



Geosyntec Consultants of NC, PC

UPDATED PFAS CHARACTERIZATION SAMPLING PLAN

Process and Non-Process Wastewater and Stormwater

Prepared for

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ACRONYMS AND ABBREVIATIONS

- CFRW – Cape Fear River Watch
DEQ – Department of Environmental Quality
DWR – Division of Water Resources
HFPO-DA – hexafluoropropylene oxide dimer acid
IXM – Ion Exchange Membrane
NCCW – non-contact cooling water
PFAS – per- and polyfluoroalkyl substances
PFCA – perfluorocarboxylic acids
PFSA – perfluorosulfonic acids
PPA – Polymer Processing Aid
SOP – standard operating procedure
USEPA – United States Environmental Protection Agency

“I certify that I am personally familiar with the information contained in this submittal, including any and all supporting documents accompanying this report, and that the material and information contained herein is, to the best of my knowledge and belief, true, accurate and complete.”



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Geosyntec Consultants of NC, PC is licensed to practice engineering in North Carolina. The certification number (Firm's License Number) is C-3500.

Geosyntec Consultants of NC, PC is licensed to practice geology in North Carolina. The certification number (Firm's License Number) is C-295.

1. INTRODUCTION

This sampling plan (the Sampling Plan) was prepared by Geosyntec Consultants of NC, P.C. (Geosyntec) for the Chemours Company FC, LLC (Chemours) to provide a plan for sampling and analysis of process wastewater, non-process wastewater (including non-contact cooling water, [NCCW], sanitary water, and utility water) and stormwater at the Chemours Fayetteville Works, North Carolina site (the Facility, Figure 1). This Sampling Plan is intended to address requirements specified in Paragraph 11(b) in the executed Consent Order dated 25 February 2019 between Chemours and the North Carolina Department of Environmental Quality (DEQ) with the Cape Fear River Watch (CFRW) as intervenor. Other parts of the Consent Order will be addressed separately by Chemours and Chemours contractors.

The purpose of this plan is to obtain more information on the concentrations and temporal trends of per- and polyfluoroalkyl substances (“PFAS”) in the three water types identified above. The Sampling Plan may be updated at a later date as analytical methods are further improved.

1.1 Background

PFAS may be present in: 1) rainwater/stormwater, 2) as dry deposition from stack emissions that washes off with overland flow during rainfall events, 3) in groundwater that has been impacted by infiltration of PFAS to the subsurface, 4) process wastewater, and/or 5) NCCW. Evaluation of the data collected to date indicates that PFAS present in the Cape Fear River are partially attributable to emissions from the Facility and partially attributable to other regional sources. Chemours has taken numerous actions to reduce releases of PFAS from the Facility, including the following partial list:

- Off-Site disposal of all Chemours process wastewater to reduce discharges to the Cape Fear River as quickly as possible;
- Installation of air emissions abatement controls in May, October, and December 2018; and
- Extraction and off-Site disposal of groundwater with elevated PFAS concentrations from the perched aquifer.

Chemours continues to work towards further reducing PFAS emissions to air and discharges to water by designing and installing enhanced PFAS abatement systems.

1.1.1 Water Usage at the Facility

The Facility is adjacent to the Cape Fear River and draws water from the Cape Fear River and returns over 95% of this water via Site Outfall 002 after being used primarily as NCCW. Rainfall at the Facility that does not evaporate or infiltrate to groundwater runs off through a series of storm drains and ditches. Figures 1 and 2 show the known drains and ditches.

The Facility has four chemical production areas, shown in Figure 1 and listed below:

- Chemours Monomers Ion Exchange Membrane (IXM) Area;
- Chemours Polymer Processing Aid (PPA) Area;
- Kuraray America northern and southern leased areas (Kuraray Area); and
- Dow-DuPont leased area (DuPont Area).

1.1.2 Analytical Methods

Two analytical methods have been employed to analyze PFAS, which include all the compounds listed in Attachment C of the executed Consent Order:

- EPA Method 537 Mod (laboratory-specific standard operating procedure [SOP]) – perfluorocarboxylic acids (PFCAs), perfluorosulfonic acids (PFSAs) and others;
- Table 3+ laboratory-specific SOP

PFAS to be analyzed by the two methods listed above will include all the PFAS listed in Attachment C of the executed Consent Order in addition to other analytes reported by these methods, as summarized in Table 1. Additional samples will be collected and archived as part of this sampling program for analysis by potential future analytical methods developed as part of the executed Consent Order.

1.2 Scope and Rationale

This Sampling Plan addresses requirements in Paragraph 11(b) as listed in the executed Consent Order. Chemours will conduct bimonthly sampling events for one year for the Initial Characterization and provide quarterly reports and prepare a final Initial Characterization Report within 18 months of NCDEQ approval of this Sampling Plan.

Chemours will continue bimonthly sampling events and quarterly reports during the Ongoing Sampling for a period of two years (i.e., 12 events and eight reports).

2. DATA QUALITY OBJECTIVES

Data quality objectives are established here to provide data of known and sufficient quality to accomplish the following:

- Characterize concentrations of PFAS in process wastewater, non-process wastewater, and stormwater at the Facility;
- Assess PFAS concentration trends over time in process wastewater, non-process wastewater, and stormwater; and
- Document intake water quality (i.e., water drawn from the Cape Fear River for use at the facility before reaching any manufacturing areas) to differentiate the components of PFAS originating at the Facility.

The criteria for achieving the data quality objectives are provided in Table 2.

3. SAMPLING PLAN

3.1 Sampling Locations

Up to thirty-two investigative samples will be collected during each of the Initial Characterization events at locations shown on Figure 2 and listed in Table 3.

3.2 Sampling Schedule

The proposed sampling and reporting schedule is provided in a Gantt Chart (Figure 3).

3.3 Sampling Protocol

3.3.1 General Field Protocol

All equipment will be inspected by the field program on-Site supervisor and calibrated daily prior to use in the field according to the manufacturer's recommendations. Calibration information will be recorded. Field parameters will be measured with a water quality meter prior to sample collection and then recorded. Field parameters will include the following:

- pH;
- Temperature (degrees Celsius; °C);
- Specific conductance [SC] (micromhos, µmho);
- Dissolved oxygen [DO] (milligrams per liter; mg/L);
- Oxidation/Reduction Potential [ORP] (millivolts; mV);
- Turbidity (nephelometric turbidity units, NTU);
- Color; and
- Odor.

