Monitoring Guidance Manual

For Minnesota's 2015 - 2020 Industrial Stormwater Multi-Sector General Permit

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Introduction

This guidance document outlines suggested stormwater monitoring procedures to help keep industrial facilities in compliance with the requirements of the Minnesota Pollution Control Agency's (MPCA) 2015 Industrial Stormwater (ISW) Multi-Sector General Permit.

This guide will lead you through the necessary steps to complete your sampling, monitoring, and reporting requirements.

Part I Why monitor?

Stormwater monitoring is necessary to identify industrial pollutants that have entered surface or groundwater through stormwater runoff from an industrial facility. The monitoring results indicate if the Best Management Practices (BMPs)implemented at the Permittee's facility are working effectively to filter or remove industrial pollutants from stormwater runoff.

Any necessary changes to BMPs indicated by the monitoring results enable the facility to develop and implement an effective Stormwater Pollution Prevention Plan (SWPPP).

Part II Who needs to monitor?

Stormwater monitoring is required for Permittees whose facilities, whether publicly or privately owned, have stormwater discharges as described in 40 CFR 122.26(b)(14)(i-ix and xi, except x) which specifies ten categories of regulated industry. These ten industrial categories are further categorized into twenty-nine sectors based on Standard Industrial Classification (SIC) code or narrative activity.

If a facility has one of the regulated SIC codes or listed Narrative Activities, monitoring of the stormwater runoff from the facility is required.

Part III What do I need to monitor?

All Permittees are required to conduct Benchmark Monitoring. Additionally, there are certain industrial activities within eight different industrial sectors which are also required to conduct effluent limit monitoring.

A facility may be required to conduct benchmark monitoring, effluent monitoring, or both.

The type of monitoring required and the parameters to test for can be found in the Sector-Specific Requirements found in Part VII of the ISW General Permit. The sampling parameters are tailored to the industrial activities and materials present at the facility.

Benchmark monitoring

Effective April 2015, benchmark monitoring is required on a calendar quarter basis beginning the first calendar quarter following the date the facility received 2015 ISW permit coverage. For example:

- If permit coverage begins during April 2015, the first monitoring quarter would be from July 1-September 30, 2015.
- If the permit coverage begins during August 2015, the first monitoring quarter would be from October 1-December 31, 2015.

Once four separate quarters of results are obtained, the Permittee averages the results and compares the resulting value(s) to the benchmark monitoring values listed in the ISW General Permit.

If an averaged value exceeds the permit benchmark value, the Permittee must make corrections to the Best Management Practices (BMPs) and continue quarterly sampling until the average values are below the permit benchmark monitoring levels. This adaptive management results in improved water quality.

Benchmark monitoring exceedances **are not** a permit violation; however failure to make adaptive BMP corrections is a permit violation.

Effluent limit monitoring

Effluent limit monitoring is required by the federal Clean Water Act for certain industrial sectors based on the pollutants present in their industrial materials or activities.

There are eight industrial sectors with effluent limit monitoring requirements:

- Sector A: Facilities with discharges from wet deck storage areas.
- Sector C: Phosphate fertilizer manufacturing facilities.

- Sector D: Asphalt emulsion facilities.
- Sector E: Cement manufacturing facilities.
- Sector J: Construction sand and gravel or Industrial sand and mining facilities with mine dewatering discharges.
- Sectors K and L: Hazardous waste and non-hazardous waste landfills.
- Sector O: Steam electric generation facilities with coal storage piles.

Effluent limit monitoring differs from benchmark monitoring in two major areas:

- Effluent limit monitoring is required only once a year.
- An exceedance of the effluent limit values listed in the permit is a permit violation.

If an effluent limit monitoring exceedance occurs, the Permittee:

- Shall immediately verify the exceedance by collecting additional samples.
- Shall immediately investigate the cause of the exceedance and take action to prevent further violations.

Violations posing a threat to human health, the drinking water supply, or represent a significant risk to the environment shall be immediately reported to the Minnesota Department of Public Safety Duty Officer at 1-800-422-0798.

Part IV When do I sample?

Choosing the correct stormwater runoff event

The Permittee can sample at any time during their monitoring quarter provided there is enough stormwater runoff to collect a sample.

The sample must be taken:

- During the facility's normal business hours.
- 30 minutes of when the stormwater runoff begins.

