



ENVIRONMENT INDICATORS

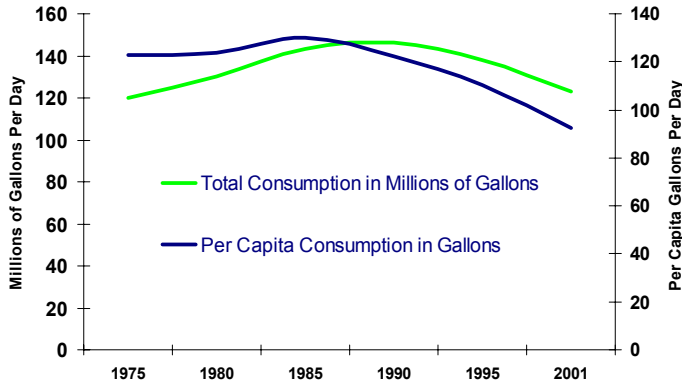
Outcome: Protect Water Quality and Quantity



INDICATOR 14. Decrease water consumption.

Fig. 14.1

Billed Water Consumption in King County: 1975 - 2001



Definitions and Notes:

1. Fig. 14.1 and Fig. 14.2 represents billed consumption in million gallons per day by residential and commercial customers, as well as wholesale water consumption.
2. Retail billed consumption does not include unmetered (non-revenue) water such as main and reservoir flushing, leaks, etc. Wholesale does include some purveyor non-revenue water.
3. The per capita amount may be slightly lower than the actual per capita consumption, due to the fact that some of Seattle Public Utility's (SPU's) suburban or rural customers have other sources of water, such as wells, that supplement what they get from SPU.

Fig. 14.2

Billed Water Consumption Per Day							
	1975	1980	1985	1990	1995	2000	2001
Per Capita Consumption in Gallons	123	124	130	122	110	103	93
Total Consumption in Millions of Gallons	120	130	143	146	138	135	123

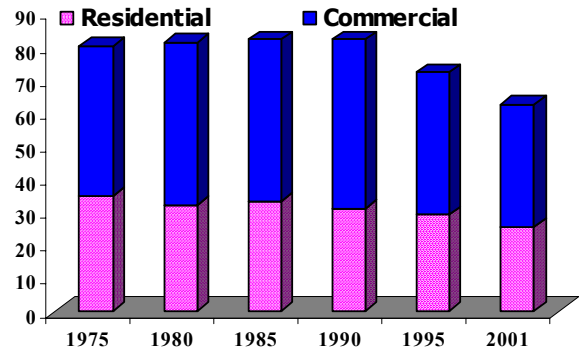
About This Indicator

- Per capita water usage in 2001 dropped significantly from the 2000 level. At 93 gallons per capita in 2001, water consumption is at its lowest level since 1975 when data collection began.
- 2001, like 1992, began with a major drought. These two years of drought brought about large drops in water consumption. The per capita drop in water consumption was even greater in 2001 than in 1992. Aided by a cool, wet summer,

following the winter/spring drought, water consumption remained low during the high-demand months.

- Total water consumption has also decreased to its lowest level since the late 1970s, despite a growing population.
- Among direct customers, total residential consumption has declined slightly in relation to commercial consumption. Residential uses represented about 44% of direct billed consumption in 1975 and about 41% in 2001.

Billed Water Consumption* by Sector in King County: 1975 - 1999



*This includes water sold directly by Seattle Public Utilities to customers. Nearly half of SPU water is sold wholesale to other purveyors.

What We Are Doing

- Constructing water reclamation facilities at King County wastewater treatment plants, and promoting use of reclaimed water for irrigation and industrial uses.
- Promoting intensive conservation measures, including low-flow shower-heads and faucets, and water-efficient clothes and dishwashers.
- Offering incentives to replace older toilets with new low flush models. Encouraging use of dishwashers and clothes washers for full loads only.
- Limiting lawn and garden watering during high demand times; promoting native landscaping requiring less watering.
- Protecting fisheries and wildlife by assuring adequate in-stream flows in rivers and streams.



