	17.44 1609	17.45 1612	17.45 1615		Sample	Analysis Time
pH	3.65	3.53	3.53	3.56			
Temperature (°C)	17.58	17.41	17.53	17.55			
Specific Conductance (umho)	0.136	0.137	0.139	0.138			
Dissolved Oxygen (mg/l)	0.85	0.73	0.61	0.61			
Redox (mV)	511	518	515	497			
Turbidity (ntu)	19.2	25.3	20.7	12.0			
Color	CLEAR	CLEAR	CLEAR	CLEAR			
Odor							

Sample Date: 01.16.18 Sample Collection Time: 1615 Sample Method:

Analysis	Volume (ml)	#	Preservative	Zero HS	Comments:

Analyst Name:
Analyst Signature: Date:

20650

Corporate Remediation Group - Field Book

Site: CHEMOURS FAY Event: LOW-FLOW GWS Date: 01.16.18 Time: 1507
Personnel: TO + CB Project Manager: TRACEY OUBEY
Well ID: LTW-02 Permit No: VO Vapors: PIDFID BZ: PIDFID CA:
Weather Conditions: ☒ Clear ☐ Cloudy ☐ Other ☐ Wind: Temp: 50 °F

Well Depth: 38 LNAPL: Purge Method: PERRY PUMP
Depth to Water: 10.07 DNAPL: Purge Start: 1512
Water Column: Casing Dia: 2" Purge Stop: 1524
Well Vol: Conv. Factor: Parameter Collection Time:
Well Vol (3x): Purge Rate: 200 Water Level Stable @: 10.16

	DTW	10.20	10.16	10.16	10.16			
Parameters		1515	1518	1521	1524		Sample	Analysis Time
pH		4.77	4.77	4.71	4.67			
Temperature (°C)		17.92	18.10	18.11	18.07			
Specific Conductance (umho)		0.058	0.063	0.055	0.055			
Dissolved Oxygen (mg/l)		5.42	5.26	5.20	4.48			
Redox (mV)		344	364	386	398			
Turbidity (ntu)		6.1	3.5	1.0	1.0			
Color		CLEAR	- - - -	- - - -	- - - -			
Odor								

Sample Date: 01.16.17 Sample Collection Time: 1523 Sample Method:

Analysis	Volume (ml)	#	Preservative	Zero HS	Comments:

Analyst Name:
Analyst Signature: Date:

20650

Corporate Remediation Group - Field Book

Site: CHEMOURS FAY Event: LOW-FLOW GWS Date: 01.16.18 Time: 1420
Personnel: TD & CB Project Manager: TRACEY CUBEY
Well ID: LTW-03 Permit No: VO Vapors: PIDIFID BZ: PIDIFID CA:
Weather Conditions: ☒ Clear ☐ Cloudy ☐ Other ☐ Wind: Temp: 50 °F

Well Depth: 30 LNAPL: Purge Method: PERRY PUMP
Depth to Water: 12.80 DNAPL: Purge Start: 1428
Water Column: Casing Dia: Purge Stop: 1440
Well Vol: Conv. Factor: Parameter Collection Time:
Well Vol (3x): Purge Rate: 200 Water Level Stable @: 13.47

DTW	13.35	13.42	13.45	13.47			
Parameters	1430	1433	1436	1439		Sample	Analysis Time
pH	4.66	4.62	4.34	4.48			
Temperature (°C)	20.83	20.73	20.52	20.33			
Specific Conductance (umho)	0.097	0.096	0.096	0.096			
Dissolved Oxygen (mg/l)	1.45	0.70	0.52	0.45			
Redox (mV)	315	318	320	324			
Turbidity (ntu)	50.4	49.0	47.9	47.2			
Color	LIGHT BROWN	- - - -	- - - -	- - - -			
Odor							

Sample Date: 01.16.17 Sample Collection Time: 1440 Sample Method:

Analysis	Volume (ml)	#	Preservative	Zero HS	Comments:

Analyst Name:
Analyst Signature: Date:

20650

Corporate Remediation Group - Field Book

Site: CHEMOURS FAY Event: LOW-FLOW GWS Date: 01.16.18 Time: 0950
Personnel: TD + CA Project Manager: TRACEY OUBEY
Well ID: LTW-04 Permit No: VO Vapors: PIDIFID BZ: PIDIFID CA:
Weather Conditions: ☒ Clear ☐ Cloudy ☐ Other ☐ Wind: Temp: 29 °F

Well Depth: 27' LNAPL: Purge Method: PERRY PUMP
Depth to Water: 8.76' DNAPL: Purge Start: 948
Water Column: Casing Dia: 2" Purge Stop: ~~1000 DRY~~ 1000
Well Vol: Conv. Factor: Parameter Collection Time: 0951 - 1000
Well Vol (3x): Purge Rate: 200 ml/min Water Level Stable @: 11.80

Parameters	DTW 10.23	10.95	11.80	11.80		Sample	Analysis Time
	0951	0954	0957	1000			
pH	4.31	3.74	3.51	3.41			
Temperature (°C)	11.50	12.09	12.51	12.61			
Specific Conductance (umho)	0.124	0.128	0.130	0.129			
Dissolved Oxygen (mg/l)	2.83	1.26	0.97	0.78			
Redox (mV)	402	462	482	495			
Turbidity (ntu)	26.7	28.1	30.1	31.3			
Color	CLEAR	CLEAR	CLEAR	CLEAR			
Odor							

Sample Date: 01.16.17 Sample Collection Time: 1010 Sample Method:

Analysis	Volume (ml)	#	Preservative	Zero HS	Comments:

Analyst Name:
Analyst Signature: Date:

20650

Corporate Remediation Group - Field Book

Site: CHEMOURS FAY Event: ~~Low-flow~~ LOW-FLOW GWS Date: 01.16.18 Time: 1100
Personnel: TD + CB Project Manager: TRACEY DUBEY
Well ID: LTW-03 Permit No: VO Vapors: PIDIFID BZ: PIDIFID CA:
Weather Conditions: ☒ Clear ☐ Cloudy ☐ Other ☐ Wind: Temp: 36 °F

Well Depth: 40' LNAPL: Purge Method: PERRY PUMP
Depth to Water: 10.67 DNAPL: Purge Start: 1100
Water Column: Casing Dia: 2" Purge Stop: 1111
Well Vol: Conv. Factor: Parameter Collection Time:
Well Vol (3x): Purge Rate: 220 ml/min Water Level Stable @: 10.85

Parameters	DTW 10.67	10.83	10.85	10.85		Sample	Analysis Time
	1102	1105	1108	1111			
pH	3.97	3.57	3.49	3.46			
Temperature (°C)	16.46	16.45	16.53	16.84			
Specific Conductance (umho)	0.177	0.176	0.177	0.176			
Dissolved Oxygen (mg/l)	5.39	4.80	4.05	2.87			
Redox (mV)	517	522	526	492			
Turbidity (ntu)	1.2	1.8	1.0	1.1			
Color	CLEAR	CLEAR	CLEAR	CLEAR			
Odor							

Sample Date: 01.16.18 Sample Collection Time: 1115 Sample Method: LOW-FLOW

Analysis	Volume (ml)	#	Preservative	Zero HS	Comments:

Analyst Name:
Analyst Signature: Date:

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Corporate Remediation Group - Field Book

Site: Fayetteville Event: January Storm H2O Date: 1/29/18 Time: 0745
Personnel: HL, LP, BP Project Manager: T. Ovbey
Well ID: LTW-01 Permit No: VO Vapors: PIDFID BZ: PIDFID CA:
Weather Conditions: ☐ Clear ☑ Cloudy ☐ Other ☐ Wind: Temp: 50 °F