3.3.2 Sample Collection Considerations

Samples containing process wastewater, non-process wastewater, and stormwater will be collected as part of this Sampling Plan. Sample collection considerations common to all sample types are outlined below and summarized in Table 4. Detailed sampling procedures can be found in the PFAS Quality Assurance Project Plan (QAPP) (AECOM, 2018).

All sample locations that include or are intended to be exclusively stormwater (Locations 1-5, 7, 9-15, 20, 21A, and 21B) will be sampled contemporaneously during storm events. All sample locations that are not intended to include stormwater (i.e., NCCW and process wastewater) that could potentially be biased by stormwater during a storm event (6A, 6B, 8, 18, 19A, 19B, 22, 23, 24A, 24B, and 24C) will be sampled on the next working day following the storm event where there is no precipitation in the forecast. Locations 16, 17A, and 17B are sampled from closed systems that can be sampled without stormwater biasing the sample, so they will be sampled at any convenient time within a sampling round.

The sample bottles will be 250 milliliter (mL) high density polyethylene (HDPE) with a wide-mouth screw-cap. For all samples, bottles will be pre-cleaned by the vendor to minimize the risk of unplanned sample contamination from the sample container (i.e., blank contamination).

Sample bottles will be filled and the caps will be securely fastened after sample collection. For each sample, sufficient water will be collected to fill seven bottles (two for EPA Method 537 Mod, one for Table 3+, and four bottles to be archive at 4°C for potential future analyses). Each sample will be labelled with a unique sample identification number, date, time and location of sampling, and the initials of the individual collecting the sample. A field form will be used to record information regarding additional items such as quality assurance/ quality control (QA/QC), sample identifications, color, odor, turbidity, and other field parameters. Some samples will be collected as grab samples (i.e., instantaneous) and some samples will be collected as temporal composite samples. Table 3 lists the sampling method for each sample location.

Grab Sample Considerations

Grab samples are appropriate where temporal variability over the course of one day is not expected at the sampling location. These locations include NCCW samples and process wastewater samples. All grab samples except for 21A and 21B (the Sediment Basins) will be collected by directly filling the HDPE bottle with sample. The method to collect samples at 21A and 21B is described further below. Prior to grab sample collection, field parameters will be measured by filling a flow through cell, either directly using a dip rod or via a peristaltic pump.

Non-Contact Cooling Water

NCCW samples will be collected as grab samples from the NCCW discharge points before these waters flow into the Site Drainage Network for Kuraray and Chemours manufacturing areas (Locations 6A, 6B, 24A, 24B, and 24C). There are multiple NCCW discharges from each of these areas to the Site Drainage Network, therefore multiple individual grab samples will be collected within the reach of each location shown on Figure 2. Individual grab samples will be poured into 250-mL HDPE bottles.

If these split locations are found to be similar to each other in compounds detected and concentrations of compounds detected during the first sampling event, they may be composited into single samples for analysis in subsequent sampling events. This will be done by pouring individual grab samples into a stainless-steel pot then pouring the composited sample from the pot into HDPE bottles.

Process Wastewater

Process wastewater samples will be collected as grab samples from the Chemours Monomers IXM Area, Chemours PPA Area, Kuraray and DuPont (Locations 16 to 19, 22, 23A and 23B). Some process wastewater locations will be collected as split samples (e.g., "A" and "B" samples) during the first sampling event. These split locations may be composited into a single sample for analysis in subsequent sampling events if the composition of the split samples are similar to each other in compounds detected and concentrations of detected compounds. Compositing will be done in the same manner as described for NCCW above.

Grab samples are appropriate for the Chemours process wastewater samples (Locations 16, 17A, and 17B) since these samples are collected from tanks that composite wastewater over several days before being taken off site by tanker truck. Grab samples are also appropriate for the DuPont process wastewater samples (Locations 19A and 19B) since these samples accumulate in a tank at the DuPont facility before being released to the sump at the wastewater treatment plant.

For the first sampling event, temporal variability of the Kuraray process wastewater locations (Locations 18 and 23A) will be assessed by collecting and analyzing 4 separate grab samples at 4-hour intervals over the course of 12 hours. Data will be evaluated to determine whether autosamplers are required for subsequent sampling events.

One sample will be collected at Location 23B during the first sampling event. If analytical results indicate PFAS concentrations greater than historical ranges for PFAS intake water, then Location 23B will also be sampled in subsequent sampling events.

Sediment Basins

Combined stormwater and excess intake water samples will be collected as grab samples from the south or north sediment basin, whichever is actively being used (Locations 21A and 21B). These basins discharge to the Site Drainage Network when basin water levels become higher than a riser pipe. Water near the effluent point (i.e. where the basin water enters the riser pipe) will be captured from shore using a pole to reach to within 8 feet of the riser pipe, from the depth of the sediment basin equivalent to the height of the riser pipe. This method will capture water that is representative of the effluent from the sediment basins and is safe for the field team to implement.

Wastewater Treatment Plant Combined Influent

Grab samples will be collected from the combined influent to the wastewater treatment plant (WWTP, Location 22). WWTP influent consists of untreated Kuraray and DuPont process wastewater and non-process wastewater (i.e., Facility sanitary and utility water).

Temporal Composite Sample Considerations

Temporal composite samples are appropriate where variability is expected to be significant within a short time frame (e.g., one day). Temporal composite samples will be collected for locations containing stormwater including intake and outfall samples, since stormwater can have highly variable dissolved and suspended constituents loads over short time periods. Composite samples will be collected using a dedicated Teledyne 6712C autosampler equipped with a rain gauge or similar device. HDPE tubing, silicon tubing, and an HDPE sample reservoir will be used during sample collection. HDPE tubing will be placed at approximately the mid-depth of the water stream, held in place with a weight or a float, and capped with a stainless-steel strainer to avoid clogging the tubing. Field parameters will be measured twice for temporal composite samples: once during composite sampling (collected directly from the water stream), and once after composite sampling (collected from the autosampler reservoir). The field parameters recorded directly from the water stream will represent the instantaneous water quality for one timepoint. The field parameters recorded from the autosampler reservoir will represent the time integrated water quality for the entire composited sample.

