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# Data Sources and Methods for the Water Withdrawal and Consumption by Sector Indicator

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# 1 Introduction

The Water Withdrawal and Consumption by Sector indicator is part of the Canadian Environmental Sustainability Indicators (CESI) program, which provides data and information to track Canada's performance on key environmental sustainability issues.

## 2 Description and rationale of the Water Withdrawal and Consumption by Sector in Canada indicator

### 2.1 Description

The Water Withdrawal and Consumption by Sector indicator measures the volume of water withdrawn, returned and consumed by the thermal power generation, manufacturing, municipal, agriculture, mining, and oil and gas sectors for 2004 to 2009. The indicator provides information about the volume of water used in Canada.

### 2.2 Rationale

Water is a vital resource driving Canada's economy. Many industrial processes depend on water for cooling. Water is also used for irrigation, for cleaning, in chemical processes, and for many other purposes. Municipalities distribute water for both residential and commercial use, including drinking, cooking and cleaning.

Water withdrawal and consumption by sector in Canada are important factors when considering water supply. The volume of water withdrawn and consumed is also relevant to wildlife conservation and environmental regulations. This indicator provides information for decision and policy makers when addressing how economic decisions and decisions related to how particular sectors may affect water resources.

## 3 Data

### 3.1 Data source

Data for municipal water use were obtained from Environment Canada's 2004, 2006 and 2009 Municipal Water and Wastewater Survey (MWWS).<sup>1</sup>

The 2005, 2007 and 2009 withdrawal figures for the thermal power generation, manufacturing, agriculture, oil and gas, and mining sectors are taken from Statistics Canada's Water Use in Canada by sector table.<sup>2</sup> Among other data sources, this table summarizes results from the Industrial Water Survey (IWS)<sup>3</sup> and Agricultural Water Survey (AWS).<sup>4</sup>

The 2005, 2007 and 2009 water consumption figures for the thermal power generation and manufacturing sectors are taken directly from the IWS.

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<sup>1</sup> Environment Canada (2011) Municipal Water Use Data. Retrieved on 18 July, 2012. Available from: <http://www.ec.gc.ca/eau-water/default.asp?lang=En&n=ED0E12D7-1#wateruse2009>

<sup>2</sup> Statistics Canada (2012) CANSIM Table 153-0101 - Water use in Canada, by sector, every 2 years (cubic metres), CANSIM (database). Retrieved on 09 October, 2012. Available from: <http://www5.statcan.gc.ca/cansim/a26?lang=eng&retrLang=eng&id=1530101&tabMode=dataTable&srchLan=-1&p1=-1&p2=9>

<sup>3</sup> Statistics Canada (2012) Industrial Water Use. Catalogue number: 16-401-XWE. Retrieved on 18 July, 2012. Available from: <http://www5.statcan.gc.ca/bsolc/olc-cel/olc-cel?catno=16-401-XWE&lang=eng>

<sup>4</sup> Statistics Canada (2011) Agricultural Water Use in Canada. Catalogue number 16-402-XWE. Retrieved on 18 July, 2012. Available from: <http://www5.statcan.gc.ca/bsolc/olc-cel/olc-cel?catno=16-402-XWE&lang=eng>

Oil and gas water-withdrawal data for 2005, 2007 and 2009 were obtained from Statistics Canada's Water Use in Canada by sector table.<sup>5</sup> For the volume of water withdrawn by the oil and gas sector, the proportions consumed and returned are not available.

The 2005, 2007 and 2009 withdrawal figures for the agricultural sector are taken from Statistics Canada's Water Use in Canada by sector table.<sup>6</sup> The estimates for agricultural water use in Alberta come from Alberta Agriculture and Rural Development, Water Resources Branch, Irrigation and Farm Water Division. Water consumption estimates for the agricultural sector were obtained from the Agri-Environment Services Branch, Agriculture and Agri-Food Canada.

### 3.2 Spatial coverage

The MWWS excludes municipalities on federal lands and First Nations municipalities. It was sent to all municipalities with a population greater than 1000 and to a sample of municipalities under 1000. Each iteration of the MWWS since 2001 has been expanded to include a greater percentage of Canadian municipalities with populations of less than 1000. Data remain comparable among surveys, because small municipalities make up less than 3% of the Canadian population and have little effect on aggregate statistics due to population weighting. For more information on changes to the survey sample and methodology, consult Environment Canada's Municipal Water Use Reports (<http://www.ec.gc.ca/eau/water/default.asp?lang=En&n=ED0E12D7-1#wateruse2006>).

