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Fact Sheet

2 Water

Water — here, there and everywhere

How much water is there in the world? Scientists estimate over one billion cubic kilometres (one cubic kilometre of water would fill 300 Olympic stadiums). Water covers nearly three quarters of the earth's surface in oceans, rivers, lakes, snow and glaciers. There is water in the atmosphere and water underground. Water leaves and returns to the earth in what is known as the *hydrologic cycle*.

In the hydrologic cycle, water precipitates from the atmosphere to the oceans or to the land surface (where it flows overland and underground back to the oceans), and then evaporates or transpires back to the atmosphere from the land and the oceans. Although the distribution of the water around the globe varies from year to year, the total quantity of water has remained essentially constant during the recent geological past.

Most of the earth's water is salty or permanently frozen. Only 1/100 of 1% (139 000 cubic kilometres) is available for meeting man's freshwater needs (see Figures 1 and 2). This small fraction is found in rivers, lakes, in the ground and in the atmosphere.

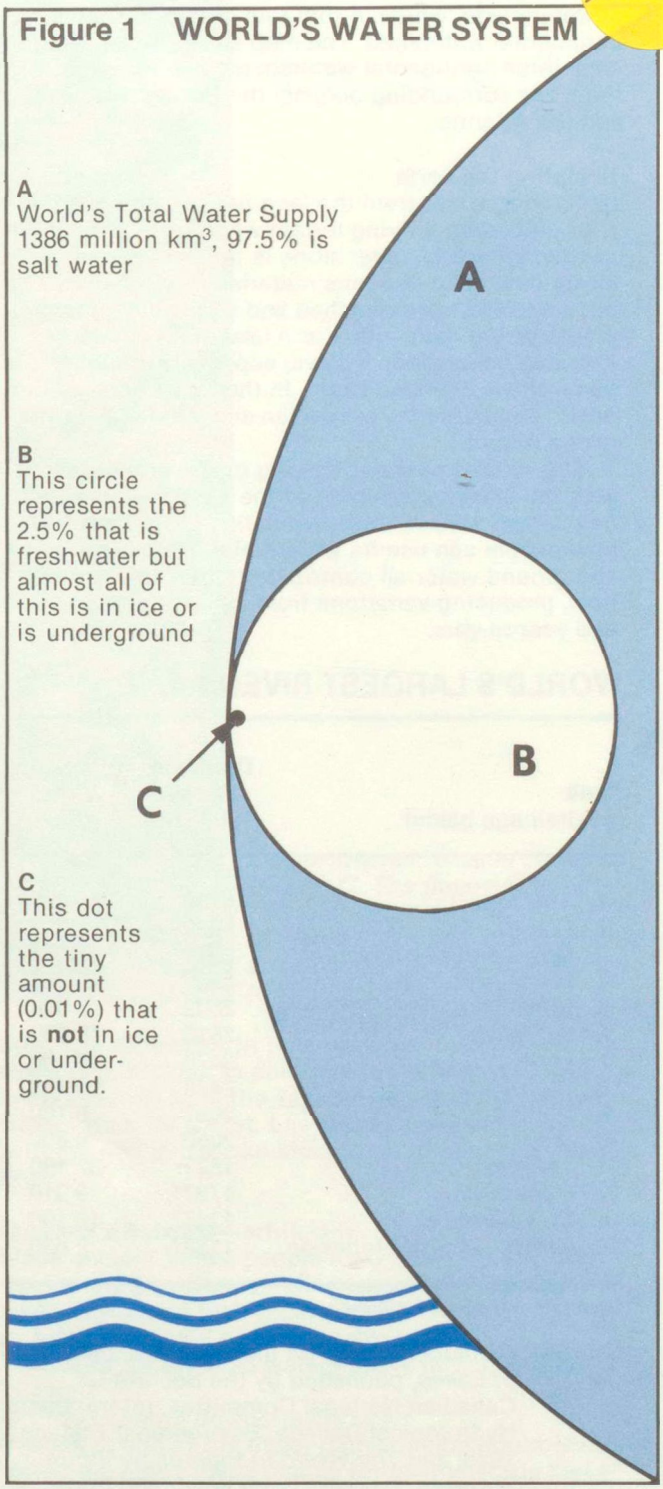
Figure 2 WORLD'S WATER SUPPLY

	Volume (km³)
Total Volume	**1 385 984 610**
Salt Water (97.47%)	
Oceans	1 338 000 000
Ground water (to 2000 m)	12 870 000
Inland seas	85 400
	1 350 955 400
Freshwater (2.53%)	
Glaciers and snow	24 064 100
Ground water	10 530 000
Permafrost	300 000
Lakes	91 000
Soil moisture	16 500
Atmospheric water	12 900
Marshes	11 470
Rivers	2 120
Water in plants and animals	1 120
	35 029 210