The Permittee may take more than one sample during their monitoring quarter provided there have been at least 72 hours with no rainfall or snowmelt between sampling events.

There may be times when the rainfall tapers off during the sampling event, preventing collection of an adequate sample. If this occurs, try another sampling time during the quarter.

There may also be times when it's not possible to get to the facility within the first 30 minutes of the start of a runoff event. When this occurs, finish collecting the sample and indicate the late collection on the Stormwater Monitoring Report (SWMR) form submitted to MPCA.

Reminders: For the 2015-2020 ISW Permit, ***benchmark monitoring*** *begins July 1, 2015 and continues pm a calendar quarter basis. Effluent limit monitoring must be conducted once each calendar year.*

Winter thaw sampling

Winter monitoring is included in the quarterly benchmark monitoring timeframes as thawing of the snow pack during winter warm spells has the potential to carry significant amounts of accumulated pollutants offsite in the meltwater.

Winter thaws of snow usually occur when temperature are at 32° F or higher for two or more days.

What if I can't collect a sample?

There may be occasions when Permittees are unable to obtain a sample.

The Stormwater Monitoring Report form must be submitted each quarter, even if a sample was not collected.

If a sample cannot be collected, the Permittee must Report on the SWMR form that no samples were collected and explain the reason(s) why. The SWMR form must still be submitted by the 21st day of the month following the end of each sampling quarter.

Part V Where do I take samples?

A facility may have more than one monitoring location, depending on how many areas of industrial materials or activities are exposed to stormwater.

Permittees are required to have a minimum of one benchmark or effluent limit monitoring location.

Common monitoring locations include stormwater storm drains, parking lot runoff (sheet flow), ditches, and other low spots.

Benchmark monitoring location selection

The benchmark monitoring location(s):

- Are located on the facility property.
- Receive discharge from an area of industrial activities, processes, and significant materials.
- Are between the final BMP and where stormwater runoff leaves the property.
- Are not subject to stormwater run-on from off-site sources.
- Yield a sample that best represents the pollutants the Permittee is required to monitor.

Representative benchmark monitoring

It may be possible to collect a sample at one benchmark monitoring location that represents multiple locations on the facility property.

In order to designate representative benchmark monitoring locations, the stormwater discharges must be 'substantially similar'. Substantially similar means the activities and exposure are the same, the BMPs are the same, and topography and receiving waters are the same.

Modifying benchmark monitoring locations

It may be possible to modify chosen monitoring location(s), provided the monitoring results from the location(s) are not exceeding benchmark values.

Any change in monitoring location will result in a new monitoring calendar, any existing monitoring results become invalid, and the facility will begin new quarterly monitoring cycles beginning the next calendar quarter after the location change was approved.

A new location may be chosen provided the new location is:

- More representative of facility activities
- In a safer location
- In a location that is physically easier to collect samples.

To modify a benchmark monitoring location(s), the Permittee must complete the Benchmark Monitoring Modification Form and submit it to the MPCA Industrial Stormwater Program for approval. Once approved by MPCA, the facility may begin benchmark monitoring at the new location the next calendar quarter following approval.

MPCA will not allow benchmark monitoring location modifications if the facility is exceeding benchmark values.

Effluent limit monitoring location selection

The effluent monitoring location(s):

- Are located on the facility property
- Are immediately below the most down-gradient BMP and prior to where the discharge co-mingles with stormwater from other sources.
- Receive discharge from an area of industrial activities, processes, and significant materials.
- Yield a sample that represents the contribution of the pollutants the Permittee is required to monitor.

For further guidance with identifying benchmark monitoring and effluent monitoring locations, guidance diagrams have been created and can be found in the Industrial Stormwater Steps to Compliance at www.pca.state.mn.us\industrialstormwater.

In certain situations, MPCA may allow the Permittee to use the same monitoring location to collect both benchmark monitoring and effluent limit monitoring samples. For applicable situations, please review the Monitoring Diagram Fact Sheet on the Agency web site: www.pca.state.mn.us/index.php?option=com_docman&task=doc_download&gid=13498&Itemid=.

Part VI Sample testing laboratories and sampling equipment

Choosing and notifying testing laboratories

The Permittee should contact the laboratory well before the first sampling quarter begins. The lab can provide the necessary sampling equipment and chemical preservatives based upon the samples the facility is required to collect, as well as helpful information about sample shipping and manifest tracking.

