

## 6.0 WATER MANAGEMENT AND USE

### *Overview*

In the Okanagan Basin water is extracted from many streams, lakes, and groundwater aquifers to support a growing population (approximately 294,000 in 2006) and a multitude of water-reliant activities. A number of investigations were completed during Phase 2 to understand how water is used and managed throughout the Basin. These investigations (which are documented in Appendix C), supported the development of the Okanagan Water Demand Model (the model is described Section 14.0). The output of that model provides an updated picture of how much water is presently<sup>1</sup> extracted from water sources and used in the Basin. A summary of the key technical findings is provided in this section.

### *Annual water balances*

The overall water balance for the Basin is shown in Figure 6.1. This figure summarizes the information presented in the present section of the report, as well as information presented in subsequent sections. The values on the figure are annual totals, but they are averaged over time for the period 1996-2006, and across the entire area of the Basin. The figure does not indicate the variability which characterizes both water supply and water demand. Decision-making must consider the seasonal variability in both supply and demand, the differences that exist from place to place within the Basin, and the annual variability in both supply and demand.

The average annual water balance for Okanagan Lake is shown in Figure 6.2. As for Figure 6.1, this figure summarizes information presented in the present section of the report, as well as information presented in later sections.

### *Water rights for extraction and use of water in the Okanagan Basin*

Within the Basin there are 101 known water suppliers and a total of nearly 4,000 active water licences<sup>2</sup> which have been issued by the Province to store or use surface water<sup>3</sup>. Approximately 443,000 megalitres<sup>4</sup> (ML) of surface water is licensed annually for offstream use while 351,000 ML is licensed for in-stream (conservation) and other “non-consumptive”

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<sup>1</sup> A period between 1996 and 2006 was analyzed to define current conditions.

<sup>2</sup> Water licences issued by the Province identify the volume of water that suppliers or users are legally entitled to extract from surface water sources for beneficial use. The volume of water allocated with water licences does not necessarily indicate the volume of water *actually* extracted and used.

<sup>3</sup> Surface water includes water from streams, lakes, and springs. It does not include groundwater, which currently does not require licensing.

<sup>4</sup> 1 megalitre (ML) is equal to 1 dam<sup>3</sup> (cubic decametre) or 1,000,000 litres. For reference, the volume of an Olympic-sized swimming pool is 2.5 ML, while the approximate volumes for the main lakes in the Okanagan Basin are as follows: Ellison (Duck) Lake (5,400 ML), Vaseux Lake (18,000 ML), Wood Lake (157,000 ML), Osoyoos Lake (325,000 ML), Skaha Lake (500,000 ML), Kalamalka Lake (1,560,000 ML), and Okanagan Lake (24,600,000 ML).

uses<sup>5</sup>. These uses are supported by 163,000 ML of water licensed for storage, typically within upland reservoirs. The operation of storage reservoirs is critical to the management of surface water in the Basin since most surface runoff occurs during a short period each spring when snowmelt occurs. However, most demand for water occurs later in the summer. The 36 major storage reservoirs in the Basin have a combined capacity of 133,000 ML, or about 82% of the total volume licensed for storage.

### ***Volume of water actually used in the Okanagan Basin***

Based on the technical studies and on the Okanagan Water Demand Model, the average annual water use in the Basin totals an estimated 219,000 ML. However, between 1996 and 2006, total annual water use has ranged from about 187,000 ML in 1997 (a relatively wet year) to 247,000 ML in 2003 (an extremely dry year) (Figure 6.3).

### ***Sources of Water in the Okanagan Basin***

Of the 219,000 ML of water actually used annually in the Basin, an estimated 147,000 ML (67%) is obtained from surface sources in the Basin (Figure 6.4). The rate of surface water extraction varies throughout the year in response to demands by water users. During the late fall and winter, when irrigation is not occurring, surface water extraction in the Basin is steady at about 500 ML/week. However, with the onset of irrigation in spring, water extraction rates increase until they peak in late July to mid-August at about 8,500 to 10,000 ML/week. While water is extracted from many locations in the Basin, about 32% of the total surface water used is obtained from the three (3) largest sources: Okanagan Lake, Mission Creek and Kalamalka/Wood Lake (Table 9.2 in Appendix C).