C

Source: *Canadian Aquatic Resources*, edited by M.C. Healey and R.R. Wallace, Ottawa: Department of Fisheries and Oceans, 1987. Adapted from Table 1 in Chapter 2 (A.H. Laycock).

Figure 1 WORLD'S WATER SYSTEM



These circles show just how little of the world's total water supply (A) is freshwater (B) and how little of that amount is actually usable freshwater (C).

Canada

Canada's freshwater can be found in the form of rivers, lakes, ground water, and ice and snow.

Rivers

A river's watershed or drainage basin—the area supplying it with water—is separated from the watersheds of neighbouring rivers by higher lands called divides. Small watersheds combine to make up regional watersheds, which in turn join others to form a continental watershed. The map shows North America's three continental watersheds, one for each of the three surrounding oceans: the Pacific, the Arctic, and the Atlantic.

Sculpting the earth

In carrying water from the land back to an ocean, a river erodes underlying terrain when it is flowing swiftly. Where the river slope is flatter, the river slows down and deposits materials. This usually occurs in the lower reaches and especially near the mouth of the river, either at a lake or an ocean. A river can carve steep valleys, especially in higher parts of the drainage basin. In the lower parts of the basin, deposits may create fan-shaped deltas at the river's mouth.

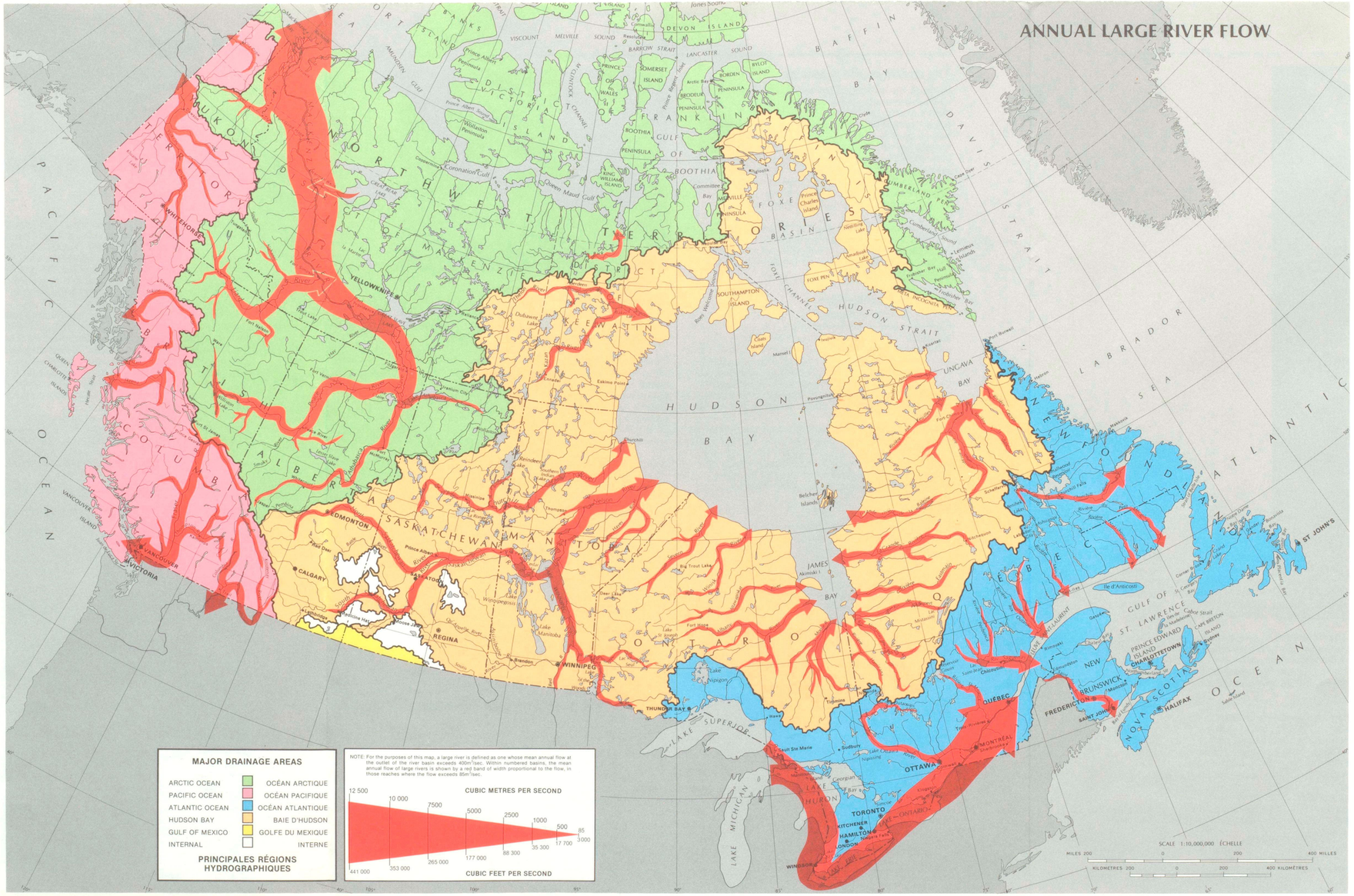
The volume of water flowing in a river together with the speed and timing of the flows determines how a river shapes the surrounding landscape and how people can use its waters. Rainfall, snowmelt, and ground water all contribute to the volume of flow, producing variations from season to season and year to year.