Use a Minnesota Department of Health-certified lab located nearest to your facility location for the sample analyses. A list of statewide certified laboratories is available at https://apps.health.state.mn.us/eldo/public/accreditedlabs/labsearch.seam.

Sampling equipment

Contact the lab in advance to see what materials are needed for the samples you are required to collect. In many cases, the labs can supply the sampling containers and preservatives. A sampling equipment checklist can be found in Appendix B.

Basic sampling equipment:

- Sample containers of different volume amounts
- Preservatives for certain samples
- Waterproof labels, sampling notebook, pens
- Laboratory paperwork
- Rain and safety gear
- Eye wash bottle
- Paper towels
- Powder-free disposable nitrile or latex gloves
- pH meter if required to sample for pH (do not use Litmus paper)
- Cooler with ice

Part VII How do I collect my samples?

Samples must be collected within the first 30 minutes of measurable runoff. Measurable runoff is any runoff sufficient in volume to collect a stormwater sample.

A sampling checklist in Appendix B is available and can be updated as needed for each facility.

Most stormwater sampling will be done by hand or using a bottle-pole collector to safely collect the sample. Any of the sampling options listed below may be used; the selection will depend upon which is best-suited for the collection site.

Pipe or grab sampling

If stormwater is being discharged through a pipe, collect the sample as it falls from the end of the pipe. If necessary, the bottle can be attached to a pole to reach the sampling point.

Sampling bottle attached to pole as found in the "Stormwater Sampling for the Vermont Multi - Sector General Permit: A Guide for Industrial Facilities"

Photo courtesy of Vermont Agency of Natural Resources

Hold the bottle with the opening facing upstream and submerge the bottle into the main part of the flow. Do not overfill sampling bottles.

Manhole sampling

If a sample is being collected from a manhole or an inlet to a municipal storm drain, remember to contact the municipality before sampling.

Never enter a manhole unless you are trained to enter confined spaces by OSHA.

Sample the flow with a bottle-pole collector, or obtain samples above ground by placing the sample bottle in the runoff stream. Do not scrape the bottle against the sides or bottom of the pipe.

Ditch or swale sampling

Stormwater samples can be collected from ditches or swales provided all they are conveying is the facility's stormwater. (e.g., no up-gradient run-on).

The sample can be collected by placing the opening of the bottle upstream into the stormwater flow. Do not scrape the bottle against the sides or bottom of the ditch or swale.

Sheet flow sampling

Sheet flow sampling is used to collect stormwater samples from impervious surfaces such as parking lots by concentrating the stormwater flow to enable adequate sample collection.

To concentrate sheet flow, install a barrier device to intercept and redirect the stormwater flow to a collection area. Barriers can be permanent or temporary, and can include berms, troughs, or gutters. MPCA's short video "How to Collect a Sheet Flow Sample" outlines the easy steps to accomplish this. http://www.youtube.com/watch?v=AmEJUNp44aU.

Stormwater detention pond sampling

Stormwater detention ponds are designed to hold large volumes of storm water for a certain period of time before discharging it. The sample must be collected within 30 minutes of when the pond begins to discharge.

Please refer to Appendix E of this manual for other sampling options.

Sampling for pH

Only Permittees with pH as a monitoring parameter need to sample for pH. Permittees can review their Stormwater Monitoring Report (SWMR) forms, or the Sector-specific Requirements in Part VII, section 7 of the ISW General Permit to determine if pH is a sampling requirement.

To measure pH in the field, use of a calibrated pH meter is required; pH paper is prohibited by the permit and cannot be used.

Make sure the pH meter is calibrated before use; Permittees should consult directions from the manufacturer on calibration and use of the pH meter before taking samples.

Part VIII How do I report sampling results?

Benchmark monitoring and effluent limit sampling results must be reported to the MPCA using the facility's SWMR form corresponding to the sampling quarter dates.

SWMRs must be completed by correctly entering the lab results for each required parameter, and mailed/ postmarked by the 21st day of the month following the end of each sampling quarter.

- Example: If the sampling quarter ends June 15, the results must be postmarked by July 21st.

If samples were not collected, or if the facility has a monitoring waiver, a SWMR must still be submitted for every monitoring interval. If a facility conducts more sampling than is required in any sampling quarter, all sampling results must be submitted.

SWMR forms are being developed as of May 31, 2015.

