Arlington County Wet Weather Monitoring Plan
MS4 Permit VA0088579 (2021-2026 Permit Cycle)

Adapted from the Arlington County Wet Weather and High Risk Screening Program: Site Selection and Screening (2016 version) prepared by Versar, Inc.

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Introduction and Purpose

Arlington County's Municipal Separate Storm Sewer System (MS4) permit requires the County to continue to implement a wet weather monitoring program in addition to other required monitoring (section C) to characterize the stormwater discharged to and from the MS4. Implementation of other MS4 programs, including Industrial and High-Risk Runoff and Dry Weather Screening and Source Identification support and complement this effort.

The purpose of this updated plan is to provide information on monitoring locations and outline the methodology that will be implemented for selected screening sites for compliance with the County's 2021-2016 MS4 permit, section 1.B.12.b.

This plan builds on the information and assessments conducted for the County's pervious plan, Arlington County Wet Weather and High-Risk Screening Program: Site Selection and Screening Plan, developed by Versar, Inc. for implementation during Arlington County's previous MS4 permit cycle, 2013-2018 plus the administrative continuance period (July 2018- June 2021).

This updated wet weather monitoring plan contains the following:

- Information on site selection and location
- Monitoring parameters
- Field protocols
- Data management / quality control
- Notification procedures
- Health and safety procedures
- References

Site Selection Process

The County's MS4 permit requires monitoring at two stormwater outfalls within the County during the term of the permit. Outfall monitoring locations were selected based on following criteria established by the Virginia Department of Environmental Quality (DEQ) and specified in the permit.

The two outfall monitoring locations shall be selected with preference for sites meeting the following criteria:

- *Located in a drainage area with a land use that is suspected to contribute significant pollutant loads to the County's MS4;*
- *Located with a receiving water listed as impaired in the Virginia 2020 305(b)/303(d) Water Quality Assessment Integrated Report;*
- *Located downstream of a Best Management Practice (BMP) to assist with evaluation of the implemented control; and*
- *The permittee can provide a paired comparison to a drainage area with a less intensive land use provided the three criteria listed immediately above are first considered*.

The County reevaluated sites that were identified in its previous wet weather screening plan as having a high potential to contribute pollutant loading to the MS4 and surface waters. That plan outlined the methodology used to select site locations, which involved using geographic information system (GIS) and land use data to identify potential high-risk facilities/areas within the County's MS4 service area. Categories of criteria used to identify these locations included land use type, parking lot / impervious

surface area, facility or building age, and property classification. Focus areas included commercial and industrial operations such as automotive service businesses, gas stations, and high-density commercial areas (grocery stores, warehouses, restaurants, and shopping strips). Field reconnaissance was conducted to assess and evaluate conditions at the identified locations. Conditions were noted on inspection forms as well as photo documented. Using this information, sites were ranked and prioritized according to their potential to contribute significant pollutant loading to the MS4. The site list continues to be maintained and evaluated as part of the County's Industrial and High-Risk Runoff inspection and Dry Weather Screening programs that include annual inspections and screenings.

Sites that discharge to the County's MS4 that have coverage under a general or individual Virginia Pollution Discharge Elimination Systems (VPDES) permit were not included in the location selection process.

Selection of monitoring locations also considered factors such as property ownership, ownership of the stormwater infrastructure, easements, access to the stormwater outfall, ability to situate and secure monitoring equipment, and safety of the area. In many instances, stormwater infrastructure or access to an outfall may be located on private property. Easements or permission from property owners would be required for monitoring at these outfalls.

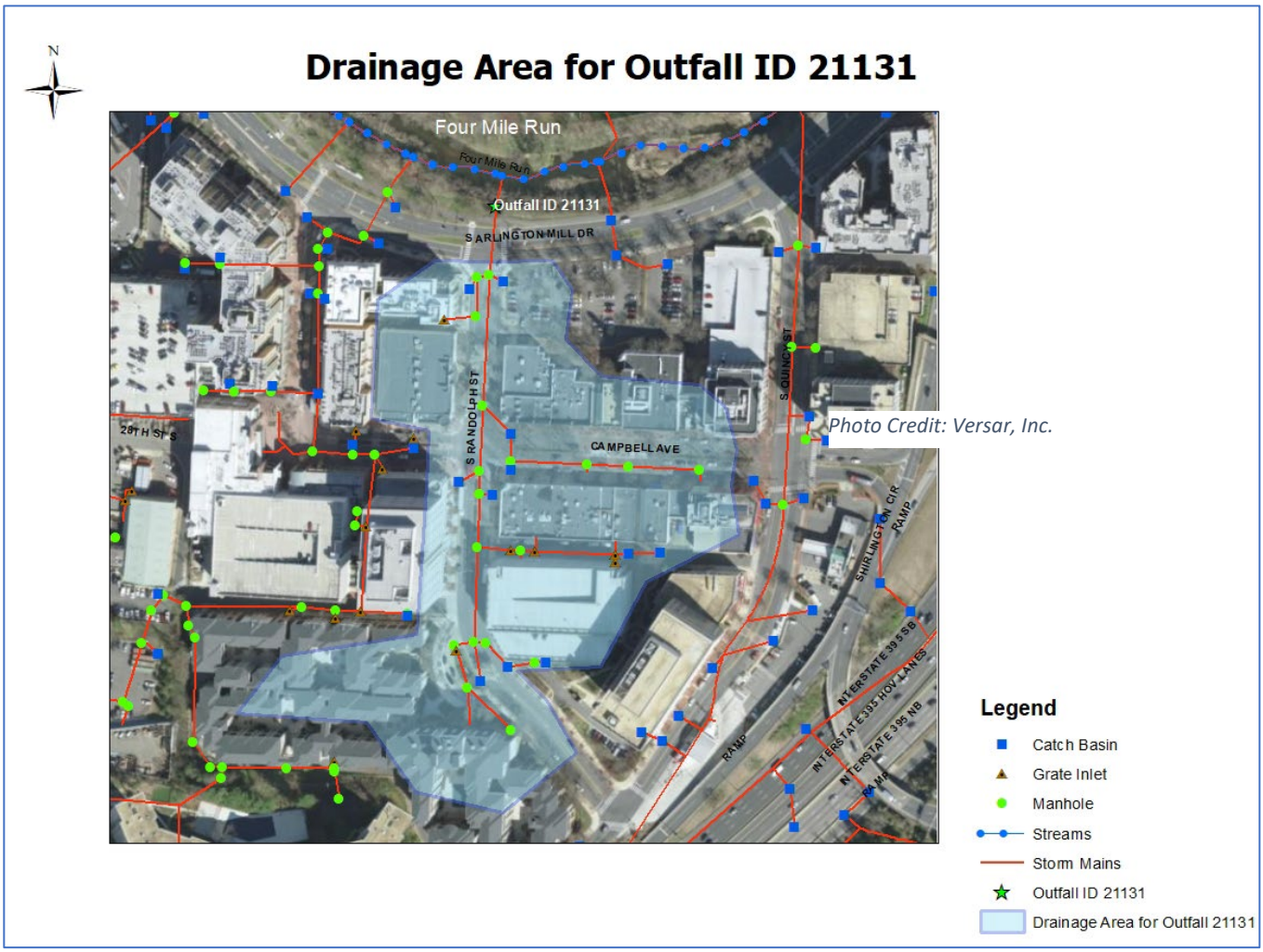
Additionally, outfalls that received runoff from a specific discrete parcel or area were prioritized to better evaluate the operations and land use/cover in the isolated drainage area and associated pollutants being discharged from the drainage area. If monitoring continues for a sufficient length of time, this could assist the County with evaluating any trends and/or assessing changes that may be seen as a result of implementation of structural or non-structural best management practices and/or pollution prevention controls in these specific drainage areas.

