Comprehensive Water Quality Assessment of Select Metropolitan Area Streams

GLOSSARY AND ACRONYMS

METROPOLITAN COUNCIL

December 2014

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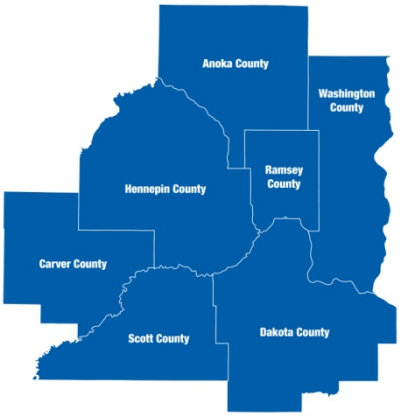

The Metropolitan Council is the regional planning organization for the seven-county Twin Cities area. The Council operates the regional bus and rail system, collects and treats wastewater, coordinates regional water resources, plans and helps fund regional parks, and administers federal funds that provide housing opportunities for low- and moderate-income individuals and families. The 17-member Council board is appointed by and serves at the pleasure of the governor.

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About the Study

The Twin Cities metropolitan area has a wealth of streams that traverse its landscape and ultimately flow into one of its three major rivers – the Mississippi, the Minnesota, and the St. Croix. These streams provide rich habitat for aquatic life and wildlife and enhance the recreational and aesthetic value of the metro area.

The Metropolitan Council is committed to the conscientious stewardship of the region's streams and works with its partners to maintain and improve their health and function. The foundation for these efforts is the collection and analysis of high-quality data about their condition over time.

The *Comprehensive Water Quality Assessment of Select Metropolitan Area Streams* is a major study conducted by the Metropolitan Council that examines the water quality of 21 streams or stream segments that discharge into the metropolitan area's major rivers. The study provides a base of technical information that can support sound decisions about water resources in the metro area − decisions by the Council, state agencies, watershed districts, conservation districts, and county and city governments.

All background information, methodologies, and data sources are summarized in *Introduction and Methodologies*. This section, *Glossary and Acronyms*, provides a glossary of frequently used technical terms and a list of common acronyms. Both of these, as well as individual sections for each of the 21 streams, are available for separate download from the report website. The staff of Metropolitan Council Environmental Services (MCES) and local cooperators conducted the stream monitoring work, while MCES staff performed the data analyses, compiled the results and prepared the report.

Cover Photo

Native water cress forms a stunning green blanket on groundwater-fed Silver Creek during winter.

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The following acronyms and terms are used frequently throughout each section of the *Comprehensive Water Quality Assessment of Select Metropolitan Area Streams.* We provide them here to assist readers in understanding the technical language in the sections discussing the individual streams.

Acronyms

AU	Animal Units
BCWD	Browns Creek Watershed District
BCWMC	Bassett Creek Watershed Management Commission
BMP	Best Management Practice
BOD_5	5-Day Biological Oxygen Demand
BP	Before present
BWSR	Minnesota Board of Water and Soil Resources
cfs	cubic foot per second
Cl	Chloride
CMSCWD	Carnelian Marine St. Croix Watershed District
CNII	SCS Curve Number for moisture conditions II
DEM	Digital Elevation Model
DO	Dissolved Oxygen
FBI	Family Biotic Index
FWM	Flow-weighted mean concentration
GIS	Geographic Information System
HIDEN	High Spatial Density Precipitation Network
IBI	Index of Biological Integrity
KCl	Potash, Potassium Chloride
LBS	Pounds
LGU	Local Governmental Unit
MCES	Metropolitan Council Environmental Services
M-IBI	Macroinvertebrate Index of Biological Integrity
mg/l	Milligrams per Liter
MPRB	Minneapolis Parks and Recreation Board
MCWD	Minnehaha Creek Watershed District
MnDNR	Minnesota Department of Natural Resources
MnDOT	Minnesota Department of Transportation
MLCCS	Minnesota Land Cover Classification System
MPCA	Minnesota Pollution Control Agency
MSL	Mean Sea Level
NASS	National Agricultural Statistics Service
NLCD	National Land Cover Database
NH_3	Ammonia/ammonium nitrogen