Once ready, they will be available on the Industrial Stormwater website www.pca.state.mn.us\industrialstormwater.

For all sampling parameters except pH, enter units in mg/L on the SWMR form. If sampling results from the lab are reported in different units, convert them into mg/L or the sampling values will be incorrect.

Reporting benchmark monitoring results

It is not a permit violation if any of the individual sample results are higher than the benchmark value.

Reporting effluent monitoring results

For those facilities required to conduct effluent monitoring, results must also be submitted to the MPCA on SWMR forms. A minimum of one effluent sample per monitoring location per year is required. If a Permittee collects more than one effluent sample, a separate SWMR must be submitted for each collection.

Facilities with effluent monitoring requirements are not eligible for waivers or allowed to change monitoring locations. All effluent limit monitoring locations must be sampled and reported.

If effluent limits are exceeded, it is a permit violation.

Adjusting values for water hardness

For information about adjusting a limit for hardness, please see Appendix B of the ISW Permit. If the facility meets these requirements, submit the adjustment form to MPCA and the benchmark values for the facility will be modified.

Appendix A Monitoring waivers

There are three different monitoring waivers available to facilities.

- General benchmark monitoring waiver
- Run-on demonstration waiver
- Natural background pollutant waiver

The waivers are only applicable to benchmark monitoring, they cannot be used for effluent monitoring.

1. General benchmark monitoring waiver

This waiver is applicable if a facility utilizes infiltration devices or stormwater ponds as treatment options. The infiltration devices or stormwater ponds must be designed and constructed to the standards described in Part III and Appendix C of the ISW General Permit.

Some industrial sectors and sub-sectors are prohibited from utilizing this waiver. These are:

- Sub-sector A2: Wood Preserving
- Sector K: Hazardous Waste Facilities
- Sub-sector M1: Auto Salvage Yards
- Sub-sector N1: Scrap Recycling Facilities
- Sector S: Air Transportation Facilities

Permittees should consult the sector-specific requirements within Part VII of the permit to determine whether the facility is allowed to utilize the general benchmark monitoring waiver.

If the facility qualifies, the Permittee can submit the Industrial Stormwater Waiver Request certification form to MPCA. The waiver certification form can be submitted at any time, and the Permittee must document the waiver use in the facility SWPPP and on all annual reports.

2. Run-on demonstration waiver

If stormwater flowing onto a facility's property causes an exceedance of benchmark monitoring values for the Permittee, a run-on demonstration waiver may be allowed.

It is the Permittee's responsibility to demonstrate the following:

- The run-on cannot be diverted.
- The run-on has caused the benchmark value exceedance.
- There is no reasonable way to separate the run-on from the facility's stormwater discharge.

Criteria to be considered when demonstrating applicability for the run-on waiver include:

- A minimum of four different storm events to demonstrate run-on over a full sampling year.
- Employing standard methods for determining flows found in engineering handbooks.
- Digital photos of up-gradient and down-gradient discharges.

If the run-on demonstration monitoring waiver is granted, the facility SWPPP must contain a narrative description of the run-on by including the following:

- The nature of the run-on and description of the adjacent property.
- Dates and lab results of samples taken.
- A statement that run-on is directly affecting a particular monitoring location.
- Efforts taken to divert the run-on.
- Calculations used to demonstrate waiver applicability.
- Any other pertinent information.

If the run-on waiver is granted, all appropriate sections of the SWMR must still be completed and submitted to MPCA. The use of the run-on waiver must be noted on all subsequent annual reports.

To obtain the run-on demonstration waiver, the Permittee must submit the Industrial Stormwater Waiver Request along with documentation of the items identified above. MPCA may disallow the waiver if it finds the documentation inadequate.

Stormwater run-on waiver example:

For this example, a calculation will be used to determine if a permittee is eligible for the run-on waiver due to upstream Total Suspended Solids (TSS) contributions. The following equations will be used:

(1) $F_T = F_U + F_F$
(2) $L = C \times F$
(3) $L_T = L_U + L_F = C_T F_T = C_U F_U + C_F F_F$

Where:

- *F_T=Total Flow (Down-gradient)*
- *F_U=Upland Flow (Up-gradient run-on)*
- *F_F=Facility Flow*
- *C_T=Total Concentration (Down-gradient)*
- *C_U=Upland Concentration*
- *C_F=Facility Concentration*
- *L_T=Total Load (Downgradient)*
- *L_U=Upland Load (Upgradient)*
- *L_F=Facility Load*

Before calculating the impact of the run-on, the facility must attempt to prevent co-mingling of upstream stormwater run-on with facility discharges. If this is possible, the run-on waiver is not applicable. If this is not possible, proceed to Step 1.