Temporal composite samples will be collected once every two months when there is a 70% or greater chance of a storm event predicted to last at least 4 hours and have at least 0.5" of rainfall, following an antecedent dry period lasting at least 72 hours. National Oceanic and Atmospheric Administration (NOAA) weather data will be used to track regional weather and identify storm events that meet these criteria. Local and site meteorological data suggests that there will be multiple storm events of this nature in each two month period, however if there is a two month period with no storm events meeting these criteria, some stormwater sampling locations may not contain any water, in which case they will not be sampled. Autosamplers will be switched on 1-2 hours ahead of the predicted storm event, and they will start collecting aliquots once their dedicated rain gages or similar device collect 0.1" of water. Water will be composited over either 4 or 8 hours, depending on the predicted length of the storm event, and 10-12 aliquots will be composited over the course of the storm event. These criteria may be updated at a later date based on experiences and data from implementing these characterization events. Following sample collection, the composited samples will be poured into 250 mL HDPE bottles.

Since sorption and volatilization losses for PFAS are not well characterized, a grab sample will be collected at one temporal composite location during each sampling event. Detection and abundance of PFAS will be compared in the grab sample and the temporal composite sample to assess whether there were losses in the temporal composite sample.

Intake Sampling Point - Excess River Water Discharge Point

Intake water will be collected as a temporal composite sample at the point where Excess River Water (Location 1) discharges into the Site Drainage Network. Excess intake water is withdrawn from the Cape Fear River, but not used as process water or NCCW. It represents the chemical composition of river water prior to use as process and non-process water.

Outfall 002

Outfall 002 water will be collected as a temporal composite sample from the Open Channel just before entering the pipe to the river (Location 20). Outfall 002 is where stormwater, NCCW and treated, non-Chemours process wastewater combine prior to discharge to the Cape Fear River.

Wastewater Treatment Plant Discharge

The discharge from the WWTP will be collected at Outfall 001 (Location 8) as a composite sample.

3.3.3 Decontamination Protocol

Sample containers will be new and used only once for each sample and disposable equipment (e.g., gloves, tubing, etc.) will not be reused, therefore; these items will not require decontamination.

All non-dedicated or non-disposable sampling equipment (i.e., the autosampler reservoir and the aluminum pole) will be decontaminated immediately before sample collection in the following manner:

- De-ionized water rinse;
- Scrub with de-ionized water containing non-phosphate detergent (i.e., Alconox®); and
- De-ionized water rinse.

If there is a delay between decontamination and sample collection, decontaminated sampling equipment will be covered with PFAS-free plastic until it is ready for use.

3.4 Sample Shipping, Chain of Custody, and Holding Times

Upon sample collection, each containerized sample will be labelled and placed as soon as possible into a heavy plastic bag inside an insulated sample cooler with ice. The cooler will serve as a shipping container and will be provided by the laboratory along with the appropriate sample containers. Chemours will request that samples be analyzed by the laboratory within the holding times specified in Table 4. The additional samples collected at each location for potential future analyses will be stored under chain of custody (COC) in a secured, refrigerated location on site.

Prior to shipment of the samples to the laboratory, a COC form will be completed by the field sample custodian. Sample locations, sample identification numbers, description of samples, number of samples collected, and specific laboratory analyses to be performed on each sample will be recorded on the COC form. The COC will be signed by the field personnel relinquishing the samples to the courier and will be signed by the laboratory

upon receipt of the cooler. The cooler will be taped shut and signed across the lid of the cooler, and the laboratory personnel will confirm the signature is intact upon receipt.

3.5 Quality Assurance/ Quality Control

QA/QC activities will be performed in the field and in the laboratories to document the data quality. Each are described in the subsections below and summarized in Table 5.

3.5.1 Field QA/QC

Field QA/QC samples will be collected and analyzed along with the investigative samples to determine the potential bias and variability introduced in sample collection, storage, handling and shipping. Criteria for achieving data quality objectives for field QA/QC samples are summarized in Table 2. During the Initial Characterization period four types of field QA/QC samples will be collected: equipment blanks, trip blanks, field blanks and field duplicates.

Equipment Blanks

Equipment blanks (field rinsate blanks) are used to evaluate equipment and cleaning or decontamination procedures. At the sample location, laboratory-supplied analyte-free water will be poured over or through the clean, non-dedicated sampling equipment, and collected in a sample container. The equipment blank samples will then be shipped, stored and handled with the other samples and will be analyzed for the same parameters as other samples collected using the same device. Equipment blanks will be collected at a frequency of one per day during Initial Characterization and Ongoing Sampling.

Trip Blanks

Trip blanks are used to assess whether samples might be inadvertently contaminated during shipment and handling. The trip blanks will consist of a series of new containers filled with analyte-free water prepared by the laboratory analyzing the samples and will travel to the Facility with the empty sample bottles and back from the Facility with the investigative samples. Trip blanks will not be opened in the field. Trip blanks will be collected at a frequency of one per day during Initial Characterization and Ongoing Sampling.

Field Blanks

Field blanks are used to assess whether field conditions pose a potential for bias or variability in the results of analysis. The field blank will be collected by transferring laboratory-supplied analyte-free water into a sample container without contacting any other sampling equipment. Field blanks will be collected at a frequency of one per day during Initial Characterization and Ongoing Sampling.

Field Duplicates

Duplicate samples are collected to assess the precision of the laboratory analysis through calculation of the relative percent difference (RPD) between duplicate samples. The equation for calculating RPD is shown below:

$$RPD(\%) = \frac{|(Sample\ 1 - Sample\ 2)|}{\left[\frac{(Sample\ 1 + Sample\ 2)}{2}\right]} \times 100\%$$

RPDs less than or equal to 25% indicate acceptable precision at mid and high range concentrations; RPDs less than or equal to 50% indicate acceptable precision within a factor of five of the reporting limit. Duplicates will be collected in the same manner as investigative samples and the duplicate samples will be analyzed for the same parameters as the co-located investigative sample. Duplicates will be numbered sequentially with investigative samples so they are not identifiable by the analytical laboratories (i.e., “blind” duplicates). Field duplicate samples will be collected at a frequency of one duplicate for every 20 investigative samples (i.e., two duplicates for every sampling event).

3.6 Documentation

The project field team will keep a daily record of field activities during the execution of field work including sampling notes and observations, instrument calibration records, measured field parameters, sample COC and shipping records. All field collected data will be furnished to Chemours within 10 business days of the conclusion of the field event.

