Technical Bulletin

Permit to Take Water – Phase 1 Monitoring and Reporting

This bulletin is to assist Phase 1 permit holders in understanding the monitoring and reporting requirements of the Water Taking and Transfer Regulation (O. Reg. 387/04).

In Ontario, water takings are governed by the Ontario Water Resources Act (OWRA) and the Water Taking and Transfer Regulation. Section 34 of the OWRA requires anyone taking more than 50,000 litres of water a day, with some limited exceptions, to obtain a Permit to Take Water (PTTW) from the Ministry of the Environment (ministry).

The new regulation, that took effect January 1, 2005, introduced improvements to the Permit to Take Water Program, including strengthening the factors to be considered by the ministry when assessing water taking applications. As well, the regulation introduced mandatory monitoring and reporting of water takings by all permit holders.

The data base will support improved water management in the province, including the sustainable management of water takings, water conservation, development of water budgets, and reporting of water use under the Great Lakes Charter. Summaries of the data on water takings will be made available to the public.

Tracking water takings can provide valuable information to help promote water conservation. By using water more efficiently every permit holder helps ensure a sustainable supply of water for the future.

Section 9 of the Water Taking and Transfer Regulation requires all permit holders to collect and record data on the volume of water taken daily and report this data annually to the ministry. These requirements will be implemented in three phases over the period July 1, 2005 through January 1, 2007. The data on the volume of water taken daily must be measured by a flow meter or calculated using a method acceptable to the ministry..

Permit holders covered under Phase 1 are required to collect and record the data on the volumes of water taken daily beginning July 1, 2005, and must submit their first set of data covering the period July 1 through December 31, 2005 to the ministry by no later than March 31, 2006. Beginning January 1, 2006, the data is required to be collected and recorded annually from January 1 to December 31 and submitted by no later than March 31 of the next year.

Phase 1 permit holders

Phase 1 applies to permit holders taking water for any of the following purposes:

- Large and small municipal residential systems as defined in the Drinking-Water Systems Regulation (O. Reg. 170/03);
- beverage manufacturing, including the manufacturing or production of bottled water or water in other containers;
- fruit or vegetable canning or pickling;
- ready-mix concrete manufacturing, not

including concrete manufactured at a portable ready-mix concrete manufacturing facility;
- aggregate processing, if the aggregate and the water that is taken are incorporated into a product in the form of a slurry;
- product manufacturing or production if, in the normal course of the manufacturing or production, more than 50,000 litres of the water taken may be incorporated in a single day into the products being manufactured or produced; and
- the operation of a facility governed by any of the following regulations, made under the Environmental Protection Act:
  - O. Reg. 560/94 (Effluent Monitoring and Effluent Limits – Metal Mining Sector)
  - O. Reg. 215/95 (Effluent Monitoring and Effluent Limits – Electric Power Generation Sector)
  - O. Reg. 561/94 (Effluent Monitoring and Effluent Limits – Industrial Minerals Sector)
  - O. Reg. 64/95 (Effluent Monitoring and Effluent Limits – Inorganic Chemicals Sector)
  - O. Reg. 214/95 (Effluent Monitoring and Effluent Limits – Iron and Steel Manufacturing Sector)
  - O. Reg. 562/94 (Effluent Monitoring and Effluent Limits – Metal Casting Sector)
  - O. Reg. 63/95 (Effluent Monitoring and Effluent Limits – Organic Chemical Manufacturing Sector)
  - O. Reg. 537/93 (Effluent Monitoring and Effluent Limits – Petroleum Sector)
  - O. Reg. 760/93 (Effluent Monitoring and Effluent Limits – Pulp and Paper Sector)

Phase 2 and Phase 3 permit holders

Information for permit holders covered in Phases 2 and 3 will be sent out in separate bulletins.

Phase 2 applies to permit holders taking water for any industrial or commercial purpose not described in Phase 1, and to permit holders taking water for wildlife and conservation purposes. Phase 3 applies to permit holders taking water for large and small municipal non-residential systems; large and small non-municipal non-residential systems; non-municipal seasonal residential systems and non-municipal year-round residential systems; as well as agricultural and all other remaining permit holders not described in Phases 1 or 2.

Monitoring of water takings by using a meter

Continuous metering at the point of water taking is the normally accepted, most accurate, and easy-to-use method of monitoring the volume of water taken daily (in litres per day).