1. Measure the concentration of up-gradient run-on, C_U, and down-gradient runoff, C_T, by collecting at least four samples during separate storm events and averaging the results. In order to qualify for the waiver, the average run-on concentration must exceed the benchmark value. If C_U does not exceed the benchmark, the permittee does not qualify for the waiver.

In this example, the Permittee took four samples; the average of C_U exceeded the TSS benchmark of 100 mg/L, so the Permittee can continue with the calculation.

	C_U (mg/L)	C_T (mg/L)
Sample 1:	**180**	**120**
Sample 2:	**201**	**134**
Sample 3:	**220**	**175**
Sample 4:	**203**	**152**
Average:	**201**	**145**

2. At the same time the concentration samples are taken, flows need to be measured for up-gradient run-on, F_U, and down-gradient runoff, F_T. The flow can be measured in any standard unit for flow (e.g. cubic feet per second, cubic meters per second, etc.), but be careful to use the same units for all of the data points and all calculations.

In this example, flows were reported in cubic feet per second (ft^3/s). Add all of the flows; then subtract total F_U from total F_T to get the total flow generated by the facility, F_F.

	C_U (mg/L)	C_T (mg/L)
Sample 1:	**0.2**	**0.6**
Sample 2:	**0.3**	**0.6**
Sample 3:	**1.1**	**1.4**
Sample 4:	**0.8**	**1.1**
Sum of Flows:	**2.4**	**3.7**
$F_F = F_T - F_U = 3.7 ft^3/s - 2.4\ ft^3/s = 1.3\ ft^3/s$		

3. Calculate the load for each upland and down-gradient sample by multiplying the measured flow and concentration. This will yield a load in units of mg/L-ft^3/s.

Add all of the loads for L_U and L_T; then subtract total L_U from total L_T to get the load generated by the facility, L_F.

	$L_U = C_U \times F_U$ (mg/L-ft^3/s)	$L_T = C_T \times FT$ (mg/L-ft^3/s)
Sample 1:	[180mg/L x 0.2 ft^3/s] = 36	[120mg/L x 0.6 ft^3/s] = 72
Sample 2:	60	80
Sample 3:	242	245
Sample 4:	162	167
Sum of Flows:	500	564
$L_F = L_T - L_U$ = 564 mg/L-ft^3/s - 500 mg/L-ft^3/s = 64 mg/L-ft^3/s		

4. The facility load, L_F, is then divided by the facility flow, F_F, to obtain concentration, C_F. C_F is then compared to the Benchmark value.

Total Suspended Solids (TSS) Permit Benchmark Value = 100 mg/L
$C_F = L_F/F_F$ = 64 mg/L-ft^3/s / 1.3 ft^3/s = 49.2 mg/L
49.2 mg/L < 100 mg/L

Criteria			Example Values			Meets Criteria?
C_T	>	Benchmark Value	145 mg/L	>	100 mg/L	Yes
C_U	>	Benchmark Value	201 mg/L		100 mg/L	Yes
C_U	>	Benchmark Value	201 mg/L	>	100 mg/L	Yes
C_U	>	C_F	201 mg/L	>	49.2 mg/L	Yes
C_F	<	Benchmark Value	49.2 mg/L	<	100 mg/L	Yes

This facility meets the criteria and therefore qualifies for the Run-on Demonstration Waiver.

3. Natural background pollutant waiver

There may be situations where the natural background concentrations for a benchmark monitoring parameter are unusually high at a permitted facility. The high concentration may be a result of geology, soil conditions, or natural characteristics of the stormwater before it contacts the Permittee's materials and activities. As these background levels are naturally occurring, not the result of industrial activities, the facility may qualify for a Natural Background Pollutant Waiver for some monitoring parameters.

Natural background pollutants do not include contaminated precipitation, legacy pollutants from earlier activity on the site, or pollutants found in run-on from neighboring sources that are not naturally occurring. Natural background parameters could include metals derived from natural mineral deposits and nutrients attributable to background soil, vegetation or wildlife sources.