The IWS included in its sample all thermal-electric power generating stations. It also sampled selected mines and manufacturing locations across Canada.

The AWS samples Canadian farm operations that irrigate.

### 3.3 Temporal coverage

Survey results from the IWS and AWS surveys since 2005 have been included in this indicator. The MWWS provides data from 2004 to 2009.

### 3.4 Data completeness

MWWS response rates vary by survey year and question. In the 2009 MWWS, residential water service data were available for a responding population of 28 884 690 Canadians.<sup>7</sup> In 2006, residential water service data were available for 28 177 339 Canadians, and in 2004 the responding population represented 25 454 421 Canadians.<sup>8</sup>

The response rate for the manufacturing component of the IWS was 70% in 2009,<sup>9</sup> 72% in 2007<sup>10</sup> and 70% in 2005.<sup>11</sup> For the mining component of the survey, it was 79% in 2009 and 2007, and

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<sup>5</sup> Statistics Canada (2012) CANSIM Table 153-0101 - Water use in Canada, by sector, every 2 years (cubic metres), CANSIM (database). Retrieved on 9 October, 2012. Available from: <http://www5.statcan.gc.ca/cansim/a26?lang=eng&retrLang=eng&id=1530101&tabMode=dataTable&srchLan=-1&p1=-1&p2=9>

<sup>6</sup> Statistics Canada (2012) CANSIM Table 153-0101 - Water use in Canada, by sector, every 2 years (cubic metres), CANSIM (database). Retrieved on 09 October, 2012. Available from: <http://www5.statcan.gc.ca/cansim/a26?lang=eng&retrLang=eng&id=1530101&tabMode=dataTable&srchLan=-1&p1=-1&p2=9>

<sup>7</sup> Environment Canada (2011) Municipal Water Use 2009 Summary Tables. Retrieved on 18 July, 2012. Available from: <http://www.ec.gc.ca/eau-water/default.asp?lang=En&n=ADD1975E-1>

<sup>8</sup> Environment Canada (2011) Municipal Water Use Data. Retrieved on 18 July, 2012. Available from: <http://www.ec.gc.ca/eau-water/default.asp?lang=En&n=ED0E12D7-1#wateruse2009>

<sup>9</sup> Statistics Canada (2012) Industrial Water Use 2009: Data quality, concepts and methodology: Data quality. Retrieved on 19 September, 2012. Available from: <http://www.statcan.gc.ca/pub/16-401-x/2012001/technote-notetech3-eng.htm>

<sup>10</sup> Statistics Canada (2007) Industrial Water Use 2007: Data quality, concepts and methodology: Data quality. Retrieved on 18 July, 2012. Available from: <http://www.statcan.gc.ca/pub/16-401-x/2010001/technote-notetech3-eng.htm>

70% in 2005. Response rates for the thermal-electric component were 84% in 2009, 92% in 2007 and 88% in 2005.

The response rate for the AWS was 57% for 2010.<sup>12</sup> The AWS excludes a variety of agricultural practices, such as reserve farms, community pastures, pure hatcheries, and farms producing only Christmas trees. Imputation was used to deduce the response of a missing or inconsistent field, when partial information was available. The 2010 AWS sampled 15 390 Canadian farm operations that irrigate.

### 3.5 Data timeliness

This indicator uses the most recent survey data available. The MWWS is conducted every two to three years with data released approximately two years after the calendar year to which the collected data apply.<sup>13</sup> The IWS is conducted every two years with the most recent results published in March 2012.<sup>14</sup> The AWS is also conducted every two years. The most recent results were published in September 2011.<sup>15</sup>

## 4 Methods

Water withdrawal data for the thermal power generation, manufacturing, and agriculture sectors were taken directly from Statistics Canada's Water Use in Canada table.

Water withdrawal estimates for the mining sector for this indicator were calculated by summing IWS mine water (water removed from mines through dewatering) estimates with that sector's water intake values. This definition of withdrawal, which includes both water intake and mine water, is different from the approach used in the IWS and the Water Use in Canada table, which excludes mine water from the estimate.

Water withdrawal for the agricultural sector is calculated using volumes of water used for irrigation taken from the AWS. The amount of water used to water livestock and clean farm buildings is estimated using data from the Census of Agriculture.

Municipal water consumption was calculated by multiplying the total population served by water in each responding municipality by the average daily flow per capita of the municipality. This value was multiplied by 365 days and was converted to cubic metres by multiplying by 0.001 (1 L = 0.001 cubic metres). The quantity of municipal water used for industrial purposes was subtracted from the total municipal water use. These values are summed for all of Canada to give a final value of the total municipal water withdrawal in Canada. The 2009 and 2006 municipal water consumption was calculated as 10% of total water withdrawal based on consumption rates seen in the previous surveys.