Well Depth: LNAPL: Purge Method: low-flow peri
Depth to Water: 16.61 DNAPL: Purge Start: 0800
Water Column: Casing Dia: 2" Purge Stop: 0824
Well Vol: Conv. Factor: Parameter Collection Time: 0824
Well Vol (3x): Purge Rate: 100 ml/min Water Level Stable @: 16.96

Parameters DTW	0809 16.93	0814 16.96	0819 16.96	0824 16.96		Sample	Analysis Time
pH	3.74	3.40	3.28	3.20			
Temperature (°C)	20.68	19.72	19.14	18.74			
Specific Conductance (umho)	0.1164	0.1146	0.135	0.132			
Dissolved Oxygen (mg/l)	3.86	0.96	0.75	0.69			
Redox (mV)	353	420	458	~~45~~479			
Turbidity (ntu)	97.6	74.9	42.9	20.9			
Color	lt. tan	lt. tan	lt. tan	Clear			
Odor	No	No	No	No			

Sample Date: 1/29/18 Sample Collection Time: 0824 Sample Method: Grab

Analysis	Volume (ml)	#	Preservative	Zero HS	Comments:

Analyst Name: Hannah Lopani
Analyst Signature: Date: 1/29/18

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Corporate Remediation Group - Field Book

Site: Fayetteville Event: January Storm H_2O Date: _____ Time: 0840
Personnel: _____ Project Manager: T. Ovbay
Well ID: LTW-02 Permit No: _____ VO Vapors: PID/FID BZ. 0.0
PID/FID CA. 0.0
Weather Conditions: ☐ Clear ☑ Cloudy ☐ Other ☐ Wind: _____ Temp: 50 °F

Well Depth: _____ LNAPL: _____ Purge Method: low-flow pump
Depth to Water: 9.66 DNAPL: _____ Purge Start: 0848
Water Column: _____ Casing Dia: 2" Purge Stop: 0909
Well Vol: _____ Conv. Factor: _____ Parameter Collection Time: 0909
Well Vol (3x): _____ Purge Rate: 150 Water Level Stable @: 9.84

Parameters	0854	0859	0904	0909		Sample	Analysis Time
DTW	9.84	9.84	9.84	9.84			
pH	4.17	4.35	4.35	4.34			
Temperature (°C)	15.73	16.02	16.19	16.15			
Specific Conductance (umho)	0.085	0.079	0.078	0.078			
Dissolved Oxygen (mg/l)	3.92	1.59	1.10	0.74			
Redox (mV)	322	294	284	279			
Turbidity (ntu)	0.0	0.0	0.0	0.0			
Color	Clear	Clear	Clear	Clear			
Odor	No	No	No	No			

Sample Date: 1/29/18 Sample Collection Time: 0909 Sample Method: Grab

Analysis	Volume (ml)	#	Preservative	Zero HS	Comments:
					MS / REP

Analyst Name: Hannah Ugoni
Analyst Signature: Hannah Ugoni Date: 1/29/18

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Corporate Remediation Group - Field Book

Site: Fayetteville Event: January Stormwater Date: 1/29/18 Time: 1441
Personnel: Project Manager: Tracy Oubey
Well ID: LTW-03 Permit No: VO Vapors: PID/FID BZ: — FID/FID CL: —
Weather Conditions: ☐ Clear ☑ Cloudy ☐ Other ☐ Wind: Temp: 52 °F

Well Depth: LNAPL: Purge Method: low flow pari
Depth to Water: 12.50 DNAPL: Purge Start: 1509
Water Column: Casing Dia: 2 in Purge Stop: 1529
Well Vol: Conv. Factor: Parameter Collection Time: 1529
Well Vol (3x): Purge Rate: 100 ml/min Water Level Stable @: 12.81