To apply for this waiver, the Permittee must be able to demonstrate that benchmark levels would have been met if the background pollutant was not present. If the Permittee qualifies for the natural background pollutant waiver, the Permittee will not be required to monitor for the background pollutant causing the exceedance.

A Reference Site shall be used to demonstrate natural background conditions are causing sampling parameter exceedances. Pollutant concentration in stormwater runoff from a local, non-human impacted site will need to be used as a reference point. This can be done by an evaluation of the following:

- Ambient monitoring data at the reference site using the same sample collection, preservation and analysis methods as required for benchmark monitoring.
- Information from peer-reviewed publications.
- Data from a local, state, or federal government publication specific to runoff or stormwater in the immediate region.

Studies from different geographic areas or based on different topographies or soils cannot be used as ambient monitoring data. When no data are available and there are no known sources of the pollutant, the background concentration should be assumed to be zero.

Historic monitoring data may be used to calculate natural background values, but if the site is no longer accessible or no longer meets reference site acceptability criteria, documentation such as historic land use maps must be included to show:

- There was no human activity on the site at the time the historic data were collected.
- The site did meet reference site criteria prior to becoming inaccessible.

To qualify for the natural background waiver:

1. Determine the natural background concentration of each sampling parameter using
   a. Ambient monitoring
   b. Information from peer-reviewed publications
   c. Local, state, or federal government published data specific to stormwater runoff in the immediate region
   d. Historic monitoring data
2. Collect a minimum of four benchmark samples over the course of at least one year:
   a. Calculate the average concentration.
   b. Compare the average concentration to the natural background concentration.
3. Subtract the natural background concentration value from the averaged concentration value:
   a. If the resulting value is less than the permit benchmark value, the facility can apply for the Natural Background Waiver.

If the natural background pollutant waiver is granted, the quarterly benchmark monitoring reports must still be completed and submitted to MPCA. The reports must indicate the benchmark exceedances are due to natural background pollutant levels, and having the natural background waiver must be indicated on all annual reports.

If the natural background pollutant waiver is granted, the following must be kept onsite with the facility's SWPP:

- Data, including literature studies, describing the levels of natural background pollutants in the facility stormwater discharge. Include:
  - Documentation from at least four separate sampling events.
  - Dates, locations, and lab reports of all samples taken.
  - Any previously collected data which supports the claim.
  - Calculations used to determine waiver applicability.
- A map with elevations showing the reference site location in relation to the facility.
- Photographs showing land cover information and site vegetation.
- Reference site geology and soil information.
- Reference site reconnaissance survey data indicating roads, outfalls, or other human-made structures.
- Records from relevant state or federal agencies indicating no known mining, forestry, or other human activities upstream of the reference site during the time the record collection occurred.
- The rationale used for determining the exceedances were caused by natural background pollutant levels.
- An explanation of why the presence of the pollutant causing the benchmark exceedance is not related to the activities at the facility.
- Any other pertinent information.

Appendix B Sampling kit checklist

Item	Yes	No	Notes
Flashlight	☐	☐	
Hard hat	☐	☐	
Safety goggles	☐	☐	
Reflective vests	☐	☐	
Gloves (Latex or Nitrile)	☐	☐	
Rain wear	☐	☐	
Safety Shoes	☐	☐	
Traffic cones	☐	☐	
Rain gauge	☐	☐	
Eye wash bottle	☐	☐	
Paper towels	☐	☐	
Ice cooler/shipping cooler	☐	☐	
Field sampling notebook	☐	☐	
Waterproof pens	☐	☐	
pH meter	☐	☐	
Sampling bottles	☐	☐	
Preservatives	☐	☐	
Waterproof labels	☐	☐	
First-aid kit	☐	☐	
Re-sealable plastic bag	☐	☐	
Laboratory Paperwork	☐	☐	