It is expected that most Phase 1 permit holders, in particular, MISA sector companies and large and small municipal residential systems, are already using water meters to monitor water use. Consequently, these permit holders may need only to establish a daily monitoring schedule to collect and record the necessary water taking data. A standard criterion for approval of a large and small municipal residential system is that a sufficient number of flow measuring devices within the drinking-water system are installed to permit continuous measurement and recording of the flow rate and daily volume of water conveyed into the treatment system.

Each water taking source should be monitored. However, where multiple water taking sources are listed on a permit, the ministry will generally accept a single daily total volume of these takings provided all the sources are from the same hydrologic unit (for example a surface water stream or a groundwater aquifer).

For large and small municipal residential systems with permitted water takings from multiple sources, flow measurement at the point where water is conveyed into the treatment system is also acceptable and meets the regulatory requirements for permit holders.

For MISA facilities governed by the Ontario Regulations 560/94, 215/95, 561/94, 64/95, 214/95, 562/94, 63/95, 537/93 and 760/93, the ministry will accept, in place of metering at the point of water taking, a calculation that aggregates metered daily total volume discharged from all discharge points and includes all estimated losses between the point of taking of raw water at source and the discharge of effluent from the facility (for example, evaporation or other losses). The calculation should be prepared by a qualified person, such as a professional engineer.

Selecting the right water meter

There are several types of water meters available for use in either closed conduit or open channel

water systems. In closed systems, water flows in enclosed pressure conduits (pipes) and the water flow is often measured by inserting a meter into the line. In an open channel, water flows through a channel with an open or exposed surface.

It is best to consult with a water meter supplier or metering contractor to select the right meter for the facility or operation. A list of some types of water meters for both closed conduit and open channel systems can be found in the resource section of this bulletin.

Maintenance and calibration of water meters and record keeping requirements

To ensure the continued accuracy of the meter, it should be maintained on a regular basis and calibrated annually.
Permit holders should maintain an on-site log of daily water takings. Maintenance and calibration records for water meters used for monitoring daily water takings and for the pump or pumps used to extract the water should also be kept on site for inspection by the ministry.

Monitoring of water takings by a calculation method acceptable to the Director

Where the use of a flow or a volumetric meter is not feasible or practical, the ministry allows manual calculation of daily water takings using acceptable methods. Acceptable methods for both closed conduit and open channel systems are discussed in the resource section of this bulletin.

The calculated volume of water taken daily is required to be within 20% accuracy or better. To ensure the calculation accuracy is 20% or better, it is recommended that at least once a year a spot meter be used to cross-check the calculated daily volume of water taken.

Annual reporting requirements

Phase 1 permit holders must submit the data on the total volumes of water taken daily for the period

Table 1 – Closed conduit water meters

Meter Type	Pipe Diameter	Accuracy	Intrusive	Remote Reading	External Power Source	Worth Noting
Differential Pressure	Typically > 300 mm	±±2% – ±±5%	Yes	Yes	No	Commonly used in larger applications and includes venturi–style, orifice plate and V-cone type meters. Long life-span with average maintenance and calibration requirements.
Magnetic	100 – 900 mm	±±2%	Yes	Yes	Yes*	Commonly used in municipal and industrial applications. Long life-span with low maintenance and calibration requirements.
Propeller & Turbine	50 – 600 mm	±±2% - ±±5%	Yes	Yes	No	Commonly used in municipal and industrial applications. Offer a lower cost solution to metering, but due to moving parts, higher calibration and maintenance requirements.
Ultrasonic	> 150 mm	±±2% - ±±5%	No	Yes	Yes	Good for temporary metering and for flow metering in locations where isolating the flow is impossible or very costly. Average maintenance requirements.
Vortex	100 – 400 mm	±±2%	Yes	Yes	Yes	Commonly used in industrial applications. Low maintenance and calibration requirements, but proper installation critical.
Velocity Jet	25 – 150 mm (for single jet) 15 – 50 mm (for multi-jet)	±±2%	Yes	Yes	No	Lower cost solution to metering smaller sized conduits with varying flow rates. More frequent calibration and maintenance requirements.
Insertion	150 – 1500 mm	±±5%	Yes	Yes	Yes*	For use in difficult installation situations or for temporary flow monitoring. Due to moving parts, higher maintenance and calibration requirements.
Positive Displacement	15 – 60 mm	±±2%	Yes	Yes	No	Commonly used in residential and small commercial applications and in industrial applications for accurate volumetric metering. Long life-span with low maintenance requirements.