Although less groundwater than surface water is used, groundwater is becoming an increasingly important source of water. There are now 23 known water suppliers (with 74 active wells) that pump a combined total of 49,000 ML of groundwater each year in the Basin. This represents 22% of the total water use in the Basin (Figure 6.4). As with surface water, the rates of groundwater extraction vary with demand through the year, from about 100 ML/week in late fall and winter to about 3,000 to 4,000 ML/week in late-summer.

There are eight (8) known water suppliers that import water from outside the Basin to supplement existing water supplies (Table 7.1 in Appendix C). On average, the volume of water imported annually is approximately 17,000 ML, or 8% of the total use in the Basin (Figure 6.4).

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<sup>5</sup> See Table 5.2 in Appendix C for a complete description of licensed end-uses.

Several water suppliers (including Greater Vernon Water, Town of Oliver, City of Armstrong, and Town of Osoyoos) are supplementing their water supply by using WTP effluent to irrigate agricultural lands. On average between 1996 and 2006, 7,000 ML of this “recycled” wastewater was used for this purpose each year, which represents 3% of the total water use in the Basin.

The study evaluated two means by which humans “return” water to groundwater: the operation of septic systems and over-irrigation. The latter is also known as *deep percolation*, and represents a volume of water that is not used by vegetation but rather infiltrates beyond the root zone to groundwater. On average, septic systems in the Basin “return” about 10,000 ML of water per year to groundwater, while deep percolation supplies about 25,000 ML per year.

Four (4) of the ten (10) known wastewater treatment plants (WTPs) in the Basin (namely City of Kelowna, City of Penticton, District of West Kelowna, and District of Summerland) discharge or “return” water to surface waterbodies, namely Okanagan Lake and Okanagan River. Combined, these four (4) WTPs discharge a total of 17,000 ML of effluent on average each year. Approximately 75% of this volume is discharged to Okanagan Lake while 25% is discharged to Okanagan River near Penticton.

#### ***Distribution of water between end-uses in the Okanagan Basin***

Year-to-year distribution of water use among the end-uses is relatively consistent, with the greatest proportion (55%) typically used for agriculture (Figure 6.5). This is followed by domestic outdoor (24%), domestic indoor (7%), golf courses (5%), commercial (4%), parks and open spaces (2%), industrial (2%) and institutional (1%) water use.

On average, 120,000 ML (or 55% of the total Basin water use) is used to irrigate an agricultural area in the Basin of approximately 18,300 ha. This represents a Basin-wide average application of 660 mm of water over the irrigation season. Locally, however water application rates vary by crop, irrigation system, soil and climate.

Within the Basin there are 41 known golf courses that irrigate an estimated 1,060 ha of land. An estimated total of 10,000 ML of water is typically used by golf courses during the irrigation season. This represents an average application of 960 mm per season. Irrigated park lands and other “green” spaces in the Basin, totalling approximately 590 ha require an additional 5,000 ML each irrigation season. This equates to an average application of 920 mm per season.

In the Basin, total domestic water use averages 68,000 ML per year, or 31% of the total water use in the Basin (Figure 6.5). Approximately 22% of this total is used indoors, while 78% is used outdoors. Between 1996 and 2006, the average year-round combined indoor and outdoor water use in the Basin was 675 L/person/day. Indoor use is relatively constant throughout the year at 150 L/person/day. Outdoor use is nearly zero for 6 months of the year, but averages over 1,000 L/person/day in the other 6 months.

Institutional, commercial, and industrial (ICI) water users include schools, hospitals, care facilities, businesses, and industry. In most cases, the main use of water is for indoor domestic-type purposes (e.g. drinking, toilet flushing, and washing). Over 5,000 ICI users were identified in the Basin, together using an average of 15,000 ML (or 7% of the Basin total) annually. Of this total, approximately 2,000 ML is associated with institutional users, 8,000 ML is associated with commercial users, and 5,000 ML is associated with industry (Figure 6.5).