NMWD	Nine Mile Watershed District
NO_2	Nitrite nitrogen
NO_3	Nitrate nitrogen
NPDES	National Pollutant Discharge Elimination System
NPS	Metropolitan Council's NonPoint Source monitoring program
NRCS	Natural Resources Conservation Service
NWI	National Wetland Inventory
PCBs	Polychlorinated biphenyls
PFOS	Perfluorooctane sulfonate
POET	Plecoptera, Odonata, Ephemeroptera, and Trichoptera macroinvertebrate orders
lb/ac	Pounds per acre
lb/ac/in	Pounds per acre per inch
PWI	Public Waters Inventory
RNR	River Nutrient Region
RWI	Restorable Wetland Inventory
RWMWD	Ramsey-Washington Metro Watershed District
SCWRS	Science Museum of Minnesota - St. Croix Watershed Research Station
SDS	State Disposal System
SWCD	Soil and Water Conservation District
STATSGO	State Soil Geographic Database
TKN	Total Kjeldahl nitrogen
TMDL	Total Maximum Daily Load
TDP	Total Dissolved Phosphorus
THPP	Trout Habitat Preservation Project
TP	Total Phosphorus
TSS	Total Suspended Solids
TWM	Time-weighted mean concentration
URHD	Urban – High Density land cover
URLD	Urban – Low Density land cover
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VBWD	Valley Branch Watershed District
WCD	Washington Conservation District
WD	Watershed District
WMC	Watershed Management Commission
WMO	Water Management Organization
WOMP	Metropolitan Council's Watershed Outlet Monitoring Program
WTP	Potable Water Treatment Plant
WWTP	Waste Water Treatment Plant

Glossary

Analyte

The term analyte refers to a chemical component, typically dissolved in water. In water quality management, analyte refers to the specific chemical of interest, for example phosphorus, nitrogen, or chloride.

Aquatic insect

Aquatic insects are bugs that spend a large portion of their lives in the stream. Aquatic insects are an important part of the food chain. Fish, birds, and other wildlife rely on them for food. In addition, these insects are highly sensitive to pollution in the water, so the variety and health of insects found in a stream can be used as a measure of overall stream health

Aquifer

A saturated geologic formation that will yield a sufficient quantity of water to serve as a private or public water supply.

Areal-weighted

A method to normalize data per unit of area. Specifically, for the Streams Report, the pollutant loads were divided by their contributing areas. This allows for the comparison between stream watersheds independent of contributing area.

Best Management Practices (BMP)

The US Environmental Protection Agency (EPA) uses the term BMP to describe a type of water pollution control. BMPs can be structures, like raingardens, ponds, swales, and stabilized stream banks. BMPs can also be non-structural, for example cleaning up pet waste or ordinances banning application of phosphorus-based fertilizers. See The Minnesota State Stormwater Manual (posted on the Minnesota Pollution Control Agency's (MPCA's) website, for additional examples of best management practices.

Biochemical Oxygen Demand (BOD)

Measure of the amount of oxygen required by bacteria to consume organic matter in water. Measured over a period of time, typically 5 days at 20°C.

Biological Interactions

The effects of organisms within a community have on each other. They influence each individual organism and the ecosystem as a whole. This includes (but not limited to): competition between organisms, consumption of other organisms (predation, herbivory, or cannibalism), or mutually beneficial interactions (symbiosis).

Catchment

See "watershed."

Causative Variable

Explanatory variables that have a strong correlation with response variables. For example, higher concentrations of total phosphorus (causative variable) correlate positively with higher concentrations of chlorophyll a (response variable).

Chloride

Chloride is a chemical commonly used in winter ice removal salts and home water softening products. When the snow and ice melt off the roads, parking lots, and sidewalks, the chloride is carried into our streams. High concentrations of chloride can be harmful to aquatic life.

Coldwater fish assemblage

Coldwater fish assemblage refers to the types of fish typically found in coldwater environments, like groundwater-fed streams with high dissolved oxygen concentrations and low levels of pollutants. Primary types of fish in a coldwater assemblage are trout and sculpins.

Coliform Bacteria

Microorganisms (for example, Escherichia coli) common to the intestinal tract of warm blooded animals. The organisms' presence in water is an indicator of the presence of pathogenic organisms.

Composite Sample

A sample which consists of a mixture of several individual grab samples collected at regular and specified time intervals (time weighted composite sample) or flow volume intervals (flow weighted composite samples).

Concentration and average concentration

The amount of a substance or pollutant per volume of water. MCES typically uses mass per unit volume of water, in units of milligram per liter (mg/l). Alternatively, concentration could be expressed in other units, such as pounds per gallon (lb/gal) or micrograms per liter (µg/l). Concentration can also be expressed as count per unit volume of water, such as organism count per 100 milliliters of water, a common measurement for bacteria.