Selected Outfall Locations

Wet weather monitoring will be conducted at the following locations during the 2021-2026 permit cycle.

Outfall 21131

Outfall 21131 is located in the Four Mile Run Watershed and discharges to Four Mile Run, which is listed as an impaired surface water in the Virginia Department of Environmental Quality 2020 305(b)/303(d) Water Quality Assessment Integrated Report. The report lists use impairments for aquatic life, recreation, and fish consumption associated with *Escherichia coli* (*E. coli*) bacteria, chlordane in fish tissue, PCBs in fish tissue, and benthic macroinvertebrate bioassessment.



The drainage area to Outfall 21131 is approximately 10.3 acres. The outfall drains a large commercial and high-density commercial area where the land use and operations have the potential to contribute significant pollutant loads to the County's MS4 and surface waters. The commercial parcel includes numerous restaurants, retail businesses, a hotel, parking areas, loading / delivery areas, and outdoor waste management areas.

There is a potential for pollutants such as trash, bacteria, nutrients, metals, hydrocarbons, and detergents to be discharged to Four Mile Run via stormwater runoff from this drainage area. Many of these pollutants have been identified during previous screenings and conditions observed during past site inspections. The County has also responded to illicit discharge reports in this location.

The County has conducted wet weather and dry weather screening in this location during the previous MS4 permit cycle. Data collected during this permit cycle can be compared to previous screening results. Hot spot inspections have also been conducted. It is anticipated that dry weather screening will also be conducted at this outfall as well as continued high-risk runoff inspections.

Also, for this location, the County can work with property management representatives in this drainage area and focus messaging on best management practices (BMP) including outside good housekeeping efforts and preventing non-stormwater discharges such as wash water runoff.

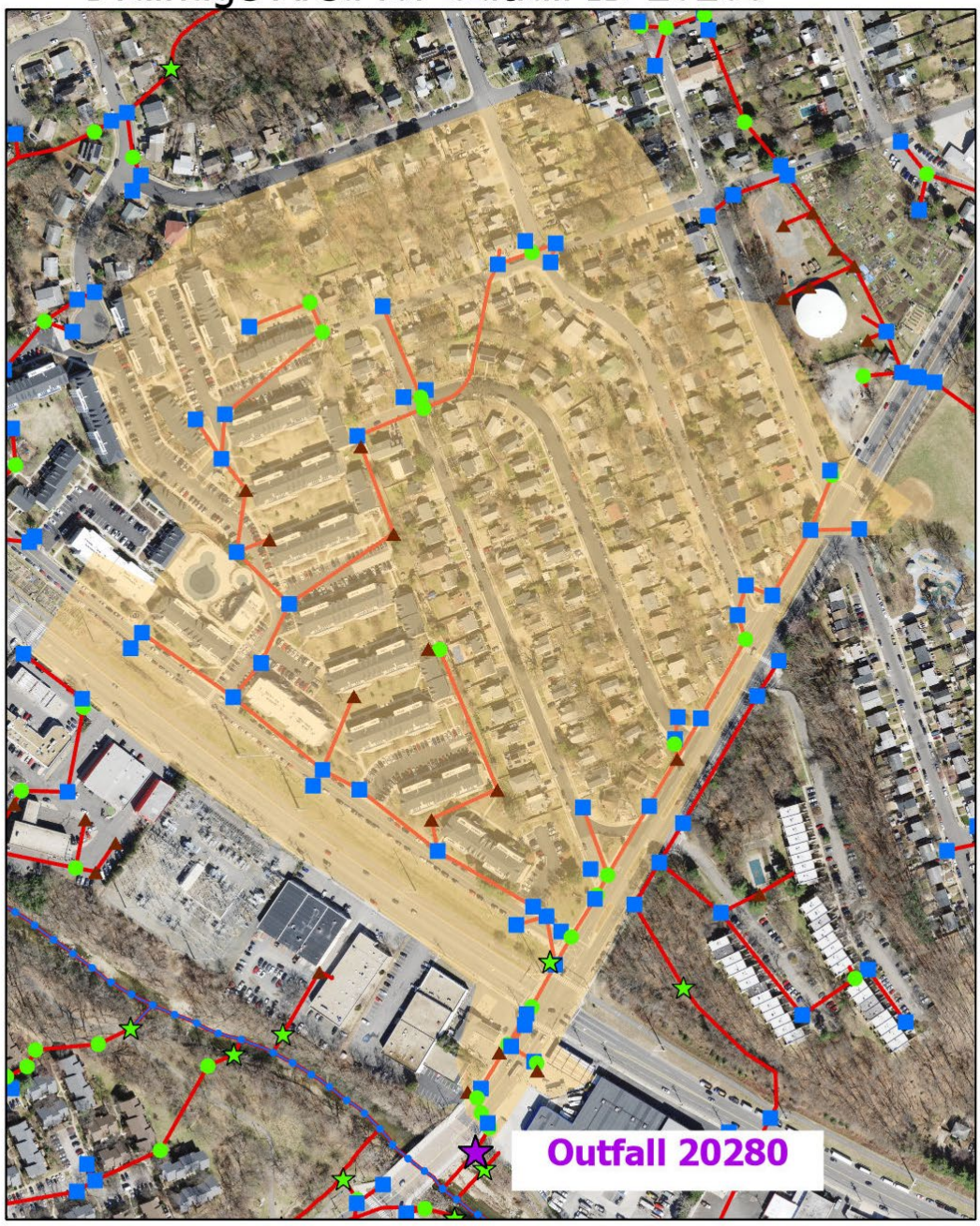
Outfall 20280

For the second quarter in FY24 (permit year 3), the County switched outfall locations due to access issues. Outfall 20280 is located in the Four Mile Run Watershed and discharges to Four Mile Run, which is listed as an impaired surface water in the Virginia Department of Environmental Quality 2020 305(b)/303(d) Water Quality Assessment Integrated Report. The report lists use impairments for aquatic life, recreation, and fish consumption associated with *Escherichia coli* (*E. coli*) bacteria, chlordane in fish tissue, PCBs in fish tissue, and benthic macroinvertebrate bioassessment.