Losses from the managed system and “unaccounted for water” (UFW) include water lost to deep percolation through over-watering, irrigation system inefficiencies, leakage in the water suppliers’ distribution systems or at the point-of-use, and water theft. The term “loss” is used relative to the managed system – the water is not lost from the groundwater system or the Basin as a whole. Based on limited records, distribution system losses for all end-use categories were assumed to be 5% of the total volumes conveyed through water supplier systems. Losses are included in all the quoted water use values above. Total losses from all end-uses average an estimated 51,000 ML.

### ***Summary***

These investigations of water use and management are the result of a major effort to understand current water management and use patterns throughout the Basin. This summary provides Basin-wide information, and information for specific areas is provided in Appendix C.

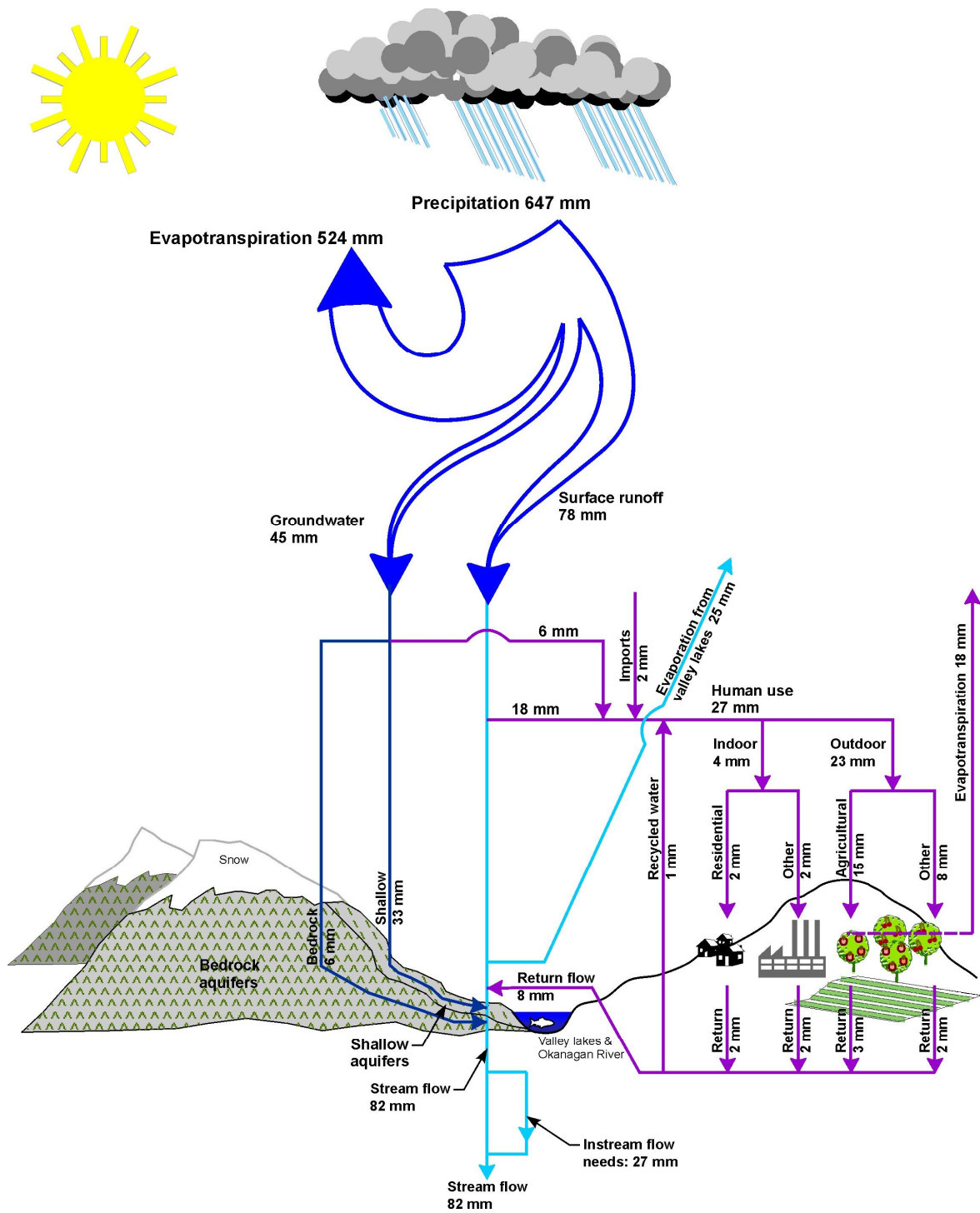


Figure 6.1 Average annual water balance for the Okanagan Basin.

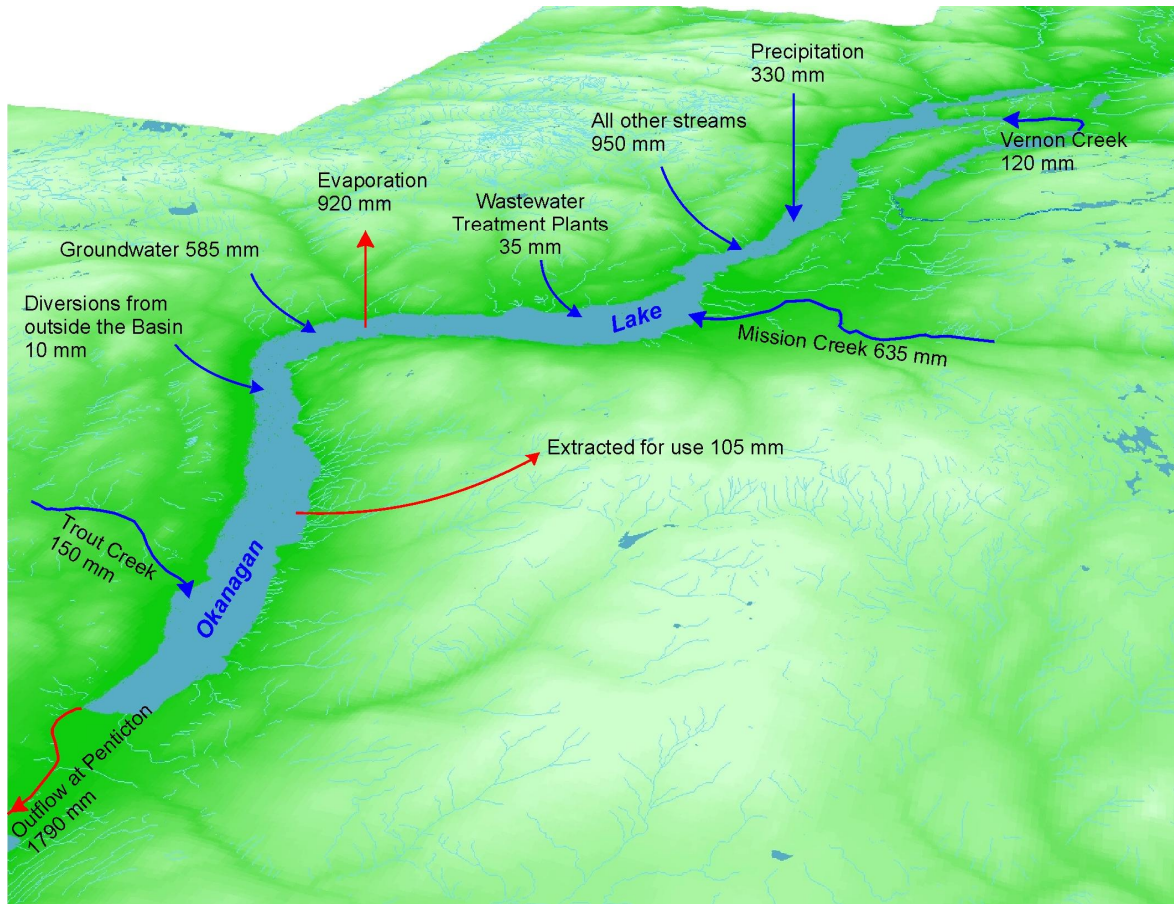


Figure 6.2 Average annual water balance for Okanagan Lake.