WORLD'S LARGEST RIVERS

Rank (by drainage basin)	Drainage Basin (1000 km²)	Discharge Rate (m³/s)
1. Amazon	6150	175 000
2. Congo	3822	39 000
3. Mississippi — Missouri	3222	17 270
4. Plata — Parana — Grande	3100	22 900
5. Nile	2802	3 000
6. Yenisey	2619	18 000
7. Lena	2478	16 100
8. Ob-Irtysh	2470	10 200
9. Niger	2092	5 700
10. Amur	2050	9 800
11. Yangtze	1827	32 190
12. Mackenzie	1787*	9 910
14. St. Lawrence	1344*	10 100
18. Nelson — Saskatchewan	1132*	2 830

*Partly or entirely within Canada.

Sources: *Canadian Survey on the Water Balance of Lakes*, published by the Secretariat, Canadian National Committee, International Hydrological Decade, Environment Canada, 1975; and *The World in Figures* by Victor Showers, Toronto: John Wiley and Sons, 1973; and The National Atlas of Canada, 1985.



In Canada, most high flows are caused by snowmelt and occur in spring. This is the season when floods are most likely to occur. Rainstorms and hurricanes can also cause high flows and floods, especially on small streams with little or no natural storage. Rivers with large drainage basins have considerable storage along their course and thus can lessen the effects of floods and storms (see next section). The lowest flows on rivers in southern Canada generally occur in late summer when precipitation is low and evaporation along with consumption by plants is high. Low flows in the North occur in late winter when rivers are ice covered and the precipitation is stored until spring in the form of ice and snow.

Lakes

Canada probably has more lake area than any other country in the world, with 565 lakes larger than 100 square kilometres. The Great Lakes, straddling the Canada-U.S. boundary, contain 25% (22 700 cubic kilometres) of the world's freshwater in lakes (sharing "first place" with Lake Baykal, U.S.S.R.).

Creating a balance—naturally

The importance of lakes lies in their ability to store water during times of plenty and release it gradually. Thus lakes perform an extremely valuable task in regulating the flow of the rivers on which they are located. For example, the Saskatchewan River has a maximum recorded flow of 4 times its average flow and 59 times its minimum flow. On the other hand, the St. Lawrence River has a maximum flow of only 1.5 times its average flow and twice its minimum

WORLD'S LARGEST LAKES

Rank (by area)	Area (km²)	Greatest Depth (m)
1. Caspian Sea	371 000	980
2. Superior	84 500*	405
3. Aral Sea	64 500	68
4. Huron	63 500*	229
5. Victoria	62 940	81
6. Michigan	58 020	281
7. Tanganyika	32 000	1471
8. Baykal	31 500	1620
9. Great Bear	31 400*	413
10. Great Slave	28 400*	614
11. Erie	25 800*	64
12. Winnipeg	24 400*	18
15. Ontario	19 300*	244
23. Athabasca	7 940*	120
25. Reindeer	6 640*	219
31. Winnipegosis	5 360*	12
32. Nettilling	5 530*	NA

*Partly or entirely within Canada.