The drainage area to Outfall 20280, shown shaded in the map below, is approximately 48.2 acres. The outfall drains roads that receive runoff from commercial and high-density residential areas that have the potential to contribute significant pollutant loads to the County's MS4 and surface waters. Pollutants that may be discharged include trash, bacteria, nutrients, metals, hydrocarbons, and detergents.

This outfall is screened as part of the County's dry weather monitoring program. The County has also responded to illicit discharge reports in this location.

Drainage Area for Outfall ID 20280



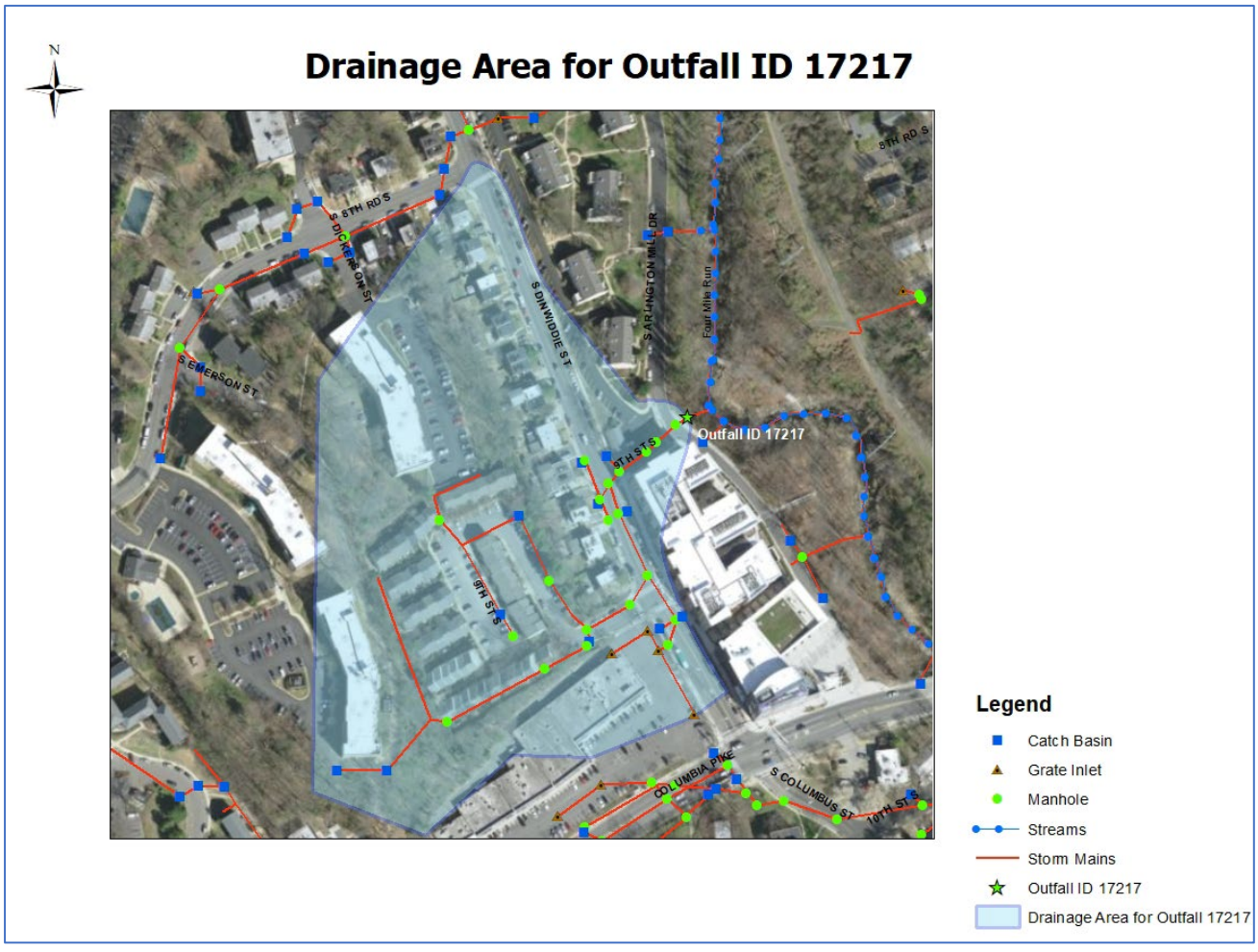
Legend

- Catch Basin
- End Wall / End Section
- Grate Inlet
- Manhole
- Drainage Area Outfall ID 20280
- Stream
- Storm Pipes
- Outfall ID 20280

Outfall 17217

Plan update (November 2023) - Screening was conducted at this outfall beginning in October 2021. In October 2023, it was determined that access to the outfall to conduct screening had become a significant safety risk to staff because of increased bank erosion and limited accessibility. The County will continue to conduct dry weather screening at this outfall as well as conducted commercial site inspections in the drainage area.

Outfall 17217 is located in the Four Mile Run watershed. The outfall discharges stormwater runoff to Four Mile Run, which is listed as an impaired surface water in the Virginia Department of Environmental Quality 2020 305(b)/303(d) Water Quality Assessment Integrated Report. The report lists use impairments for aquatic life, recreation, and fish consumption associated with *Escherichia coli* (*E. coli*) bacteria, chlordane in fish tissue, PCBs in fish tissue, and benthic macroinvertebrate bioassessment.



The drainage area to Outfall 17217 is approximately 12.7 acres (shown in the shaded area in the map above). The land use in the drainage area for Site 1 is classified as commercial and high density residential. The drainage area includes a commercial retail strip (Columbia Pike Plaza) that includes a grocery store, several restaurants, other retail establishments, and a large parking area. There are numerous dumpsters, used grease containers, and storage containers located in the alley behind the

retail strip. The drainage area also includes older high density residential properties that were developed prior to stormwater management requirements that required water quality treatment. A portion of S. Dinwiddie Street is included in this drainage area, which receives significant vehicular traffic. Given the proximity to the Arlington Mill Community Center, Arlington Mill Residences, Arlington Run town home community, shopping area, and access to Columbia Pike, there are several public transit stops along S Dinwiddie Street that are used by the community.

This is considered a high-risk drainage area given the potential to contribute significant pollutant loading to the County's MS4 and Four Mile Run. There is a potential for pollutants such as trash, bacteria, metals, hydrocarbons, and detergents to be discharged to Four Mile Run via stormwater runoff from the landscape.

The County has conducted wet weather and dry weather screening in this location during the previous MS4 permit cycle. Data collected during this permit cycle can be compared to previous screening results. High risk runoff or "hot spot" inspections have also been conducted in this area. The County has received reports about unauthorized and non-stormwater discharges and inadequate housekeeping in this area. Discharges associated with washing operations and parking lot maintenance have been documented in the past.

The County will work with property management representatives in this drainage area as needed to focus messaging on best management practices (BMP) including outside good housekeeping efforts and preventing non-stormwater discharges such as wash water runoff.

Field Protocol for Wet Weather Monitoring

This section details the water quality and floatables sampling protocols to be followed during implementation of wet weather monitoring, including descriptions of sampling equipment, constituents monitored, sampling frequency, and antecedent conditions. Specific information related to operating sampling equipment and health and safety procedures are provided in Appendix A and Appendix D, respectively.