4. TEST METHODS AND LABORATORY STANDARDS

4.1 Analytical Methods

Collected samples will be analyzed by the following three laboratory methods:

- EPA Method 537 Mod (Laboratory SOP); and
- Table 3+ Laboratory SOP.

4.2 Laboratory QA/QC

Laboratory QA/QC procedures will be employed to document the quality of the data resulting from the analytical programs. Laboratory procedures will include method blanks, matrix spikes (MS), laboratory replicate samples, laboratory control samples (LCS), isotope dilution analytes (IDA), and continuing calibration verification (CCV) to verify and document the precision and accuracy of the results of analysis. The laboratory will prepare and analyze all samples according to their in-house Standard Operating Procedures (SOPs) and laboratory Quality Assurance Plans (QAPs). Data quality objectives for laboratory QA/QC samples are summarized in Table 2.

Method Blanks

Method blanks are used to evaluate laboratory contamination. Laboratory-supplied analyte-free water will be analyzed for the same parameters as investigative samples. Method blanks will be analyzed at a frequency of one per sample group up to 20 investigative samples at the laboratory. Method blanks with no detected target analytes are considered acceptable. If target analytes are detected in the method blanks, associated data for investigative samples will be B-qualified if the concentrations are less than 5-times higher than the concentration detected in the method blank.

Matrix Spike

A matrix spike (MS) is a subsample of an investigative sample to which the laboratory adds a spike containing target analytes at known concentrations prior to extraction/analysis of the sample to assess the effect of sample matrix on the extraction and analysis procedures. A matrix spike sample will be analyzed by the laboratory once for each sample group (of the same matrix) or at a minimum of one in every 20 samples

analyzed. The percent recovery of the MS is calculated to document the accuracy of the method for the matrix. Percent recovery is calculated as follows:

$$\% \text{ Recovery} = \left(\frac{\text{Amount of Spiked Sample} - \text{Amount of Sample Before Spike}}{\text{Amount of Spike}} \right) \times 100\%$$

Percent recoveries within the range of 70% to 130% indicate acceptable accuracy. If the percent recovery is greater than the range of acceptable accuracy, detected results will be J-qualified. If the percent recovery is lower than the range of acceptable accuracy, detected results will be J-qualified and non-detect results will be UJ-qualified. If the percent recovery is less than 10%, results may be R-qualified, pending evaluation by the data reviewer.

Laboratory Replicate Samples

Laboratory replicate samples are subsamples of the same investigative sample, split and analyzed by the laboratory to assess the precision of the laboratory analysis through calculation of the RPD. Laboratory replicate samples will be analyzed at a frequency of one per sample group, up to 20 investigative samples analyzed. RPDs less than or equal to 25% indicate acceptable precision at mid and high range concentrations; RPDs less than or equal to 50% indicate acceptable precision within a factor of five of the reporting limit. If the RPD is outside the acceptable precision range, associated results will be J-qualified.

Laboratory Control Samples (Second Source Standard)

LCS (otherwise known as second source standards) are samples prepared by the laboratory with known concentrations of target analytes prepared from a source that is different than the standards used to calibrate the instrument. The percent recovery of the LCS is calculated to document the accuracy of the method. LCS samples will be analyzed at a frequency of one per sample group. Percent recoveries within the range of 70% to 130% indicate acceptable accuracy. If the percent recovery is greater than the range of acceptable accuracy, detected results will be J-qualified. If the percent recovery is lower than the range of acceptable accuracy, detected results will be J-qualified and non-detect results will be UJ-qualified. If the percent recovery is less than 10%, results may be R-qualified, pending evaluation by the data reviewer.

Isotope Dilution Analytes (IDA)

Isotope dilution analytes (IDA) consist of carbon-13 labeled analogs, oxygen-18 labeled analogs, or deuterated analogs of the compounds of interest, and they are spiked into the samples at the time of extraction. This technique allows for the correction for analytical bias encountered when analyzing more chemically complex environmental samples. The isotopically labeled compounds are chemically similar to the compounds of concern and are therefore affected by sample-related interferences to the same extent as the compounds of concern. Compounds that do not have an identically labeled analog are quantitated by the IDA method using a closely related labeled analog. IDAs are added in known amounts to all (100%) investigative and quality control samples where appropriate IDAs are available. The percent recovery of the surrogate is calculated to document the accuracy of the method. Recoveries in the range of 25% to 150% indicate acceptable accuracy. If the percent recovery is outside the range of acceptable accuracy, detected results will be J-qualified. If the percent recovery is lower than the range of acceptable accuracy, detected results will be J-qualified and non-detect results will be UJ-qualified. If the percent recovery is less than 10%, results may be R-qualified, pending evaluation by the data reviewer.

Continuing Calibration Verification

CCV samples are samples prepared with known concentrations of target analytes from the primary standards used to calibrate the instrument. They are analyzed periodically to verify the instrument calibration is still acceptable before analyses are performed on investigative samples. A percent difference (%D) is calculated to document the continuing calibration of the instrument. %D values less than or equal to 30% indicate acceptable calibration. If the %D is outside the acceptable range, associated results detected at or above 5 times the PQL will be J-qualified.

5. DATA VERIFICATION

The analytical laboratory performing the analysis will provide all analytical data to Chemours' data verification contractor, AECOM's in-house Analytical Data Quality Management (ADQM) group. The data package will be reviewed by ADQM for compliance with the laboratory SOPs and usability. The laboratory will also deliver the analytical data electronically for upload to the Chemours Locus EIM™ database.

All data will be reviewed using the Data Verification Module (DVM). The DVM is an automated database algorithm developed by the ADQM group that includes a series of data quality checks, which are binary (yes/no) and do not require professional judgement. Manual review is performed after the DVM process to address validation components that are not readily automated. The data are evaluated against the following data usability checks:

- Field and laboratory blank contamination
- USEPA hold time criteria
- Missing quality control samples
- MS recoveries to verify measurement precision
- LCS recoveries verify measurement precision
- Surrogate spike recoveries to verify measurement accuracy
- RPD between field duplicate sample pairs to verify field duplicate precision
- Completeness as a percentage of the planned samples actually collected and analyzed
- Sensitivity of the PQL compared to regulatory standards or screening levels

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.

An individual DVM narrative report will be generated for each lot entered into the EIM™ database which will summarize any samples that are qualified, the specific reasons for the qualification, and the potential bias in reported results.