In streams or rivers, two types of "average" concentrations can be calculated and each accurately represents a specific type of stream condition. The "time-weighted mean concentration" (TWM) reflects the average pollutant concentration as seen by fish in the stream or public water supplies that draw upon the river for drinking water. Calculation of the time-weighted mean concentration requires information on the concentration in each sample plus the time window during which that concentration occurred. This calculation is independent of the flow in the stream at the time of sample collection. By calculating the TWM concentration, the concentration in each sample is weighted by the period of time it represents. For the TWM concentration, samples at all flow regimes are weighted the same. MCES did not calculate TWM concentrations for this report.

The "flow-weighted mean concentration" reflects the load of pollutant delivered by a stream to receiving water body, like a major river. Calculation of the flow-weighted mean concentration (FWM) requires data on the concentration, sample time window, and stream flow at the time of sample collection. Through calculation of the FWM concentration, each sample is weighted by both the time and the flow that accompanied it. Simply stated, the FWM concentration is the total pollutant load transported during a specific time period divided by the total flow volume for that time period. For the FWM concentration, sample concentrations during high-flow storm events are weighted more heavily than low -flow or baseflow samples. MCES did calculate FWM concentrations for each stream as part of the pollutant load calculation process, and those concentrations are presented in the report. (Adapted from

https://www.heidelberg.edu/sites/default/files/jfuller/images/2.d.%20Time-weighted%20and%20Flow-weighted%20Mean%20Concentrations.pdf. Accessed Sept. 11, 2014).

Conductivity

A measure of the conduction of electricity through water; can be used to determine the total dissolved salts content. EC is measured in µS/cm.

Contaminant

Any chemical, microbe, or other material that is not found in pure water and that can make water unsuitable for its intended use. Some contaminants only affect aesthetic qualities such as appearance, taste, or odor of the water, while others can produce adverse health effects.

Constituent

One of the chemicals that are a part of the chemical composition of a water sample.

Dissolved Oxygen (DO) Flux

DO flux is the difference between the daily maximum and daily minimum DO. DO concentrations naturally exhibit a diel (daily) cycle. Photosynthesizing aquatic plants and algae increases DO concentrations throughout daylight hours. At night, DO decreases when photosynthesis stops and respiration continues. A high daily flux value indicates eutrophication.

E. coli

Escherichia coli; bacterium found in the intestinal tracts of warm blooded animals, including humans. Used as an indicator of the presence of pathogenic organisms.

Effluent

Wastewater, treated or untreated, that flows out of a wastewater treatment plant, or industrial outfall.

Entrain

A process where material such as suspended solids is picked up and carried along in the current of a stream.

Eutrophication

The process by which a body of water becomes enriched in nutrients that stimulate the growth of aquatic plant life, especially algae.

Evapotranspiration

The water evaporated from soil surfaces and transpired by plants, which ultimately ends up in the atmosphere.

Fecal coliform

The coliform bacteria group, present in the intestinal tracts and feces of humans and other warm-blooded animals. Drinking water with fecal coliform can cause diarrhea and other gastrointestinal illnesses. Often reported in units of CFU/100 ml.

First Flush

The first portion of runoff from a storm event, in which the concentrations of pollutants are higher than in subsequent runoff from the same storm event.

Flow Path

Subsurface preferential pathways (due to geologic properties) of least resistance that groundwater travels.

Flow

Stream flow can refer to both the rate of water flowing in the stream at any particular time (cubic feet per second, or gallons per second) or the total amount of water delivered by the stream into a larger body of water (gallons per year).

Flow Rate

The rate at which a volume of water flows in a stream channel in a given period of time. Flow rate is often reported as cubic feet per second (cfs).

Flux

The movement and transportation of a mass of any water quality constituent such as suspended solids or nutrients over a set period of time.

Glacial Outwash Plain

Flat area of sediment deposited by melting ice at the leading edge of a glacier.

Grab Sample

A water sample collected at a single point in time.

Groundwater

Water that has seeped beneath the earth's surface and is stored in the pores and spaces between solid materials (e.g., sand, gravel or clay).

Indicator species

Microorganisms whose presence is indicative of pollution or of more harmful microorganisms (e.g., E. coli can indicate the presence of pathogenic bacteria).