Monitoring Station Preparation

An inspection of the outfall is conducted by field staff when ancillary monitoring equipment is installed. Any indicators of illicit (unauthorized non-stormwater) discharges are noted in the installation log / data sheet. Indicators include presence of rancid, chemical or petroleum odors, buildup of stains or deposits along the wetted perimeter of the pipe that are not generally associated with stormwater runoff, or presence of floatables on a debris line within the pipe. The condition of the outfall and surrounding area is also evaluated and documented.

Sampling Method

The preferred sampling method uses an electronic, automated sampler, which collects discrete samples of runoff at specific intervals throughout a storm event. Automated samplers and flow logging techniques are used to sample runoff from areas that be contributing significant pollutant loading to receiving surface waters. Sampling repeatedly throughout a storm is important because various pollutants of concern mobilize and are delivered to the MS4 at different times depending on the rate and duration of rainfall. This method of sampling also allows for unattended monitoring in the event of

overnight storm events. A discharge volume-weighted composite sample provides an accurate representation of the overall concentration of given analyte in the runoff from a site. Wet weather monitoring the County's permit program is intended as a screening tool rather than a long-term monitoring program at any particular site.

Automated samplers (ISCO model 6712C or equivalent) are attached to the selected MS4 outfall. The storm drain network that leads to the outfall should only receive runoff from a distinct area so that the area is isolated from runoff from other areas and potential pollutant inputs.

Grab sampling is also conducted in addition to automatic sampling approaches. A grab sample is taken by hand at a specific point in time during the storm's progress (e.g., during first flush). Certain parameters are at their highest concentrations during the initial stages of a runoff event. Grab samples are taken remotely by using an extender pole with swing sampler attached. A Teflon pitcher is attached to the swing sampler.

One grab sample and one composite sample are obtained at each sampling point and transported to an approved certified analytical laboratory to be tested for the selected suites of analytes listed in the next section. The grab sample is used for measuring pH, temperature and specific conductivity and testing *E. coli* and TPH concentrations. When sampling using manual means for TPH is impractical due to site conditions or timing of the storm event, the first flush sample obtained by the automated sampler will be used for this parameter.

The composite, automated sample is tested for the remaining parameters. Samples obtained by grab and automated means are transferred to laboratory bottles of the required type and containing appropriate preservative.

Flow rates are logged at all sampling points to enable flow-weighted compositing of samples. The flow-logging apparatus is secured (e.g., with scissors ring) within the pipe for the duration of screening at a site (i.e., four monitoring events /storms). Individual samples are combined into a discharge volume-weighted composite sample. Field technicians measure composite pH and specific conductivity before delivering samples to the laboratory.

Monitoring Constituents

Categories of constituents to be sampled and tested are nutrients, sediment, bacteria, metals, and other water quality parameters typically used to assess water quality. These constituents are commonly found in urban stormwater runoff. The following list of constituents will be monitored as part of the County's wet weather monitoring program:

- *E. coli*
- Nitrate and Nitrite Nitrogen
- Total Kjeldahl Nitrogen
- Total Phosphorus
- Total Suspended Solids
- Chemical Oxygen Demand
- Zinc
- Cadmium
- Copper

- Lead
- Hardness
- Specific Conductance
- Temperature
- pH

Floatable materials, including litter and organic material, will also be collected and analyzed as part of the monitoring process.

Additional parameters such as total petroleum hydrocarbons (TPH), ammonia, and detergents may be included in the monitoring protocol at the County's discretion.

Laboratory analytes and detection limits			
Constituent (units)	Sample Collection Type	Detection Limit	Method
E. Coli (col/100mL)	Grab	1	SM 9223B
TPH (mg/L)**		5	EPA 1664
Nitrate and nitrite (mg/L)	Composite	0.02	SM 4500 NO3-H
Ammonia (mg/L)**		0.2	SM 4500 NH3-C
Total Suspended Solids (mg/L)		1	SM 2540 B
Chemical Oxygen Demand (mg/L)		10	EPA 410.4
Total Phosphorus (mg/L)		0.01	SM 4500 P-E
Total Kjeldahl Nitrogen (mg/L)		0.5	SM 4500 NH3-C
Zinc (µg/L)		20	EPA 200.8
Cadmium (µg/L)		2	EPA 200.8
Copper (µg/L)		2	EPA 200.8
Lead (µg/L)		2	EPA 200.8
Hardness (mg/L)		1	SM 2340 B

**Parameters not required by MS4 permit but may be included in the monitoring protocol at the County's discretion.

Temperature, pH, and specific conductance are measured using a probe or test kit.

Floatables will be sampled at the same time water quality sampling is conducted. A collection trap will be installed at the end of the outfall. The trap consists of a support ring and removable net. The net may be attached directly to the scissors ring (described above) to provide an anchor and support. The net apparatus is adjustable to enable deployment in conduits of varying standard sizes.

Captured floatables / debris are collected from the net after each rain event. The sample is weighed to obtain total mass of material and then sorted into categories and counted. Counts of material are recorded on a field data sheet.

Monitoring Frequency

Outfall monitoring will be conducted once per calendar quarter each permit year (July 1 – June 30). Monitoring will be conducted at least 14 days apart. The following quarterly calendar schedule will apply.

- July 1 – September 30
- October 1 – December 31
- January 1 – March 31
- April 1 – June 30

Antecedent Dry Period and Rainfall Criteria

Antecedent dry periods required by discharge permits typically range from 48 hours for BMP effectiveness studies to 72 hours for standard discharge permit monitoring programs (U.S. EPA 1992). Sampling after a dry period reduces the likelihood that surfaces have been "washed" off by a prior storm. A 72-hour antecedent dry period (rainfall < 0.03") will be observed in Arlington County's wet weather monitoring program.

Storms that are forecast to deliver 0.3 in. or more of rain within 24 hours are eligible for monitoring. A rainfall depth of 0.3 in. represents a moderate quantity that should produce sufficient runoff to allow automated sampling. Since the goal of the program is to sample some distance down-network from a selected facility, a moderate quantity of rain may be needed to deliver sufficient runoff. The minimum rainfall depth may be revised if it affords insufficient runoff for automated sampling.

Eligible storms will be identified by staff evaluating various weather forecasting tools. Field staff will be notified when an anticipated storm is expected to deliver at least 0.3 in. of rainfall at a targeted site. Rainfall depth will be estimated from regional rainfall accumulation as determined by Doppler radar and/or from a local rain gauge.