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

6. REPORTING

Quarterly reports will be submitted for the Initial Characterization as specified in subpart 11(c) of the executed Consent Order. In compliance with Subpart 11(d), Chemours will report quarterly during the Ongoing Sampling period. Sampling will be performed every two months beginning within 30 days of approval of this Sampling Plan. The sampling and reporting schedule is summarized in Figure 3. Each quarterly report will include a map of sample locations, data tables of measured concentrations and data review summary.

7. REFERENCES

AECOM, 2018. Poly and Perfluoroalkyl Substance Quality Assurance Project Plan for the Chemours Corporate Remediation Group. August, 2018.

Chemours, 2017. Chemours Announces Voluntary Actions to Respond to North Carolina Community. <http://pages.chemours.com/FayettevilleStatement.html>. Accessed March 18, 2018.

Chemours, 2018 – May 2018 abatement measures.

TABLES

**TABLE 1
PFAS AND ASSOCIATED METHODS
Chemours Fayetteville Works, North Carolina**

Analytical Method	Common Name	Chemical Name	CASN	Chemical Formula	PQL (ng/L)	
					TestAmerica	Eurofins Lancaster
Table 3+ Lab SOP	HFPO-DA	Hexafluoropropylene oxide dimer acid	13252-13-6	C6HF11O3	2.0	2.0
	PEPA	Perfluoroethoxypropyl carboxylic acid	267239-61-2	C5HF9O3	20	20
	PFECA-G	Perfluoro-4-isopropoxybutanoic acid	801212-59-9	C12H9F9O3S	2.0	2.0
	PFMOAA	Perfluoro-2-methoxyacetic acid	674-13-5	C3HF5O3	5.0	5.0
	PFO2HxA	Perfluoro(3,5-dioxahexanoic) acid	39492-88-1	C4HF7O4	2.0	2.0
	PFO3OA	Perfluoro(3,5,7-trioxaoctanoic) acid	39492-89-2	C5HF9O5	2.0	2.0
	PFO4DA	Perfluoro(3,5,7,9-tetraoxadecanoic) acid	39492-90-5	C6HF11O6	2.0	2.0
	PMPA	Perfluoromethoxypropyl carboxylic acid	13140-29-9	C4HF7O3	10	10
	Hydro-EVE Acid	Perfluoroethoxyspropanoic acid	773804-62-9	C8H2F14O4	2.0	2.0
	EVE Acid	Perfluoroethoxypropionic acid	69087-46-3	C8HF13O4	2.0	2.0
	MMF	Difluoromalonic acid	1514-85-8	C3H2F2O4	100	100
	MTP	Perfluoro-2-methoxypropanoic acid	93449-21-9	C4H4F4O3	20	20
	PPF Acid	Pentafluoropentonic acid	422-64-0	C3HF5O2	20	20
	PFECA B	Perfluoro-3,6-dioxahexanoic acid	151772-58-6	C5HF9O4	2.0	2.0
	R-EVE	R-EVE	N/A	C8H2F12O5	2.0	2.0
	PFO5DA	Perfluoro-3,5,7,9,11-pentaoxadecanoic acid	39492-91-6	C7HF13O7	2.0	2.0
	Byproduct 4	Byproduct 4	N/A	C7H2F12O6S	2.0	2.0
	Byproduct 6	Byproduct 6	N/A	C6H2F12O4S	2.0	2.0
	Byproduct 5	Byproduct 5	N/A	C7H3F11O7S	2.0	2.0
	DFSA	Difluoro-sulfo-acetic acid	422-67-3	C2H2F2O5S	100	100
	NVHOS	Perfluoroethoxysulfonic acid	1132933-86-8	C4H2F8O4S	2.0	2.0
	PES	Perfluoroethoxyethanesulfonic acid	113507-82-7	C4HF9O4S	2.0	2.0
	PFESA-BP1	Byproduct 1	29311-67-9	C7HF13O5S	2.0	2.0
PFESA-BP2	Byproduct 2	749836-20-2	C7H2F14O5S	2.0	2.0	
EPA Method 537 Mod	PFBA	Perfluorobutanoic acid	375-22-4	C4HF7O2	2.0	5.5
	PFDA	Perfluorodecanoic acid	335-76-2	C10HF19O2	2.0	1.8
	PFDoA	Perfluorododecanoic acid	307-55-1	C12HF23O2	2.0	1.8
	PFHpA	Perfluoroheptanoic acid	375-85-9	C7HF13O2	2.0	0.91
	PFNA	Perfluorononanoic acid	375-95-1	C9HF17O2	2.0	1.8
	PFOA	Perfluorooctanoic acid	335-67-1	C8HF15O2	2.0	0.91
	PFPeA	Perfluorohexanoic acid	307-24-4	C5HF9O2	2.0	1.8
	PFPeA	Perfluoropentanoic acid	2706-90-3	C5HF9O2	2.0	5.5
	PFTeA	Perfluorotetradecanoic acid	376-06-7	C14HF27O2	2.0	0.91
	PFTriA	Perfluorotridecanoic acid	72629-94-8	C13HF25O2	2.0	0.91
	PFUnA	Perfluoroundecanoic acid	2058-94-8	C11HF21O2	2.0	1.8
	PFBS	Perfluorobutanesulfonic acid	375-73-5	C4HF9SO	2.0	0.91
	PFDS	Perfluorodecanesulfonic acid	335-77-3	C10HF21O3S	2.0	1.8
	PFHpS	Perfluoroheptanesulfonic acid	375-92-8	C7HF15O3S	2.0	1.8
	PFHxS	Perfluorohexanesulfonic acid	355-46-4	C6HF13SO3	2.0	1.8
	PFNS	Perfluoronanesulfonic acid	68259-12-1	C9HF19O3S	2.0	1.8
	PFOS	Perfluorooctanesulfonic acid	1763-23-1	C8HF17SO3	2.0	1.8
	PFPeS	Perfluoropentanesulfonic acid	2706-91-4	C5HF11O3S	2.0	1.8
	10:6 FTS	10:2-fluorotelomersulfonic acid	120226-60-0	C12H5F21O3	2.0	2.7
	4:2 FTS	4:2 fluorotelomersulfonic acid	757124-72-4	C6H5F9O3S	20	2.7
	6:2 FTS	6:2 fluorotelomersulfonic acid	27619-97-2	C8H5F13SO3	20	1.8
	8:2 FTS	8:2 fluorotelomersulfonic acid	39108-34-4	C10H5F17O3S	20	5.5
	NEtFOSAA	NEtFOSAA	2991-50-6	C12H8F17NO4S	20	2.7
	NEtPFOSA	NEtPFOSA	4151-50-2	C10H6F17NO2S	2.0	8.2
	NEtPFOSAE	NEtPFOSAE	1691-99-2	C12H10F17NO3S	2.0	2.7
	NMeFOSAA	NMeFOSAA	2355-31-9	C11H6F17NO4S	20	2.7
	NMePFOSA	NMePFOSA	31506-32-8	C9H4F17NO2S	2.0	8.2
	NMePFOSAE	NMePFOSAE	24448-09-7	C11H8F17NO3S	2.0	2.7
	PFDOS	Perfluorododecanesulfonic acid	79780-39-5	C12HF25O3S	2.0	0.91
	PFODA	Perfluorohexadecanoic acid	67905-19-5	C16HF31O2	2.0	0.91
PFODA	Perfluorooctadecanoic acid	16517-11-6	C18HF35O2	2.0	1.8	
PFOSA	Perfluorooctanesulfonamide	754-91-6	C8H2F17NO2S	2.0	2.7	