Isotope

One of two or more species of the same chemical element; that is, having the same number of protons in the nucleus but differing from one another by having a different number or neutrons. The isotopes of an element have slightly different physical and chemical properties, owing to their mass differences, by which they can be separated.

Isotopic Analysis

The identification of isotopic signature, the distribution of certain stable isotopes and chemical elements within chemical compounds. Often used to identify the age of water or food web/ trophic interactions.

Knickpoint

Any interruption or break of slope; especially a point of abrupt change or inflection in the longitudinal profile of a stream or of its valley.

Leachate

A liquid (most often water), that passes through soil or sediment and extracts solutes, suspended solids, or any other component of the material which it has passed. Coffee making is often used to explain leachates. In order to make coffee water percolates down through the coffee grounds and the end result is the coffee we drink.

Load

The mass (as expressed in pounds or kilograms) of constituent or pollutant transported by a river or stream during a specified time period (for example, pounds-per-year). MCES typically uses the computer tool Flux32 to estimate stream and river loads using sample concentrations and daily average flow values.

Load Duration Curve

A plot of daily flow and pollutant (typically nutrients, sediment, or chloride) concentration that allows for characterization of the water quality occurring at different flow regimes. Flow regimes (or categories) typically used in a load duration curve include low flow, dry conditions, mid-range flows, moist conditions, and high flows.

Macroinvertebrate

The US Environmental Protection Agency (EPA) defines aquatic macroinvertebrates as organisms large enough to be seen with the naked eye that lack a backbone. They inhabit all types of running water, including small streams and large rivers. Examples include insects (mayflies, stoneflies, caddisflies), crayfish, clams, snails, and worms. Presence of aquatic macroinvertebrates is a good indicator of stream quality. See “aquatic insect”.

Mechanical System with Activated Sludge

This term refers to a type of wastewater treatment plant (WWTP), which uses “activated sludge” (a mixture of bacteria, fungi, protozoa and rotifers) and dissolved oxygen to remove waste, nutrients, and pollutants from the water before it is discharged back to the environment. The final product of a WWTP is called treated effluent; the treated is effluent is typically discharged to a river or stream.

Moraine

Material, usually soil and rock, left behind by a moving glacier.

MSL (mean sea level)

A datum representing the average height of the ocean’s surface; used as a standard in determining land elevation.

Nitrate

Nitrate (NO_3) is a nutrient necessary for aquatic growth, but excessive amounts can lead to problems like algae blooms, decreased oxygen levels, and fish kills. In addition, high NO_3 levels in drinking water can lead to methemoglobinemia, a blood condition usually affecting infants that

is caused by NO_3 molecules interfering with the ability of red blood cells to transport oxygen efficiently. Common sources of NO_3 include fertilizers, plant debris, and septic and municipal wastewater treatment systems.

Nutrient

The most common nutrients of concern in stream water quality are nitrogen (often measured as nitrate) and phosphorus. Low levels of nutrients do occur naturally and are important for stream health. However, too many nutrients (from lawn or agricultural fertilizers, malfunctioning septic systems, grass clippings, and manure and pet wastes) can be harmful to stream health.

PCBs

PCBs stands for the series of pollutants polychlorinated biphenyls. PCBs were banned in the United States in 1979. The chemicals were originally used in products like transformers and capacitors, motor and hydraulic system oils, thermal insulation, adhesives and tapes, plastics, and caulk. PCBs have been demonstrated to cause cancer and affect the immune, nervous, and reproductive systems.

PFOS

PFOS stands for the pollutant perfluorooctane sulfonate. PFOS is a human-made substance originally manufactured for use in a variety of products, including firefighting foams, coating additives, cleaning products, paper and packaging, and coating additives. Intake of the chemical can cause developmental, reproductive, and systemic effects (U. S. Environmental Protection Agency, March 2014. Emerging Contaminants – Perfluorooctane Sulfonate (PFOS) and Perfluorooctanoic Acid (PFOA). EPA 505-F-14-001).

pH

A method to measure how much acid is in the object you are measuring. pH values range from 0 (the most acidic) to 14 (the least acidic). A value of 7 is neutral.

Phosphorus

Phosphorus is a nutrient that can contribute to water quality issues in lakes and streams. Low levels of phosphorus do occur naturally and are important for stream health. However, too much phosphorus (from lawn or agricultural fertilizers, malfunctioning septic systems, grass clippings, and manure and pet wastes) can be harmful to stream health. See “Total Phosphorus”.