Safety Protocols

Ensuring the health and safety of field personnel is the responsibility of every member of the staff for the project. The collective effort of all staff members in providing a healthy and safe work environment will minimize or eliminate the potential for accidents. In general, the following safety protocol will be followed to protect the field staff:

1. Bring and wear appropriate personal protective equipment (safety vests, eye protection, steel-toed shoes).
2. Perform field work in teams of at least two individuals.
3. Bring a cell phone and first aid kit on all field site visits.
4. Exercise caution when encountering any wildlife, off-leash pets, and hazardous plants. In addition, many outfalls are located in remote areas that may be near gathering places for homeless or transient individuals. Do not enter a potentially hostile area. Exercise caution when accessing manholes and outfall areas and when encountering uneven or slippery terrain (rip rap), steep slopes, and possible sharp objects such as broken glass, gabion baskets, metal, fencing, needles, or any debris with sharp or pointed edges or corners.

5. Use common sense during electrical storms and/or when severe conditions (e.g., high wind, hail) develop. The safety of field staff overrides all other considerations.
6. Storm sewers contain a variety of water-borne bacteria and other harmful chemicals. Wash hands or use anti-bacterial wipes or hand gels liberally, especially prior to lunch breaks, etc.
7. Any work in confined spaces will be performed by technicians who are appropriately trained and certified for such work.

Additional information on Health and Safety may be found in Appendix D, including information on personal protective equipment, confined space entry, flora and fauna, unknown hazardous substances, and wastes, bloodborne pathogens, remote areas, tool safety, and weather-related hazards.

Field Monitoring Documentation / Quality Control

For storm events, a dedicated data sheet will be used to document sample location, rainfall depth, date of sampling initiation, serial numbers of automated sampler and flow module, names of field crew, discrete sample interval, discharge volume represented by each discrete sample, proportional aliquot of discrete sample used in compositing, date, and time of sample composite.

For floatables monitoring, a dedicated field data sheet is used to document the quantity and count of captured floatable material for a given event. The field data sheet contains similar storm characteristic information as for water quality monitoring.

Chain of custody (COC) forms, used for all samples, are a permanent record of transfer of sample custody. Custom COC forms for this project are preprinted with the analytes and partial laboratory numbers particular to the activity at hand. Field staff need only to complete the laboratory numbers, complete the columns designated for other information, line out any samples that will not be submitted, and sign the form. When picking up the samples for delivery to the laboratory, the laboratory courier signs and dates the COC form in the "Received By" box and provides a photocopy for project records.

Sampler Maintenance

An ISCO Model 6712C portable automated sampler or other similar model will be used to collect the samples for testing. The sampler assembly consists of a keypad, pump, tubing, and sample bottle container which holds 24 plastic or glass bottles. The 24 bottles are used to contain the discrete samples collected at intervals throughout the storm. Required maintenance involves checking the integrity of the suction tubing, checking to see that suction tubing is securely attached to the pump tubing (when sampler is attached), making sure that pump tubing is properly threaded through the distributor arm, running the internal electronic maintenance cycle (includes electronic tests of RAM and ROM, mechanical tests of sample pump and distributor arm), and making sure the knurled knob that holds the distributor arm to the frame is tight. Monthly maintenance consists of running the sample pump to check for suction line integrity. The suction line at a sampling point is replaced when the apparatus is moved to a new site upon completion of sampling. The pump tubing is replaced annually or as needed.

Notification / Follow-Up Procedures

Designated staff with Arlington County's Department of Environmental Services, Office of Sustainability and Environmental Management (OSEM) will be notified when analytes exceed surface water criteria established in this plan when results are available.

OSEM staff will be notified by field personnel if a there is evidence of an active illicit discharge or substantial pollution release during monitoring activities. A description of the location of the facility, chemical results, and date and time of screening will be conveyed first to OSEM by phone and e-mail to Diana Handy (703-228-0772, Dhandy@arlingtonva.us). The County will contact DEQ and other county agencies subsequently as necessary.

If a hazardous material spill or other illicit discharge is suspected or detected while in the field, staff will immediately call the County's Non-Emergency service (703-558-2222) or 911.

Laboratory Analytes and detection limits for Arlington County's wet weather monitoring program		
Parameter	Detection Limit	Exceedance Criterion
E. Coli[(a)]	1 col/100mL	1173 col/100mL*
TPH[(b)]**	5 mg/L	15 mg/L
Nitrate and nitrite[(b)]	0.02 mg/L	0.68 mg/L
Ammonia[(b)]**	0.2 mg/L	19 mg/L
TSS[(b)]	1 mg/L	100 mg/L
COD[(b)]	10 mg/L	120 mg/L
Total phosphorus[(b)]	0.01 mg/L	2 mg/L
Total Kjeldahl nitrogen[(b)]	0.5 mg/L	1.5 mg/L
Zinc[(a)]	20 µg/L	120 µg/L
Cadmium[(a)]	2 µg/L	3.9 µg/L
Copper[(a)]	2 µg/L	13 µg/L
Lead[(a)]	2 µg/L	120 µg/L
Hardness	1 mg/L	N.A.
pH[(b)]	1-14	< 6 or > 9 pH units
Specific Conductivity		N.A.

[(a)] Virginia State Water Control Board 2009
Acute water quality criterion for metals is hardness dependent. Values above reflect hardness standardized to 100 mg/L as CaCo3. See Virginia State Water Control Board regulations for explanation of factors used to adjust criterion based on hardness for specific metals.

[(b)] Virginia State Water Control Board 2011

* Value cannot be exceeded in more than 10% of samples in assessment period

N.A. = No EPA or Virginia acute standard available

**Parameters not required by MS4 permit but may be included in the monitoring protocol at the County's discretion.

Event Monitoring Reports

For each storm event monitored, a monitoring report will be created for each site monitored during that event. The following information will be provided in the report: site location, weather conditions, storm/precipitation data, flow data, hydrograph data, sampling results, field observations, summaries of site conditions, summaries of any follow-up investigations, photographs of outfalls, field forms, chain of custody forms, lab results and any additional photos taken during sampling events.

Evaluation of Monitoring Data

The drainage areas for the selected monitoring locations are discrete and allow for follow-up inspections of the specific areas of concern. These areas will be inspected on an annual basis as part of the County's high risk commercial facilities inspections program. Additional inspections may be conducted over the course of the permit to assess conditions at specific locations in the drainage areas that have been identified as having high potential to contribute pollutants to the MS4 and surface waters. As previously discussed, the County will work with property management representatives and conduct focused outreach efforts based on monitoring results and inspection findings.

Results of wet weather monitoring will be evaluated to see if targeted education and outreach, implementation of non-structural BMPs, and increased site inspections affect sampling results and/or show any change with regard to pollutant loading to Four Mile Run. The ability to do any in-depth data trend or correlation analyses during a five (5) year permit cycle is not scientifically practicable given relatively few data points, seasonal variabilities, differences in storm events and intensities, time between storm events, and ever-changing inputs / conditions in an urban watershed. These factors can significantly influence results, especially over shorter time spans.

These wet weather monitoring data provide a snapshot of stormwater runoff, water quality, and area conditions during four storm events at two locations within the County. The information obtained from monitoring and inspections can be used to help refine outreach messaging and provide recommendations for applicable BMPs at various facilities.