** External power source not required for some models*

covering July 1, 2005 through December 31, 2005, to the Ministry of the Environment on or before March 31, 2006.

Annual reports of the data on the total volume of water taken daily (in litres per day) for each subsequent year must be submitted on or before March 31 each year thereafter.

The new monitoring and reporting requirements contained in O. Reg. 387/04 work in conjunction with conditions imposed in a permit.Where a permit requires the permit holder to collect information at a greater frequency or to collect additional information (for example, recording daily maximum flow and/or a requirement that all water taking information be analyzed by a qualified professional and reported annually), the permit holder must comply with these conditions. In addition, the data on the total volume of water taken daily must be submitted to the ministry annually, notwithstanding any contrary conditions in the permit that only require the permit holder to retain the data on site.

Information on the specific form and manner for annual reporting will be made available to permit holders in a separate technical bulletin.

Monitoring and reporting resources

There are numerous types of water meters available on the market for both closed conduit and open channel systems. Below is a description of some types of available water meters for volumetric measurement.

Closed conduit metering systems

Water meters for closed conduits or pipes are typically inserted directly into the line, but there are non-intrusive models available. Table 1 provides a brief description of some types of available water meters for volumetric measurement for use in closed conduit systems.

Open channel metering systems

Open channel metering systems are used on gravity-fed applications and are normally metered by one of the following methods:

1. **Area / Velocity water meters:** A water flow velocity sensor and depth sensor is placed at the bottom of an open channel of known configuration. Flow and volumetric readings are obtained by determining the cross-sectional area of the water flow and multiplying it by the sensed velocity.

2. **Weir flow measurement:** A weir is a calibrated structure used to relate water level to flow. Water flow over a weir will create a unique head-to-discharge relationship, thus by measuring the head above the weir crest; an accurate flow-rate can be established.

3. **Flume flow measurement:** A flume is a specially shaped open channel flow section that restricts the channel area in such a way that the depth of flow in the channel restrictions is directly proportional to the flow of water.

To obtain daily volumetric measurements for Weir-flow and Flume-flow metering systems, an instrument to measure the water level (depth of flow) and recording device (such as a data logger) are required. A calculation must be made manually or automatically to convert the flow rate measurement and daily taking times into a daily volumetric measurement.

Calculation method for closed conduit systems

In order to demonstrate that the calculation method used for the daily volume of water taken in closed conduit systems is acceptable, a permit holder is required to keep on site the following information (at a minimum) for inspection:

Daily pump run-time – Daily pump run-time is the amount of time each day (24 hour period) the pump is in operation. The pump run-time can be recorded with an automatic recording device, such as an hour meter, affixed directly to the pump.

Pump discharge pressure head – Pump discharge pressure head is the total water pressure expressed in elevation at the point the water is discharged from the pump itself. Pump discharge pressure head is obtained by monitoring the pump with a pressure head transducer and recording device, such as a data logger.

Suction head – Suction head is the vertical distance between the pumped water (at the point of taking) and the pump (the lift). If the water

source and pump are both located at the same level or height then the suction head would be zero. If the water is taken from a well or a surface source located down-hill from the pump, it will be necessary to determine the suction head by determining the elevation difference between the water source and the pump.

Total Dynamic Head (TDH) – TDH is the pump discharge pressure head plus the difference in head between the pumped water extraction point and the pump discharge point. TDH is calculated by adding the total pump discharge pressure head and the suction head.

TDH = pump discharge pressure head + suction head

Pump curve – A pump curve is a graph showing the range of head-discharge performance for a specific pump. The pump curve specific to the type of pump should be included with the literature supplied by the pump manufacturer or installer. Pump curves from the manufacturer have at least an accuracy of 20%. The accuracy of the pump curve can be improved to within 10% if a site-specific pump curve is developed at the actual pump installation point. If a pump curve cannot be located, identify the model number on the pump and contact the manufacturer to request a pump curve.

Average pump flow rate – The average pump flow rate is obtained from the pump curve using the Total Dynamic Head (TDH) measurement.