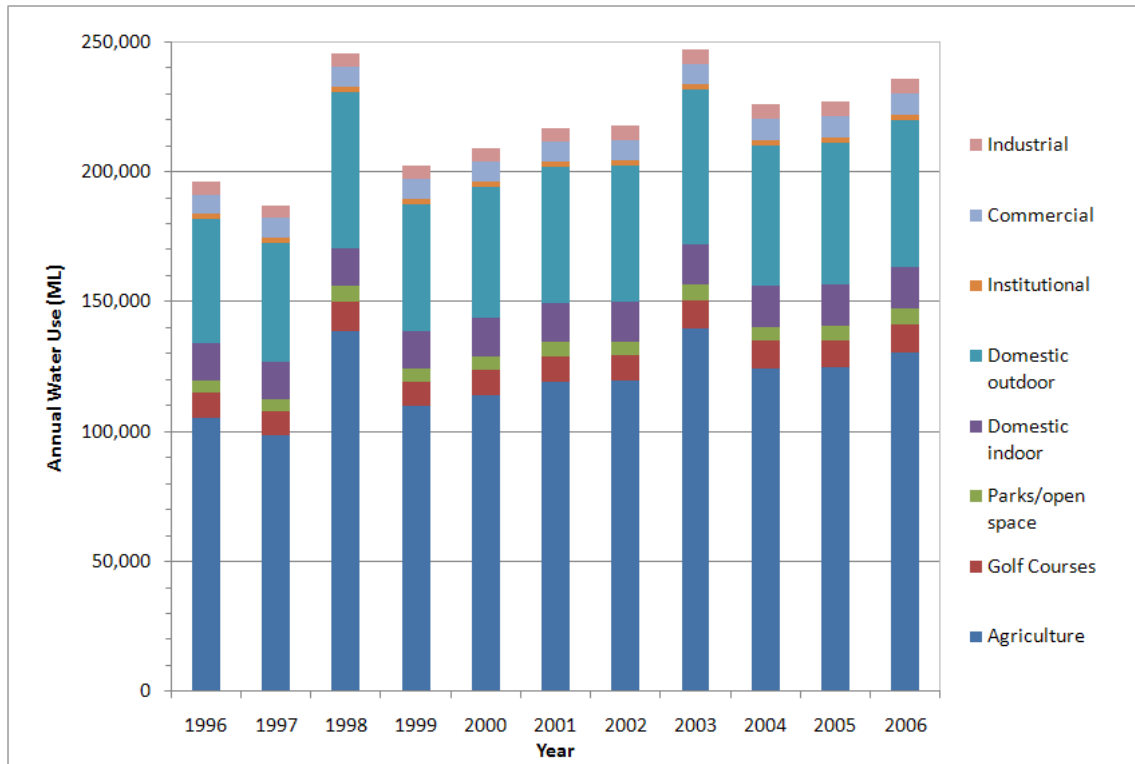


Figure 6.3 Estimated volume of water used in the Okanagan Basin between 1996 and 2006 by end-use.