MS4 Permit Reporting

At the end of each MS4 permit year (July 1 – June 30), the County provides information from the reports in its MS4 Annual Report. Per the County's permit, the *annual report shall include a list of locations upon which wet weather monitoring was conducted: weather conditions at the time the sample was collected to include date and approximate time of most recent storm event preceding sample collection and a summary of the monitoring results. An analysis and interpretation of the monitoring data will be provided as part of the fourth annual report, by October 1, 2025.* Summary data will include field observations, sampling results, and any follow up activities taken.

References

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Appendix A - Equipment Installation, Operation, and Sampling Procedures

Wet Weather Monitoring Equipment

The automated sampler to be employed will be an ISCO Model 6712C compact portable sampler (or other model) capable of collecting up to 24 500-mL water samples in polyethylene bottles. The size of the samples and number of bottles will assure that several bottles will be filled corresponding to all portions of the storm event hydrograph. The automated sampler will be transported to the sampling sites prior to the storm event and removed after event conclusion. This sampler is of a size and configuration that will allow it to be inserted and retrieved from a manhole and suspended using a pro-hanger and appropriate harness (for manholes 18 to 24 inches in diameter). Alternatively, the samplers may be secured using rebar loops inserted into the ground and combination bicycle locks to discourage theft. During the event, each sampler will be covered by a lid to protect it from the effects of weather. The samplers will be powered by 12-volt Ni-Cd rechargeable batteries.

Attached to all automated samplers will be an ISCO Model 730 bubbler flow module that will log the water flow rate in the pipes of interest. The flow module measures water level within the pipe based on overlying water pressure exerted on bubbles pumped from the module that exit the bubbler tubing at the base of the pipe. Flow rates are calculated from the water level measurements based on Manning's Equation. The bubbler line is mounted to a "spring ring" that is secured within the pipe.

On-Site Equipment Installation

Materials, Equipment and Supplies:

1. Confined Spaces entry apparatus (if necessary) consisting of tripod, winch, lanyard, harness, oxygen meter.
2. Scissors ring or spring ring with appropriate extensions, where applicable
3. Remote installation tool
4. Bubbler line
5. Suction line and stainless-steel low-flow strainer
6. Thel-mar weir
7. Ratchet set, English
8. Sensor carrier
9. Cable ties

Confined-spaces entry-certified personnel (see Appendix D) and apparatus are to be used if installation is to be within a pipe inlet to a below-grade junction (pipes greater than > 15" diameter only; for pipes less than 15", see step 3).

1. Measure outfall pipe and assemble scissors ring with designated extensions. Retract brace by rotating nut counterclockwise with ratchet.

2. Install sensor carrier and attach bubbler line to sensor carrier. Attach suction line to low-flow strainer and attach strainer to sensor carrier using cable ties. Insert scissors ring in pipe just upstream of outlet orifice; orient scissors ring so that metal bubbler line outlet is in the invert of pipe, pointing downstream.

3. In the case of 15” diameter or less pipes, a remote, street-level installation tool can be used. Sensor carrier, strainer, and tubing are to be attached as described above.

4. The tubing can be tied off at the upper step of the closed manhole or threaded through manhole cover and secured on nearby brush until such time as storm event is monitored.

Preparation for Storm Event

Materials, Equipment, and Supplies:

1. Programmable, automated sampler equipped with flow module
2. 24 500-mL polypropylene bottle configuration
3. Pro-hanger and harness for automated sampler
4. Ice
5. Bike locks or chain and padlocks
6. Ni-Cd battery
7. Floatables monitoring support & net

Meteorology

Obtain storm forecast from staff meteorologist. The meteorologist should be, beforehand, made aware of antecedent dry-time criteria; minimum rainfall depth requirement; and lead time required to gather sampling equipment, travel to the site, obtain ice, and place and program sampler. Such lead time will vary with distance from equipment storage.

Deployment

1. Attach bubbler line and suction tubing to sampler. Attach suction line (other end) to low-flow strainer in pipe (if not already).
2. Attach floatables capture net to stainless steel ring support. Extend net slack down-conduit in the same direction as stormwater flow path.
3. Place ice in center of sampler. Make sure sampler is level.
4. When putting sampler back on top of bottom, make sure straps are outside, so distributor arm doesn’t catch (or slip straps between bottle carrier and sampler bottom)
5. Program sampler to capture entire flow event. Program duration should reflect both the duration of the rain and estimated time allowance for sampling of trailing limb (rule of thumb for highly impervious catchments: 4 hours). To determine sample interval in minutes, multiply sum of the rainfall and trailing limb allowance in hours by 2.5.
6. Secure samplers to fencing or manhole steps using bike lock. Stabilize with line if necessary.
7. Attach sampler covers. Be sure that neither the suction line nor the bubbler tubing is pinched between the cover and sampler body. Also check the lines to be sure there are no holes.
8. If placing sampler in manhole using pro-hanger and harness, replace manhole cover by gently sliding horizontally over the hole. If the angle of the manhole is too great as it nears seating, it may press down on the pro-hanger with enough force to dislodge it and cause the sampler to drop to the bottom of the manhole.

Storm Sample Compositing

Materials, Equipment, and Supplies:

1. Laptop PC / software
2. Discrete sample bottle caps
3. Ice
4. Graduated cylinders (100-mL and 500 mL)
5. Scale

Methodology

Automated Sampler

1. Open sampler body and examine bottles for presence of liquid. Cap each discrete bottle if containing liquid. Replenish with ice if necessary. Close sampler body and transport it to office/laboratory for sample processing.
2. Download sampler data to laptop PC. Create hydrograph of downloaded level data covering the time that the sampler was onsite in the field. Convert continuous level data to flow rate using Manning's equation and input appropriate coefficients for the specific pipe.
3. Export combined level and flow rate data into.csv file (e.g., "sitename levelflow [date of storm].csv").
4. Import level and flow rate data (name of level & flow files will appear as sites).
5. Construct table of discharges in the usual way, using flow rate data just imported and appropriate sample interval.
6. Export table of discharges to another .csv file (e.g., "sitename discharge [date of storm].csv").
7. Open discharge export file in spreadsheet. Copy 1st 24 bottles and times to template file. The template file will automatically calculate discrete volumes (volumes to add to composite bottle) once the formula is corrected to reflect volume at peak discharge [discrete volume = 500 mL for compact sampler].
8. Save the discrete volume file just created in Excel as a new file (e.g., "sitename discrete [date of storm].xls"). Print the spreadsheet and refer to it when compositing. Reduce discrete volumes by a proportional amount if the total volume is greater than the capacity of the 4-L bottle.
9. Use graduated cylinders to measure discrete aliquots.
10. After compositing, wash and rinse plastic bottles with soap, 10% nitric acid solution, and distilled water.

Note: because of variations in water level in pipe over time, a discrete sample may be low or nonexistent despite a measurable discharge volume represented by the discrete sample as measured by the flowmeter. This is due to the fixed time frame that the sampler takes samples. At the time that the sampler takes the sample, there may be insufficient water in the pipe despite the fact that there was sufficient water at a different time during the interval between discrete samplings.