Water consumption values for the thermal power and manufacturing sectors were taken directly from the appropriate IWS tables. The estimate of water consumption for the mining sector is calculated by subtracting mining IWS discharge volumes from the CESI withdrawal estimate described above.

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<sup>11</sup> Statistics Canada (2005) Industrial Water Use 2005. Retrieved on 18 July, 2012. Available from: <http://www.statcan.gc.ca/pub/16-401-x/2008001/technote-notetech3-eng.htm>

<sup>12</sup> Statistics Canada (2011) Agricultural Water Use in Canada. Catalogue number: 16-402-XWE. Retrieved on 19 September, 2012. Available from: <http://www5.statcan.gc.ca/bsolc/olc-cel/olc-cel?catno=16-402-XWE&lang=eng>

<sup>13</sup> Environment Canada (2011) Municipal Water Use Data. Retrieved on 18 July, 2012. Available from: <http://www.ec.gc.ca/eau-water/default.asp?lang=En&n=ED0E12D7-1#wateruse2009>

<sup>14</sup> Statistics Canada (2012) Industrial Water Use. Catalogue number: 16-401-XWE. Retrieved on 18 July, 2012. Available from: <http://www5.statcan.gc.ca/bsolc/olc-cel/olc-cel?catno=16-401-X&chropt=1&lang=eng>

<sup>15</sup> Statistics Canada (2011) Agricultural Water Use in Canada. Catalogue number: 16-402-XWE. Retrieved on 18 July, 2012.

Water consumption by agriculture is calculated as the difference between the volume of water withdrawn from a river for irrigation and the volume measured as return flows back to the river. The volume of water used for irrigation is managed to match crop water requirements; thus, water consumption by agriculture varies annually depending on the weather, with much less consumption during wet years. On average, 16% of all water removed from the river system for irrigation is returned, and thus 84% is consumed (L. Brault, Agriculture and Agri-Food Canada, personal communication).

This version of the indicator reports data for 2005, 2007 and 2009 for all six sectors, whereas the last report provided data for one year only: 2001, 2004 or 2005, depending on data availability at the time of publication.

## 5 Caveats and limitations

While water is withdrawn for human use from both surface water and groundwater sources, most water is returned to surface water. The effects of these withdrawals on groundwater resources have not been quantified. The possible depletion of groundwater resources due to economic practices, such as mine dewatering or municipalities using groundwater for drinking, are not captured in this indicator. Water removed from a groundwater source and returned to surface water is not considered to be consumed, according to the System of Environmental Economic Accounts (SEEA) for Water,<sup>16</sup> because although it is not returned to its original source under the ground, the water returned to a surface water body is still available for other economic uses.

Although efforts were made by Statistics Canada to reduce errors in the IWS and AWS through data validation, errors are unavoidable and are likely present in the data. Imputation was used by the IWS on partial-response records.

The MWWS has undergone revisions and modifications since the 2006 survey cycle. Changes made to the survey questionnaire and to the data analysis have allowed greater precision in survey results. However, in some cases these changes have affected the comparability of the 2009 results with previous cycles' data. The MWWS no longer collects data on wastewater discharges, which does not allow an accurate value of total municipal water consumed to be produced, given that the value is calculated based on how much water is returned to the environment.

For the volume of water withdrawn by the oil and gas sector, the proportions consumed and returned are not available.

## 6 References and further reading

Environment Canada (2011) Municipal Water Use 2009 Summary Tables. Retrieved on 18 July, 2012. Available from: <http://www.ec.gc.ca/eau-water/default.asp?lang=En&n=ADD1975E-1>

Environment Canada (2011) Municipal Water Use Data. Retrieved on 18 July, 2012. Available from: <http://www.ec.gc.ca/eau-water/default.asp?lang=En&n=ED0E12D7-1#wateruse2009>

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<sup>16</sup> United Nations Department of Economic and Social Affairs. 2012. SEEA-Water System of Environmental-Economic Accounting for Water. Retrieved on 19 September 2012. Available from: <http://unstats.un.org/unsd/envaccounting/seeaw/>

Statistics Canada (2005) Industrial Water Use 2005. Retrieved on 18 July, 2012. Available from: <http://www.statcan.gc.ca/pub/16-401-x/2008001/technote-notetech3-eng.htm>

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