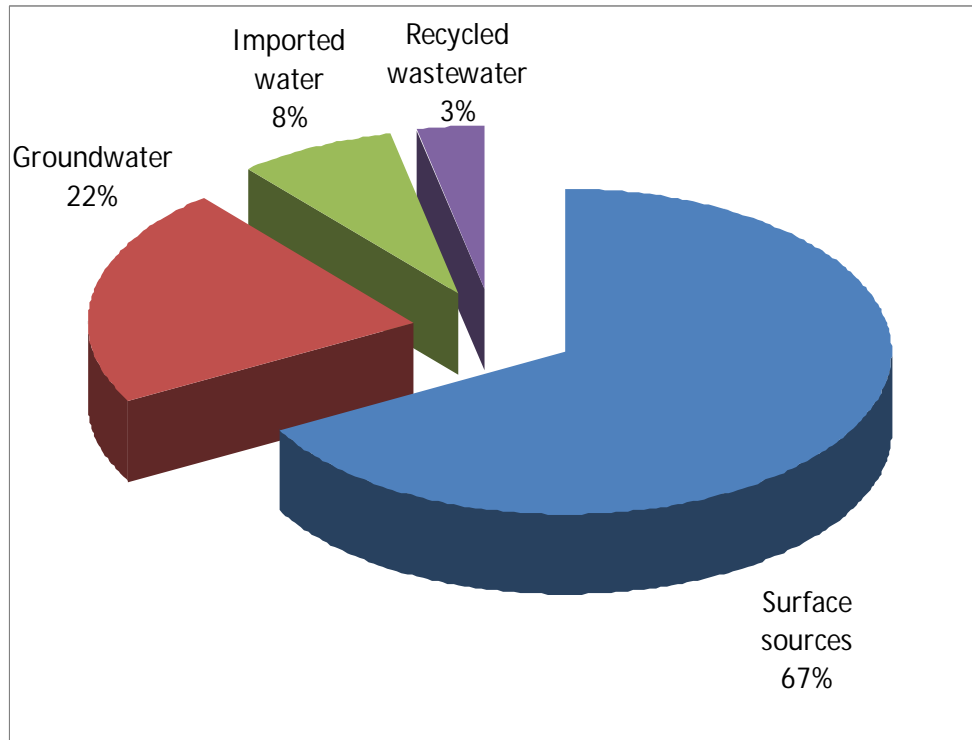


Figure 6.4 Typical distribution of total water use in the Okanagan Basin by source (based on data for 1996 to 2006).

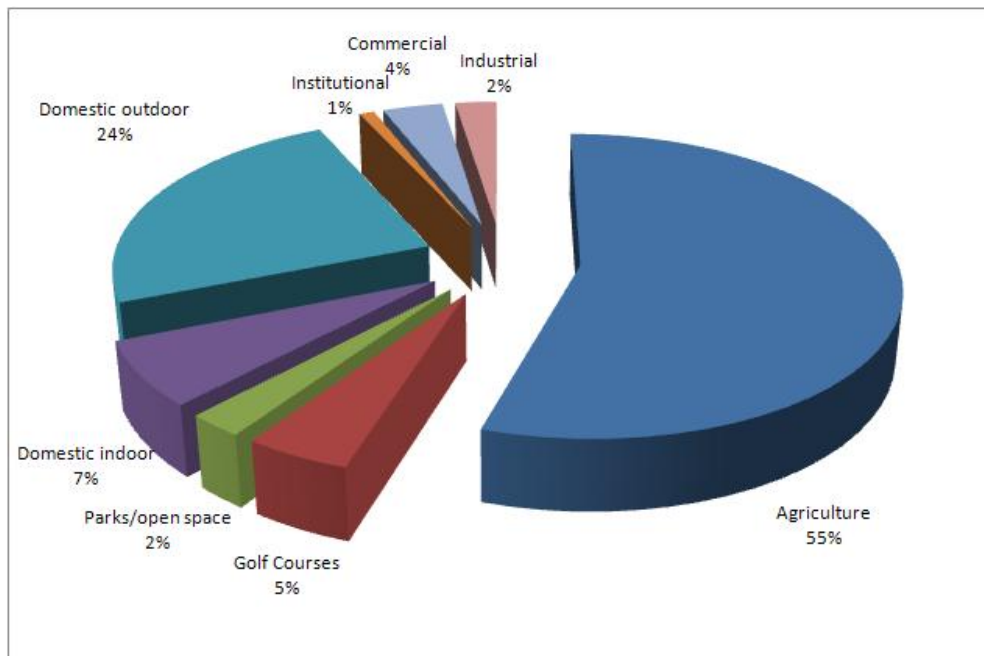


Figure 6.5 Typical distribution of water use amongst water users.