Piezometer

A well drilled to measure the elevation of the water table. The well usually has a very small diameter and is not used to pump water.

Piezometric Survey

A survey that defines the piezometric surface of groundwater.

Piezometric Surface

An imaginary surface representing the total head of groundwater and defined by the level to which water will rise in a well. The water table is a particular piezometric surface. Synonymous with potentiometric surface.

Point source

A source of pollution that has a clear and identifiable location such as a pipe. Most of the point source discharges are from wastewater treatment plants and industrial facilities.

Precipitation-weighted

A method to normalize areal-weighted data per depth of precipitation. Specifically, for the Streams Report, the areal-weighted pollutant loads were divided by the depth of precipitation received in each year. This allows for the comparison between stream watersheds independent of contributing area and amount of precipitation.

Raingarden

A best management practice used for treating runoff from impervious urban areas such as roofs, driveways, sidewalks, parking lots and compacted lawns. A raingarden is a depressional area with plants where rainwater runoff from the impervious surfaces is directed to allowing the runoff to soak into the ground, reducing the runoff and absorbing pollutants.

Rating Curve

A relationship between discharge and water depth for a give point on a stream or river. The development of a rating curve requires many field measurements.

Response variable

A way to measure how a factor changes.

Riparian

Pertaining to or situated on the bank of a body of water, esp. of a river.

Runoff

The flow of water from precipitation or other source that appears in surface streams. Runoff may be classified depending on how quickly it appears after rainfall or snowmelt (for example, direct runoff or base runoff, respectively) or classified as to the source of water (for example, surface runoff or overland flow, stormwater runoff, groundwater runoff). For this report, MCES reported runoff volume as depth of water over the contributing watershed area as measured during a specific time period (in this case one year), with units of inches per year. The calculation was made by dividing the observed streamflow (in units of cubic feet per year) by the watershed area. (Adapted from http://water.usgs.gov/wsc/glossary.html#R. Accessed Sept. 10, 2014).

Sediment

Sediment is made up of sand, silt, or clay particles. Sediment is naturally present in all streams, but excessive sediment can enter the stream from construction sites or eroded stream banks and gullies. Excess sediment in a stream decreases the light available for plant growth, increases water temperature, clogs gills of fish, and smothers the habitat of valuable aquatic insects. In the MCES monitoring program, sediment is referred to as “total suspended solids” (TSS).

Seeps and Springs

Areas where groundwater is discharged directly onto the land surface. Seeps can provide habitat for wildlife. Springs can flow year round and provide a water source for wetland vegetation and forage as well as can help to maintain baseflow levels in streams and rivers.

Solute

A solute is a chemical dissolved in a liquid, typically water.

Surface Water

Water that remains on the earth's surface, in oceans, rivers, streams, lakes, wetlands or reservoirs.

Surficial Flowpaths

Flowpaths that are not very deep in the subsurface.

Talus slope

A steep angled slope that has accumulated debris piles.

Taxa

Plural form of taxon.

Taxon

A biological term to define a group of one (or more) populations of organism(s), which a taxonomist adjudges to be a unit.

Till

Poorly sorted sediment that was deposited under or immediately next to a continental glacier.

Till Plain

A smooth, flat area of glacial till.

Total Maximum Daily Load (TDML)

A calculation of the maximum amount of a pollutant that a water body can receive and still meet water quality standards established by the Minnesota Pollution Control Agency (MPCA).

Total Phosphorus

Phosphorus is a nutrient that is necessary for growth of aquatic organisms, excessive amounts can lead to algae blooms, decreased oxygen levels, and fish kills. Erosion of fertilized soils is a primary source of phosphorus to streams or rivers. Total Phosphorus (TP) is the total mass of soluble and particulate phosphorus in a volume of water. See "Phosphorus".

Total Suspended Solids

Total Suspended Solids (TSS) are solid materials, organic and inorganic, that are suspended in the water, including silt, sand, soil, and algae. TSS in a stream can be expressed as a concentration (in units like milligrams per liter) or a mass load (in units like pounds per year). See "Sediment".

Trophic

A biologic term pertaining to nutrition or feeding.

Turbidity

The amount of small particles of solid matter suspended in water as measured by the amount of scattering and absorption of light rays caused by the particles. Turbidity is measured in nephelometric turbidity units (NTU).

Watershed

A land area defined by topography, soil and drainage characteristics that collects water that flows to a common point. The watershed of a stream is all land area that drains to stream along its entire length.

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