Notes:

- PQLs are listed as of March 31, 2019.
- EPA - Environmental Protection Agency
- ng/L - nanograms per liter
- PFAS - per- and polyfluoroalkyl substances
- PQL - practical quantitation limit
- SOP - Standard Operating Procedure

TABLE 2
CRITERIA FOR ACHIEVING DATA QUALITY OBJECTIVES
Chemours Fayetteville Works, North Carolina

Category	Data Quality Objective	Criteria
Precision	Field Duplicate RPD (%)	25*
	Lab Replicate RPD (%)	25*
Accuracy	MS % Recovery	70-130
	LCS % Recovery	70-130
	Isotope Dilution Analyte % Recovery	25-150
Calibration	CCV % Difference	70-130
Completeness	% Complete	90

Notes

* RPD criteria is 25%, or 50% within a factor of five of the reporting limit.
Criteria may be replaced by statistical limits generated by the laboratory(ies).
CCV - continuing calibration verification
LCS - laboratory control sample
MS - matrix spike
RPD - relative percent difference

**TABLE 3
DESCRIPTION OF SAMPLING LOCATIONS
Chemours Fayetteville Works, North Carolina**

Sample Number	Sample Location Description	Sample Category				
		Sampling Method	Intake/Outfall	Process water	Non-process wastewater	Stormwater
1	Discharge point of excess river water (i.e., water drawn from the Cape Fear River, but not used as process water or NCCW) to characterize background levels of PFAS	Temporal Composite	Intake			
2	Kuraray northern leased area stormwater discharge	Temporal Composite				✓
3	Chemours PPA area stormwater discharge	Temporal Composite				✓
4	Combined stormwater discharge from Kuraray northern leased area and Chemours PPA area	Temporal Composite				✓
5	Kuraray southern leased area stormwater	Temporal Composite				✓
6A*	Kuraray southern leased area NCCW discharge - Vacuum Condenser	Grab			✓	
6B*	Kuraray southern leased area NCCW discharge - Resins Area	Grab			✓	
7A	Combined stormwater and NCCW discharge from western portion of the Facility	Temporal Composite			✓	✓
7B	Combined stormwater and NCCW discharge from western portion of the Facility and treated discharge from WWTP	Temporal Composite**		✓	✓	✓
8*	Outfall 001 - Wastewater Treatment Plant Discharge to open channel flowing to Outfall 002. Contains treated non-Chemours process wastewater and treated sanitary water.	Temporal Composite		✓	✓	
9	Chemours Monomers IXM NCCW and stormwater discharge including stormwater from Vinyl Ethers South and Vinyl Ethers North	Temporal Composite			✓	✓
10	Chemours Monomers IXM area stormwater discharge	Temporal Composite				✓
11	Stormwater discharge from portion of grassy field to north of decommissioned Chemours Teflon area.	Temporal Composite				✓
12	DuPont area southern drainage ditch stormwater discharge and NCCW	Temporal Composite			✓	✓
13	DuPont area northern drainage ditch stormwater discharge and NCCW	Temporal Composite			✓	✓
14	DuPont area southeast stormwater and NCCW discharge	Temporal Composite			✓	✓
15	Combined stormwater and NCCW discharge from eastern portion of the Facility	Temporal Composite			✓	✓
16	Chemours Monomers IXM Area combined process wastewater	Grab		✓		
17A	Chemours PPA Area waste acid stream into trailer	Grab		✓		
17B	Chemours PPA Area waste rinse water trailer	Grab		✓		
18*	Kuraray process wastewater	Grab		✓		
19A*	DuPont process wastewater, Plant 1	Grab		✓		
19B*	DuPont process wastewater, Plant 2	Grab		✓		
20	Outfall 002 pipe to Cape Fear River	Temporal Composite	Outfall			
21A	Sediment Basin South	Grab			✓	✓
21B	Sediment Basin North	Grab			✓	✓
22*	WWTP Combined Influent	Grab		✓	✓	
23A*	Kuraray northern leased area combined process wastewater and non-process wastewater	Grab		✓	✓	
23B*	Kuraray laboratory process wastewater‡	Grab		✓		
24A*	Chemours Monomers IXM Vinyl Ethers South NCCW	Grab			✓	
24B*	Chemours Monomers IXM Line 3 and Line 4 Extruder NCCW	Grab			✓	
24C*	Chemours Monomers IXM Water Return Header NCCW	Grab			✓	

Notes

Sample numbers refer to locations identified in Figure 2

Some locations will be collected as split locations (e.g., "A" and "B" samples) during the first sampling event. These split locations may be composited into a single sample for analysis in subsequent sampling events if the composition of the split samples are similar to each other in compounds detected and concentrations of detected compounds.

NCCW - non-contact cooling water

PPA - polymer processing aid

WWTP - Wastewater treatment plant

* - Samples will be collected during dry weather only, on the next working day with dry weather following a storm event.

** - Location 7B will be a grab sample for the first sampling event due to time constraints associated with acquiring an autosampler. For subsequent events, Location 7B will be a temporal composite sample.

‡ - Location 23B will be sampled during the first sampling event. If analytical results indicate PFAS concentrations greater than historical ranges for PFAS intake water then this location will also be sampled in subsequent sampling events.