Appendix C Benchmark and Effluent sample collection parameters

Sampling Parameter	Sample Container Type	Minimum Sample Volume (mL)	Sample Temperature Requirement	Sample Preservative Type
Aluminum, Total (as Al)	Plastic or Glass	150		HNO_3 to pH<2
Aniline	Glass, Teflon-lined cap	1000	Cool <=6°C	
Antimony, Total (as Sb)	Plastic or Glass	150		HNO_3 to pH<2
Arsenic, Total (as As)	Plastic or Glass	150		HNO_3 to pH<2
BOD, Carbonaceous 05 Day (20 Deg C)	Plastic or Glass	1000	Cool <=6°C	
COD (Chemical Oxygen Demand)	Plastic or Glass	12	Cool =6°C	H_2SO_4 to pH<2
Cadmium, Total (as Cd)	Plastic or Glass	150		HNO_3 to pH<2
Chromium, Total (as Cr)	Plastic or Glass	150		HNO_3 to pH<2
Copper, Total (as Cu)	Plastic or Glass	150		HNO_3 to pH<2
Cyanide, Total (as Cn)	Plastic or Glass	150	Cool <=6°C	NaOH to pH>12
Fluoride, Total (as F)	Plastic	75		
Hardness, Calcium & Magnesium Calculated (as $CaCO_3$)	Plastic or Glass	150		HNO_3 or H_2SO_4 to pH<2
Iron, Total (as Fe)	Plastic or Glass	150		HNO_3 to pH<2
Lead, Total (as Pb)	Plastic or Glass	150		HNO_3 to pH<2
Nickel, Total (as Ni)	Plastic or Glass	150		HNO_3 to pH<2
Nitrite plus Nitrate, Total (as N)	Plastic or Glass	30	Cool <=6°C	H_2SO_4 to pH<2
Nitrogen, Ammonia, Total (as N)	Plastic or Glass	30	Cool <=6°C	H_2SO_4 to pH<2
Oil & Grease, Total	Glass, Amber	1000	Cool <=6°C	H_2SO_4 or HCL to pH<2
pH	Plastic or Glass	100		
Phenol	Glass	500	Cool <=6°C	H_2SO_4 to pH<2
Phosphorus, Total (as P)	Plastic or Glass	30	Cool <=6°C	H_2SO_4 to pH<2
Selenium, Total (as Se)	Plastic or Glass	150		HNO_3 to pH<2
Silver, Total (as Ag)	Plastic or Glass	150		HNO_3 to pH<2
Solids, Total Suspended (TSS)	Plastic or Glass	500	Cool <=6°C	
Zinc, Total (as Zn)	Plastic or Glass	150		HNO_3 to pH<2

Appendix D Sample SWMR *In development as of 5/31/2015*

Appendix E Other sampling methods

While the industrial stormwater permit primarily focuses on taking grab samples to accomplish monitoring requirements, there are other options. Though grab samples are the easiest to conduct, they may not always be the best option. Listed below are some other types of acceptable sampling methods:

1. Flow-weighted composites

Automated samplers are programmed to collect an aliquot (a set sample size) for a set volume of discharge. More samples are collected during the peak of the hydrograph than towards the trailing edge of the hydrograph. All of the aliquots are combined into one container, so the pollutant concentration for the rain event is weighted by flow.

2. Time-based discrete samples

Automated samplers are programmed to take an aliquot at set time intervals with a separate bottle for each aliquot. Each bottle is processed separately, thereby characterizing the changes in pollutant concentrations throughout the rain event.

3. Time-based composites

Automated samplers are programmed to take an aliquot after a set period of time, and the aliquots are combined into one container. All parts of the rain event receive equal weight with this method, and the large number of aliquots can produce a reasonably accurate composite concentration.

4. A composite of discrete samples from first 30 minutes

The automated sampler is programmed to take an aliquot at set intervals and the aliquots are combined into one container. The sampler stops collecting samples after 30 minutes.