To calculate the daily volume of water taken, multiply the average pump flow rate by the Daily pump run-time:

Daily volume = average pump flow rate X daily pump run-time

It is strongly recommended that the pump be calibrated at minimum annually, or after any maintenance or part replacement and routinely run pump curve tests to ensure the accuracy of the daily water taking volume calculations.

Calculation method for open channel systems

Open channel systems involve the use of a canal, ditch, stream or other constructed infrastructure to divert water from its source. In order to demonstrate that the calculation method used for daily volume of water taken from open channel systems is acceptable, a permit holder is required to keep on site the following information:

Stage-discharge Rating Curve – A stage-discharge rating curve depicts an average flow rate for a certain depth of water (stage) in an open channel. In order to develop a stage-discharge rating curve, detailed recording of actual discharge at several stages (depths of water) must be taken. Once the stage-discharge curve is established, volume measurements can be calculated based on the depth of water recorded at set intervals (normally every 15 minutes) over a day.

Open channel discharge – The open channel discharge needed for the development of a stage-discharge rating curve can be recorded using a temporary open channel metering system as described above in the section titled “Open channel metering systems”. In addition, discharge can be measured using standard river gauging techniques. Stream or river gauging is a graphic integration of the velocity distribution over the cross-sectional area of the open channel. The process can be difficult for streams and ditches as the cross-sectional area at the measurement location must be established. It is much easier to undertake this process in canals of constant geometry. Velocity measurements are taken using, current, magnetic, acoustic or Doppler velocity meters.

Open channel stage (water level) – The open channel stage is measured using a depth transducer or level transducer and recorded using either a chart or data recorder. This provides a constant level or stage indication from which an average flow rate can be established from the stage-discharge rating curve.

To calculate the daily volume of water taken, the average daily open channel flow rate (calculated from the stage-discharge rating curve and average stage depth), is multiplied by the total daily taking time (24 hours in systems with no control gates).

Daily Volume = average open channel flow rate X daily taking time

It should be noted that volumetric calculations using the stage-discharge rating curve method require frequent verification of the stage-discharge rating curve for streams and ditches as channel geometry may change rapidly. It is recommended

that the stage-discharge rating curve be calibrated on an annual basis.

Where to obtain more information on water metering

For general information on the types and use of water meters and methods of metering, please refer to the following publications:

- "Establishing a Metering Plan to Account for Water Use and Loss", available at www.infraguide.ca or by contacting Infraguide at 1-866/330-3350

- "Water meters – Selection, Installation, Testing and Maintenance" (M6 manual), available at www.awwa.org or by contacting the American Water Works Association (AWWA) at 1-800/926-7337

- "Water Metering Trade Sector Review", available at the Measurement Canada web site at www.strategis.ic.gc.ca/engdoc/main.html or by phone at 613/952-5405

- "Water Measurement Manual: A Water Resources Technical Publication", available at the U.S. Department of Interior web site at www.usbr.gov (follow link to Publications and Reports)

- "Integrated Water Metering Management", by F. Arregui, E. Cabrera Jr., R. Cobacho, available at www.iwapublishing.com or by contacting the publisher at +44 1206 796351

Where to obtain general information on monitoring and reporting requirements

General information on the monitoring and reporting requirements is available at the ministry's Public Information Centre at 1-800/565-4923 (within the Toronto calling area at 416/325-4000) or on-line at the ministry web site at www.ene.gov.on.ca

Where to obtain information regarding a permit

Information specific to the permit requirements and conditions is available at the Ministry of Environment Regional Offices:

Eastern Region (Kingston)
Tel. 613/549-4000 or 1-800/267-0974

Central Region (Toronto)
Tel. 416/326-6700 or 1-800/810-8048

Northern Region (Thunder Bay)
Tel. 807/475-1205 or 1-800/875-7772

Northern Region (Sudbury)
Tel. 705/564-3237 or 1-800/890-8516

West Central Region (Hamilton)
Tel. 905/521-7640 or 1-800/668-4557

Southwest Region (London)
Tel. 519/873-5000 or 1-800/265-7672

This bulletin is provided for general guidance purposes only. To determine specific legal responsibilities, please refer directly to the Ontario Water Resources Act, Water Taking and Transfer Regulation (O. Reg. 387/04) and the conditions set in the permit.

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