**TABLE 4
 SAMPLING CONTAINERS, PRESERVATION, AND HOLDING TIMES
 Chemours Fayetteville Works, North Carolina**

Analytical Method	Container Type and Volume	Number of Containers	Preservation	Holding Times	
				TestAmerica	Eurofins Lancaster
EPA Method 537 Mod	250 mL HDPE	2	None	14 days to extraction, 40 days to analysis	14 days to extraction, 28 days to analysis
Table 3+ Lab SOP	250 mL HDPE	1	None	28 Days	14 days
Non-Targeted Analysis ⁽¹⁾	250 mL HDPE	4 ⁽¹⁾	None	14 days to extraction, 40 days to analysis	14 days to extraction, 28 days to analysis
Archived for potential future analyses	250 mL HDPE	4	None	14 days to extraction, 40 days to analysis	14 days to extraction, 28 days to analysis

Notes:

HDPE - high density polyethylene
 SOP - Standard Operating Procedure

(1) - Simultaneous samples will be collected for non-targeted analysis at select locations during the first sampling event, and at Location 16 (Monomers IXM process wastewater) during each sampling event for the first year. The field team implementing this plan should refer to the PFAS Non-Targeted Analysis and Methods Development Plan (Chemours, January 2019) for details on sample locations.

TABLE 5
QUALITY ASSURANCE/ QUALITY CONTROL SAMPLES
Chemours Fayetteville Works, North Carolina

Analytical Method	Field					Lab					
	Investigative Samples ¹ (per event)	Equipment Blank (per day)	Trip Blank (per day)	Field Blank (per day)	Field Duplicate (per 20 samples)	Method Blank (per sample group)	Matrix Spike (per sample group)	Lab Replicate (per sample group)	Lab Control Sample (per sample group)	Isotope Dilution Analytes ¹ (every sample)	Continuing Calibration Verification (beginning of each group)
EPA Method 537 Mod	32	1	1	1	1	1	1	1	1	32	1
Table 3+ Lab SOP	32	1	1	1	1	1	1	1	1	N/A	1

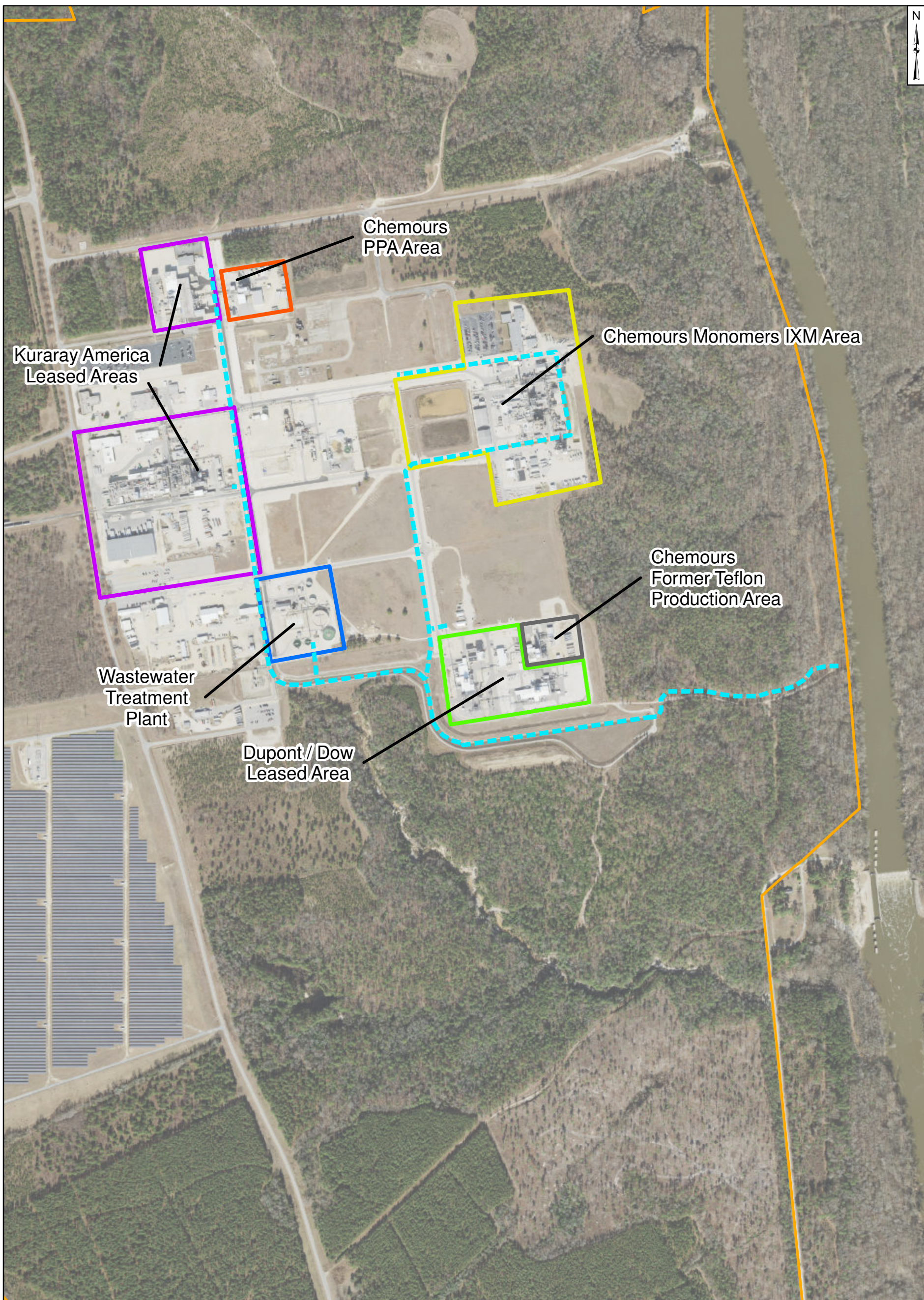
Notes:

1 - Number of samples may be subject to change following Initial Characterization

N/A - none available at present

SOP - Standard Operating Procedure

FIGURES



Legend

- Drainage Network
- Site Boundary
- Areas at Site**
- Chemours Monomers IXM Area
- Chemours PPA Area
- Dupont / Dow Leased Area
- Chemours Former Teflon Production Area
- Kuraray America Leased Area
- 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 Location