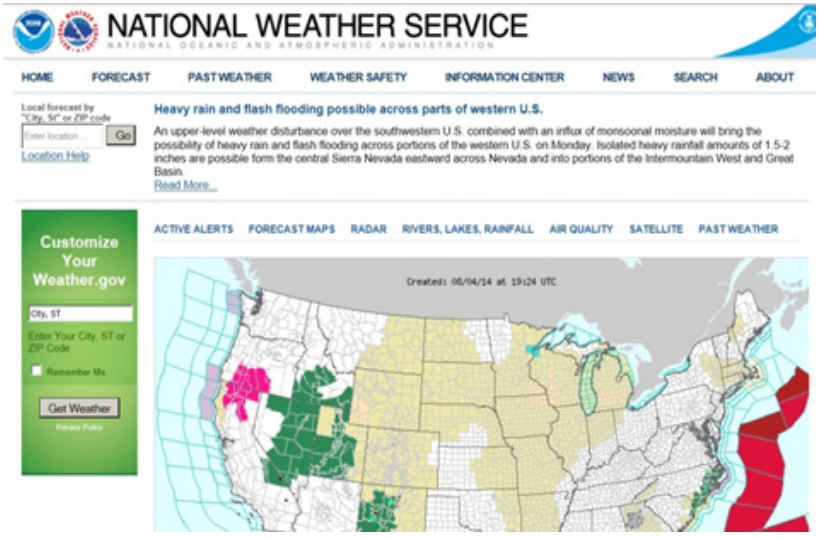
5. Time composite sheet flow samples

A programmable sheet flow sampler takes an aliquot of sheet flow after a set period of time and combines each sample into one bottle. All of the parts of the hydrograph receive equal weight in the final concentration, and the large number of aliquots can produce a reasonably accurate composite concentration.

Appendix F Minnesota rainfall information

Forecasting of rainfall amounts

Use the National Weather Service's "Forecasting of Rainfall Amounts" to get storm event information and optimize monitoring opportunities at www.weather.gov.



In general, Permittees in the Twin Cities and surrounding metropolitan area can expect approximately four to eight storm events per month.

Table 1 Days per month with storms greater than 0.1 inch (rainfall equivalents)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
N	31	31	31	31	31	31	31	31	31	31	31	31
50%	3	2	5	6	7	7	6	7	5	4	4	2
75%	4	4	6	8	9	9	7	8	7	6	6	4
25%	2	1	4	4	5	5	4	5	4	2.3	2	1.3

Data from the past 31 years was compiled and summarized in the table above. Quartiles with drier periods are indicated by the 25th percentile, wetter conditions by the 75th percentile and average conditions by the 50th percentile.

Minnesota thaw events

The probability of January thaws is very high in southern Minnesota (~90% likelihood) and parts of central Minnesota (~80% likelihood), and somewhat lower in northern Minnesota (~50% likelihood).

Table 2 Historical likelihood of January thaws* since 1948

(*Defined as 2 or more days with daytime temperatures greater than 32° F

Twin Cities 92%	Rochester 95%	Pipestone 92%
Fairmont 93%	St. Cloud 87%	Morris 80 %
Crookston 62 %	Duluth 60%	International Falls 50%

Source: Mark Seeley, Minnesota WeatherTalk Friday, January 4, 2008

Appendix G Impaired waters

All Permittees are required to check annually to determine whether a facility has stormwater discharges that flow to, and are within a mile of, a United States Environmental Protection Agency (USEPA)-approved listed impaired water. The following Impaired Waters Search Link can be used to make this determination: http://www.pca.state.mn.us/mvri1126.

If the facility discharges to a designated Impaired Water, the Permittee is required to conduct additional monitoring for only those pollutants of impairment or a surrogate pollutant (see Table 2 of the Industrial Stormwater General Permit). If one of the pollutants that a waterbody is listed as being impaired for matches one of the parameters in your sector-specific requirements, additional benchmark monitoring is required if the facility monitoring locations are within a mile of the impaired water and the stormwater discharge flows to it.

* The first sampling interval will begin no later than 180 days after the final USEPA-approved listing.
* The Permittee should follow the monitoring schedule already used by the facility.
* If the facility's monitoring schedule has a sampling interval that will begin in the month immediately after the 180 days, a facility may wait until that time to begin monitoring.

Facilities which exceed benchmark monitoring values after averaging sample results from four separate quarters must continue quarterly monitoring until average sample results fall below the benchmark monitoring values.

Appendix H Resources and references

United States Environmental Protection Agency, 1992
NPDES Storm Water Sampling Guidance
EPA 833-B-92-001

Washington Department of Ecology Water Quality Program, December 2002
How To Do Stormwater Sampling A guide for industrial facilities
Publication #02-10-071

Washington Department of Ecology Water Quality Program, December 2002 (rev. March 2010)
How To Do Stormwater Sampling: A guide for industrial facilities
Publication #02-10-071

Wisconsin Department of Natural Resources Bureau of Water Management
Municipal Wastewater Section—Storm Water Unit, 1994
Wisconsin's Guidance for Industrial Storm Water Monitoring.

Vermont Agency of Natural Resources, Department of Environmental Conservation
Water Quality Division—Stormwater Section
Stormwater Sampling for the Vermont Multi-Sector General Permit: A Guide for Industrial Facilities