Sources: *Canadian Survey on the Water Balance of Lakes*, published by the Secretariat, Canadian National Committee, International Hydrological Decade, Environment Canada, 1975; and *The World in Figures*, by Victor Showers, Toronto: John Wiley and Sons, 1973.

Beaver Glacier, Glacier National Park, B.C. The importance of glaciers lies in the large quantity of water they contain and in their stabilizing effect on streamflow. (Courtesy of Parks Canada).

Questions

1. What is the largest river in Canada in terms of mean (average) annual flow?
2. What is the longest and largest river in Canada?
3. What factors account for the importance of the Saskatchewan River system?

flow. The difference in flow patterns in these two rivers is partly due to precipitation differences, but results mainly from the vast storage provided by the Great Lakes for the St. Lawrence River compared with the negligible lake storage on the Saskatchewan River.

Creating a balance—artificially

Since ancient times, people have built dams to control the outflow from existing lakes or to create new lakes. Dams and their reservoirs have provided:

- A stable source of inexpensive energy
- A more dependable water supply throughout the year
- Flood control downstream.

Canada is one of the major dam-building countries in the world, using dams mainly for hydroelectric power production.

The underground reservoir

Beneath the surface of the earth is a huge reservoir of freshwater. Ground water does not rest; it moves continuously, but at a snail's pace, from its point of entry to areas of natural discharge. Ground water moves so slowly that its speed is measured in metres per day, and even per year. (Surface water velocities are described in metres per second.) Wells intercept some ground water but for the most part it continues until it reappears naturally in a spring or a seepage area and joins a watercourse.

Ground water contributes to Canada's water supply by:

- Feeding streams, producing the entire flow of some streams during dry periods
- Replenishing wells—a valuable source of supply for individuals, communities, industries, and irrigated farms.

Nature's frozen rivers

A huge quantity of freshwater—far more than all the liquid freshwater—is frozen in polar ice caps and in high mountain glaciers. Snow packed down over many years at high elevations becomes glacial ice, which slowly proceeds downslope like a frozen river, under the pull of gravity, and eventually melts and becomes part of streamflow at lower elevations. If the rate of melting is greater than the rate of accumulation the glacier recedes; if it is less the glacier advances.

Glaciers exert a direct influence on the hydrologic cycle by slowing the passage of water through the cycle. Like lakes and ground water reservoirs, glaciers are excellent natural storehouses, releasing water when it is needed most. Glacier-fed rivers reach their peak during hot summer weather.

Snowfall

Much of Canada's annual precipitation comes as snow: in the North, 50%; in the Prairies, 25%; and on both coasts and in southern Ontario, as little as 10%. Snow exerts a marked effect on the distribution of streamflow throughout the year. Instead of immediately infiltrating the soil or running off into stream channels as rainfall does, this water is first stored for several months.

The relatively quick thawing of snow in spring causes peak flows, often resulting in floods. Some of the worst and most unpredictable flooding occurs when ice that has not yet melted is carried along in the swollen rivers until it jams, blocking the flow of water and creating a lake behind the jam with attendant flooding. When the ice jam breaks, a tremendous amount of water is suddenly released downstream, and more flooding results.

Answers

1. The St. Lawrence River, which drains the Great Lakes.
2. The Mackenzie River flowing to the Arctic Ocean through the Northwest Territories.
3. (a) It originates in the Rocky Mountains and is the principal water source for the largest semi-arid region in Canada;
   (b) Its water supply is divided among all three Prairie Provinces; and
   (c) Southern Alberta and Southern Saskatchewan regions utilize close to the total capacity of existing river flow.

Diving beneath the surface

For more information about water, its nature, what it can do and how it is used and managed by people, consult the other fact sheets in this series.

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