Parameters	1514	1519	1524	1529		Sample	Analysis Time
DTW	12.67	12.75	12.78	12.805			
pH	4.19	4.03	3.97	3.88			
Temperature (°C)	16.03	15.03	14.99	14.95			
Specific Conductance (umho)	0.104	0.092	0.091	0.091			
Dissolved Oxygen (mg/l)	2.54	1.00	0.85	0.85			
Redox (mV)	311	298	299	301			
Turbidity (ntu)	0.0	0.0	0.0	232			
Color	Cloudy	Cloudy	Cloudy	Clear			
Odor	ND	No	No	No			

Sample Date: 1/29/18 Sample Collection Time: 1529 Sample Method: Grab

Analysis	Volume (ml)	#	Preservative	Zero HS	Comments:

Analyst Name: Charles Pyce
Analyst Signature: [signature] Date: 1/29/18

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Corporate Remediation Group - Field Book

Site: Fayetteville Event: January Stormwater Date: 1/29/18 Time: 1100
Personnel: Project Manager: Tracy Oubey
Well ID: LTW-04 Permit No: VO Vapors: PIDIFID BZ: PIDIFID CA:
Weather Conditions: ☐ Clear ☑ Cloudy ☐ Other ☐ Wind: Temp: 50 °F

Well Depth: LNAPL: Purge Method: lowflow pump
Depth to Water: 8.39 DNAPL: Purge Start: 1101
Water Column: Casing Dia: 2 in Purge Stop: 1120
Well Vol: Conv. Factor: Parameter Collection Time: 1120
Well Vol (3x): Purge Rate: 150 ml/min Water Level Stable @: 11.57

Parameters	1105	1110	1115	1120		Sample	Analysis Time
DTW	9.19	10.16	10.94	11.57			
pH	3.81	3.41	3.37	3.33			
Temperature (°C)	15.48	15.48	15.13	15.21			
Specific Conductance (umho)	0.112	0.111	0.111	0.110			
Dissolved Oxygen (mg/l)	3.62	0.76	0.59	0.51			
Redox (mV)	411	454	463	464			
Turbidity (ntu)	101	55.3	46.1	34.2			
Color	Tan	Tan	Tan	Tan			
Odor	No	No	No	No			

Sample Date: 1/29/18 Sample Collection Time: 1120 Sample Method: Grab

Analysis	Volume (ml)	#	Preservative	Zero HS	Comments:

Analyst Name: Charles Pace
Analyst Signature: Date: 1/29/18

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Corporate Remediation Group - Field Book

Site: Fayetteville Event: January stormwater Date: 1/29/18 Time: 1020
Personnel: Project Manager: Tracy Ovbey
Well ID: LTW-05 Permit No: VO Vapors: PID/FID BZ: PID/FID CX:
Weather Conditions: ☐ Clear ☑ Cloudy ☐ Other ☐ Wind: Temp: 50 °F

Well Depth: LNAPL: Purge Method: low-flow pari
Depth to Water: 9.66 DNAPL: Purge Start: 1020
Water Column: Casing Dia: 2 in Purge Stop: 1042
Well Vol: Conv. Factor: Parameter Collection Time: 1042
Well Vol (3x): Purge Rate: 150 ml/min Water Level Stable @:

Parameters	1027	1032	1037	1042		Sample	Analysis Time
DTW	9.09	10.01	10.03	10.04			
pH	3.77	3.68	3.69	3.69			
Temperature (°C)	16.30	16.43	16.56	16.64			
Specific Conductance (umho)	0.162	0.160	0.158	0.158			
Dissolved Oxygen (mg/l)	2.51	1.16	0.82	0.64			
Redox (mV)	368	362	355	351			
Turbidity (ntu)	3.7	3.2	3.4	1.2			
Color	clear	clear	clear	clear			
Odor	NO	NO	NO	NO			

Sample Date: 1/29/18 Sample Collection Time: 1042 Sample Method: Grab

Analysis	Volume (ml)	#	Preservative	Zero HS	Comments:

Analyst Name: Charles Pace
Analyst Signature: Chas Pace Date: 1/29/18

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Appendix C
Laboratory Reports