Chemours Fayetteville Works, North Carolina

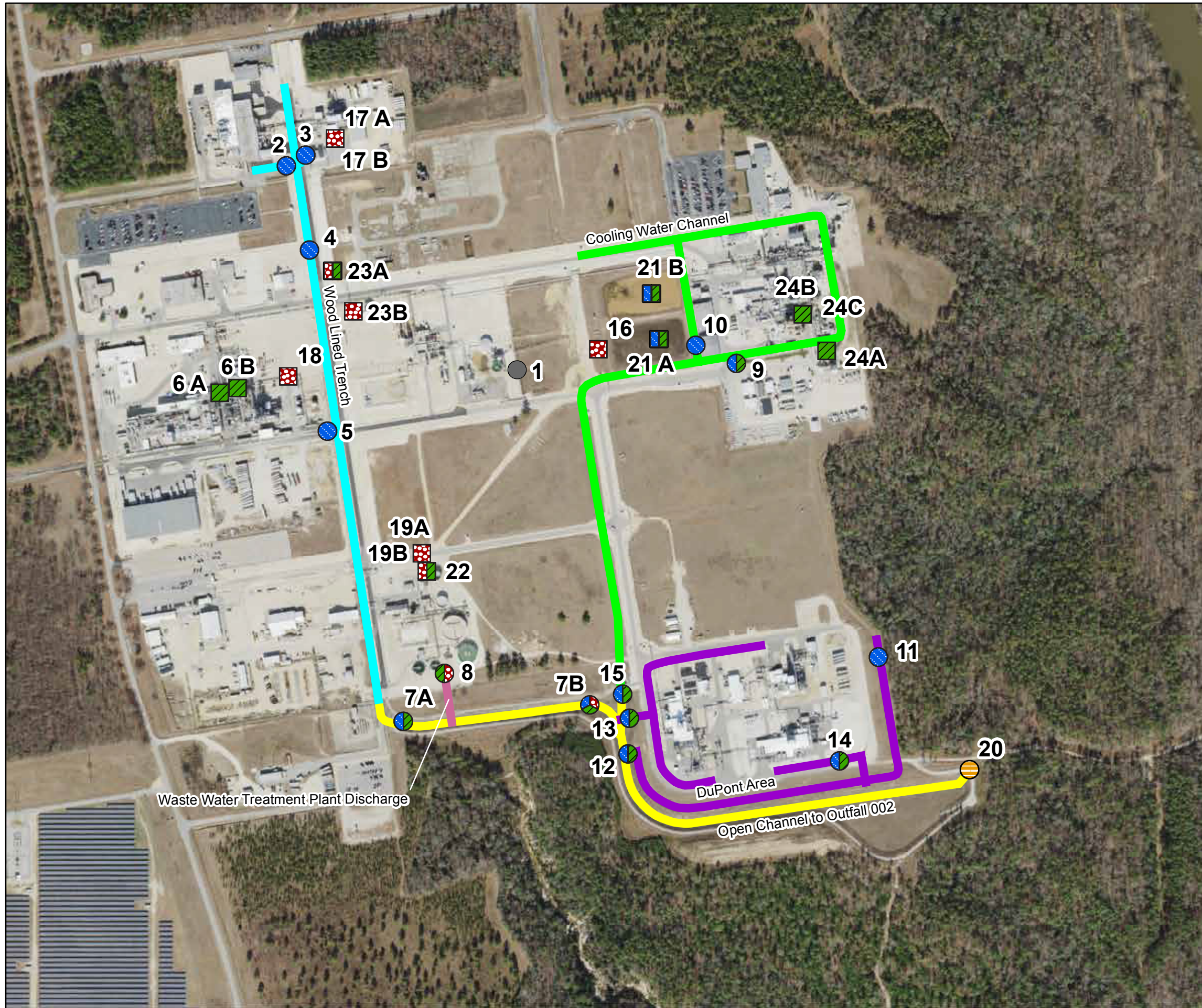
Geosyntec
 Consultants of NC, PC
 NC License No.: C-3500

Figure



1

Raleigh






May 2019








Legend

-  Temporal Composite Sample
-  Grab Sample

Sample Location Category

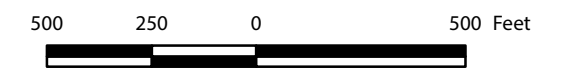
-  Outfall
-  Intake
-  Process wastewater
-  Non-process wastewater
-  Stormwater

Ditch Types

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

Notes:

Location 7B will be a grab sample for the first sampling event due to time constraints associated with acquiring an autosampler. For subsequent events, Location 7B will be a temporal composite sample.



Sample Locations

Chemours Fayetteville Works, North Carolina

Geosyntec
 Consultants of NC, PC
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Raleigh

May 2019

Figure


2

Projection: NAD 1983 StatePlane North Carolina FPS 3200 Feet; Units in Foot US

Project Milestone/Deliverable	2019												2020												2021												2022									
	01	02	03	04	05	06	07	08	09	10	11	12	01	02	03	04	05	06	07	08	09	10	11	12	01	02	03	04	05	06	07	08	09	10	11	12	01	02	03	04	05	06	07	08		
Approval of Sampling Plan					✓																																									
Initial Characterization (IC)				--	--	--	--	--	--	--	--	--																																		
IC Sampling Events				●		●		●		●		●			●																															
IC Quarterly Reports					○			○			○				○																															
Scope updates, regulatory approval															□																															
Initial Characterization Final Report																				◆																										
Ongoing Sampling (OS)																	--	--	--	--	--	--	--	--																						
OS Sampling Events					●			●		●		●			●		●		●		●		●				●		●		●		●		●		●									
OS Quarterly Reports																					○		○				○		○		○		○		○		○									
Scope updates, regulatory approval																																														
Ongoing Sampling Final Report																																														

Notes:

- Timespan for major tasks
- ✓ Anticipated approval of sampling plan
- Bimonthly sampling event. This schedule assumes that storm events will occur resulting in enough rain such that water is present at all sampling locations in the stormwater drainage network for the proposed sampling events.
- Quarterly reports
- Scope updates and regulatory approval following Initial Characterization and Ongoing Sampling. The number of locations may be reduced following Initial Characterization, and the frequency of sampling events may be reduced following Ongoing Sampling.
- ◆ Final reports

Gantt Chart of Proposed Sampling Schedule Chemours Fayetteville Works, North Carolina	
 Consultants of NC, PC NC License No.: C-3500	
Raleigh	May 2019
Figure 3	