Floatables

1. Detach net from supporting ring.
2. Note presence of scum, suds, or oily residue at water line of pipe.
3. In water quality laboratory, measure gross weight of net and contents.

4. Remove contents of net and place onto stainless steel analysis tray.
5. Determine weight of bedload items.
6. Count and record quantity of floatable objects of each type (e.g., aluminum cans, pieces of plastic, paper, etc.).
7. Rinse net with distilled water and obtain tare weight.

Appendix B – Sample Wet Weather Monitoring Field Data Sheets

ARLINGTON COUNTY WET WEATHER MONITORING FIELD DATA SHEET

Sample Collection Crew ___ / ___ Date:_____

Site Information (Outfall ID / Location): _____

Storm Duration (hr): _____ Sample Interval (min):_____

Sample Begin (Date/Time): _____ Sample End (Date/Time):_____

Total Storm Precipitation (in): _____

SLOPE:_____ DIAMETER:_____

CONSTRUC. MAT'L:_____ ROUGHNESS:_____

HYDROGRAPH/COMPOSITE INFORMATION:

Bottle	Time	Interval discharge (cf)	Discrete vol
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			

SAMPLE COLLECTION DATA:

FIRST FLUSH SAMPLES
DATE/TIME OF COLLECTION _____

COMPOSITE SAMPLES
DATE/TIME OF COLLECTION _____

A	R				S	T					G	W	Q

INSERT TYPE:_____

MANHOLE ID:_____

LATITUDE:_____

LONGITUDE:_____

SAMPLER SERIAL:_____

MODULE SERIAL:_____

REVIEWED BY _____ DATE: _____

TSJ 04/14

Issues encountered:

ARLINGTON COUNTY WET WEATHER MONITORING FLOATABLES DATA SHEET

Sample Collection Crew ___ / ___ Date/Time:_____

Site 1 Outfall ID / Location: _____

Site 2 Outfall ID / Location: _____

Gross Characterization of Net Contents

	Total Wt.	Tare Wt.	#Al cans	#Glass bottles	#Plastic bottles	#Plastic bags
Site 1						
Site 2						

	#plastic pieces	#Styrofoam® & paper	Est. Wt. organic debris (seeds, leaves, sticks, bark; kg)	Est. Wt. bedload material (kg)
Site 1				
Site 2				

Characterization of Conditions at Outfalls

Site 1: Scum _____ Suds____ Sheen _____ Sediment_____

Other floatable material not captured by net _____

Site 2: Scum _____ Suds____ Sheen _____ Sediment_____

Other floatable material not captured by net _____

Comments:

Appendix C – Sample Chain of Custody Form

MARTEL *CHAIN OF CUSTODY / SAMPLE INFORMATION FORM*

Martel Laboratories JDS Inc. • 1025 Cromwell Bridge Road • Baltimore, MD 21286 • (410) 825-7790 • FAX (410) 821-1054

MARTEL Log # _____ Client Code _____

Client Name/Phone/FAX _____

Client Address _____

Invoice Address _____

Sampler _____

Project Name/# _____

Contract/P.O Number _____

Sample Turnaround Time _____

Station No./ Sample ID	Station Location	Matrix	Container Description/ Preservation Status	Potentially Hazardous?	# of Containers	Date	Time	Analyses Required/Comments

Transferred by:	Received by:	Date	Time	Cooler Receipt Information **(LAB USE ONLY)**
Transferred by:	Received by:	Date	Time	Sufficient ice? - Yes/No If No, temp.= _____
Transferred by:	Received by:	Date	Time	Sample containers pres'd? - Yes/No If No, explain Custody Seal present/intact? - Yes/No Initials: Date:

Appendix D – Health and Safety Guidance for Wet Weather Monitoring Field Work

Health and safety responsibility and accountability involves every employee. The collective effort of all employees in providing a healthy and safe work environment will minimize or eliminate the potential for accidents. In general, field sampling will require the following safety protocol to protect the field staff:

1. Perform field work in teams of at least two.
2. Provide information to others about location of the work area / where field work will be done.
3. Bring cell phone and first aid kit on all field site visits.
4. Exercise caution when encountering any wildlife and hazardous plants. In addition, many outfalls are located in remote areas that may be near gathering places for homeless or transient individuals. Do not enter a potentially hostile area.
5. Use common sense during electrical storms and/or when severe conditions (e.g., high wind, hail) develop. The safety of field staff overrides all other considerations.
5. Storm sewers contain a variety of water-borne bacteria and other harmful chemicals. Wash hands or use anti-bacterial wipes or hand gels liberally, especially prior to lunch breaks, etc.
6. While traveling to and from the job site, employees shall: obey all federal, state and local regulations regarding seat belt use, all traffic laws, and any other laws regarding proper conduct in public areas.

Personal Protective Equipment (PPE)

Engineering and administrative controls will be used as the primary means of exposure control, as required by OSHA standards. However, PPE may also be necessary to further minimize potential employee exposure. All employees shall dress appropriately for the tasks to be performed. Specialized health and safety equipment, including personal protective equipment, monitoring equipment, and other devices designed to protect the employee shall be issued to the employee on an as-needed basis.

Employees performing field activities and certain laboratory functions have the potential of coming in contact with hazardous materials. Many of these hazardous materials can cause significant injury or illness through acute or chronic exposures. For field work (including industrial operations), all field employees are required to wear the following basic PPE:

- Appropriate work clothing
- ANSI-approved steel-toed, steel-shank boots
- ANSI-approved safety glasses
- ANSI-approved hard hat (when overhead hazards exist)
- Rain Gear (when appropriate)

Confined Space Entry

Confined space is any location not intended for human occupation, has limited or no ventilation, has the potential for containing dangerous or lethal atmospheres, and has limited ingress/egress. OSHA has addressed confined space entry requirements and procedures in 29 CFR 1910.146 (Permit Required Confined Spaces) and 1926.651 (Excavations). Confined space entry, if necessary, will be performed in accordance with OSHA confined space entry procedures, industry-standard practices, and will be performed by confined space trained personnel.

The Team Leader will provide ongoing, real time ambient air monitoring of the locations to be sampled to determine the need for personal protection. Entry of the sampling personnel will be allowed if the following criteria are met:

- Oxygen level greater than 19.5%. Atmospheres with oxygen concentrations less than 19.5% are considered oxygen deficient and must be treated as Immediately Dangerous to Life and Health (IDLH) atmospheres.
- Lower explosive limit (LEL) reading is less than 3%

Flora and Fauna of Concern

During the course of field activities, employees may come in contact with a wide range of dangerous or toxic animals and plants. Dangerous animals may include black widow and brown recluse spiders; fire ants; mosquitoes and biting flies; bees, wasps and hornets; ticks and chiggers; microbial organisms (e.g., found in water, soil, and air and on carrier/host organisms); rabid mammals; and venomous snakes. Dangerous plants may include thorny plants; poison ivy, oak, and sumac; and molds, mildews, and fungi (which may cause allergic reactions). Contact with these organisms can cause effects from simple discomfort (such as from thorny bush scratches) to severe allergic reactions and possibly death. If interactions do occur, take appropriate actions related to specific interaction and individual response to interaction. Employees should information team members if they have allergies to insect bites and whether they carry an Epi-Pen or medication for an allergic reaction.

Unknown Hazardous Substances and Wastes

The nature of monitoring and inspection field work often times requires the investigation of unknown hazardous substances or wastes. Because of the serious personal and environmental consequences of unintentional release of chemicals, very specific health and safety procedures must be implemented to monitor ambient conditions, mitigate releases to the environment, and protect workers from exposure. Most of these procedures dovetail with site investigation, sampling, and remediation techniques outlined by EPA policy and should be included in the project comprehensive work plan.

Bloodborne Pathogens

Exposure to bloodborne pathogens (BBP) is possible in the case of certain emergency situations. Personnel may be exposed to body fluids. These fluids could contain pathogens that have the potential for causing disease in humans. Should personnel be required to administer lifesaving procedures, such as CPR, the following procedures will be followed to minimize the potential for exposure:

1) Wear disposable gloves when hand contact with blood, mucus membranes, non-intact skin or other potentially infectious materials could be involved.
2) When administering CPR, conduct chest compressions. Only conduct artificial, oral ventilation if absolutely necessary. When doing so, use disposable mouthpieces, pocket masks or other ventilation devices for administering artificial ventilation.
3) Wash hands with soap and water after administering first aid
4) In the case of eye contact, flush eyes using an eye wash for at least 15 minutes
5) Remove garments contacted by blood or other body fluids as soon as possible
6) Do not eat, drink, or handle contact lenses in areas with possible BBP exposure

7) Persons cleaning up an accident scene should not pick up broken glass or other sharp objects by hand. All clothes and other items at the first aid scene should be safely secured prior to leaving.

Employees who may have been exposed to BBPs should report the incident at once.

Remote Locations / Areas

A monitoring site may be located in areas not readily accessible by vehicle. Communication will be maintained from the sampling team to a base station in the event of an emergency. Employees need to pay attention to their surroundings. Some areas may be near gathering places for homeless or transient individuals. Do not enter a potentially hostile area.

Heavy Lifting

It may be necessary to carry sampling equipment (e.g., coolers, sampling containers, and equipment) during the course of the field activities. Care must be taken to avoid injury while carrying equipment to the sampling locations.

Tools / Sharps Safety

Some of the field activities and sampling procedures may require the use of tools with sharp edges including scissors, clippers, knives, and razor blades. Care must be taken during their use to prevent injuries from cuts.

Weather-Related Hazards

Weather-related hazards include the potential for heat or cold stress, electrical storms, treacherous weather-related working conditions, high winds, and limited visibility. These hazards correlate with the season in which site activities occur. In the event of adverse weather conditions, the Field Team Leader will determine if work can continue without endangering the health and safety of site personnel.

Heat and Cold Stress

This section is applicable to all personnel involved in field work as well as any other workers who may be exposed to temperature stress conditions.

Heat Stress

Heat stress is a significant potential hazard during the warmer months. Heat stress manifests itself as one of three conditions: heat cramps, heat exhaustion, or heat stroke. Heat cramps are brought about by a prolonged exposure to heat. As an individual sweats, water and salts are lost by the body, triggering painful muscle cramps. The signs and symptoms of heat cramps include:

- Severe muscle cramps, usually in the legs and abdomen
- Exhaustion, often to the point of collapse
- Dizziness or periods of faintness.

First aid treatment includes shade, rest, and fluid replacement. The individual will drink electrolyte-replacement fluids (e.g., Gatorade, Squencher, 10-K), which will be made available to field personnel. If the individual has not recovered within ½ hour, then he/she will be transported to the hospital for medical attention.

Heat exhaustion usually occurs in a healthy individual who has been exposed to excessive heat while working or exercising. Blood collects near the skin in an effort to rid the body of excess heat. The signs and symptoms of heat exhaustion include:

- Rapid and shallow breathing
- Weak pulse
- Cold and clammy skin, with heavy perspiration
- Skin appears pale
- Fatigue, weakness, and/or dizziness
- Elevated body temperature

First aid treatment includes cooling the victim, elevating the feet, and replacing fluids. If the individual has not recovered within ½ hour, he/she will be transported to the hospital for medical attention.

Heat stroke occurs when an individual is exposed to excessive heat, and their body systems become overwhelmed by heat and begin to stop functioning. This condition is a medical emergency, requiring the immediate cooling of the victim and transport to the hospital immediately. The signs and symptoms of heat stroke include:

- Victim has stopped sweating
- Dry, hot, red skin
- Body temperature approaching or above 105° F
- Dilated (large) pupils
- Loss of consciousness; victim may lapse into a coma

Local weather conditions may produce an environment which will require restricted work schedules in order to protect employees. The Field Team Leader will observe workers for any potential symptoms of heat stress. Adaptation of work schedules and training in recognition of heat stress conditions will help prevent heat-related illnesses from occurring.

Cold Stress

Cold stress is a danger at low temperatures and when the wind chill factor is low. Cold stress is generally described as a local cooling (frost nip, frost bite, and freezing) or a general cooling (hypothermia). Personnel working outdoors in temperatures at or below freezing may be subject to local cooling. Areas of the body that have a high surface area-to-volume ratio, such as fingers, toes, and ears, are the most susceptible.

The three categories of local cooling include:

- Frost nip - characterized by a blanching or whitening of the skin
- Frost bite - skin has a waxy or white appearance and is firm to the touch, but the tissue beneath is resilient
- Freezing - skin tissue is cold, pale, and solid

Frost nip and frost bite first aid includes covering the affected area with warmth and retreating to a warm area. Frozen tissue is a medical emergency, and the victim will be transported to the hospital immediately.

General cooling (hypothermia) occurs when exposure to cold reduces body temperature. With prolonged exposure, the body becomes unable to maintain its proper internal temperature. Without treatment, hypothermia will lead to stupor, collapse, and death.

The signs and symptoms of mild hypothermia include:

- Shivering
- Numbness
- Drowsiness

First aid for mild hypothermia includes using heat to raise the individual's body temperature. Heat may be applied to the victim in the form of heat packs, hot water bottles, and blankets.

The signs and symptoms of severe hypothermia include:

- Unconsciousness
- Slowed respiration or respiratory arrest
- Slowed pulse or cardiac arrest
- Irrational or stuporous state
- Muscular rigidity

First aid for severe hypothermia includes handling the victim very gently; rough handling may set off an irregular heartbeat. Do not attempt to re-warm the severely hypothermic victim; re-warming may cause the development of an irregular heartbeat. Severe hypothermia is a medical emergency, and the victim will be transported to the hospital immediately.

Prevention of cold stress is a function of whole body protection. Adequate insulated clothing will be worn when the air temperature drops below 50 °F. Reduced work periods may be necessary in extreme conditions to allow adequate periods in a warm area.