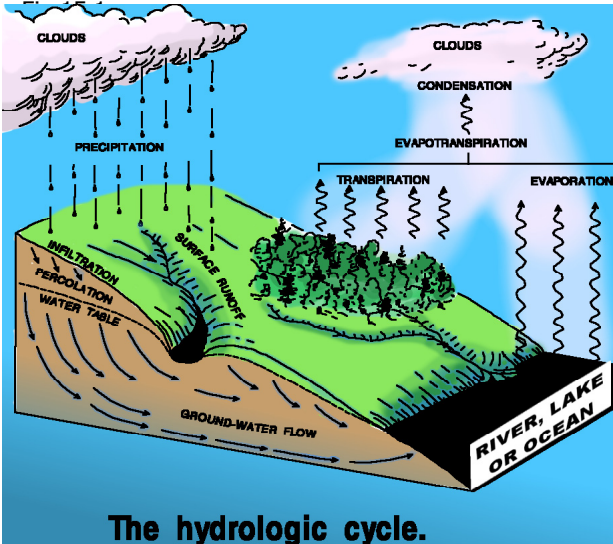
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Outcome: Protect Water Quantity and Quality



INDICATOR 15: Changes in groundwater levels and groundwater quality.

Groundwater is a significant natural resource in King County, providing safe drinking water through thousands of wells for approximately 30% of the County's population. In rural parts of the County, groundwater is often the only feasible source of water for domestic or other uses. During the summer and fall, when rain rarely falls, groundwater provides the base flow in streams that is necessary to maintain fish and other wildlife habitat. (Figure 15.1).



Groundwater Monitoring

Background

An **aquifer** is the underground soil material where water is stored. A **groundwater well** taps into an aquifer to bring water to the surface. Since 1985, King County has periodically monitored water quality and quantity (water levels) at approximately 70 wells at representative locations in the five "groundwater management areas" within King County. In 2001-2002, King County staff conducted three rounds of monitoring at 65 wells and two springs within four of those areas, and compared the water quality and quantity results with the results from previous years. The four management areas are **not** representative of King County as a whole. They are mainly rural areas in northeast King County and Vashon Island, where groundwater is a significant source of domestic water consumption.

I. Groundwater Quality

Background

Water quality can be characterized by identifying and evaluating changes over time, or by comparing water quality conditions to established federal or state water quality standards. The results from the 2001-2002 sampling are described in both these ways: (1) as trend information when compared to results from the earlier (1989 – 1995) sampling, and (2) relative to drinking water quality standards.

About This Indicator

A. Comparison between Old and New Data

- This assessment shows that groundwater quality has generally improved since 1989-1995 in the areas of King County that have been tested.

Changes in Groundwater Quality: 1989 - 2002					
	East King Co	Issaquah Creek Valley	Redmond / Bear Creek	Vashon / Maury Island	All Wells Monitored
As Arsenic	+	+	+	+	+
	12,3	14,1	12,4	13,8	51,16
NO₃ Nitrate	+	+	+	=	+
	13,2	10,5	11,5	11,10	45,22
Pb Lead	+	+	+	+	+
	15,0	14,1	15,1	20,1	64,3
Numbers at bottom of each cell are the numbers of wells that improved / degraded (out of 67 wells monitored)					
Legend					
Symbol	Meaning				
+	Most concentrations are lower now than previously. Water quality appears better than before				
=	Changes in concentration are mixed, up and down. Water quality about the same now				
X	Most Concentrations are higher now. Water quality appears worse now than before				

- The three chemical substances found in the ground water that are of most concern from a health perspective are **arsenic (As)**, **nitrate (NO₃)**, and **lead (Pb)**. In general, these three showed declining levels, although there were pockets of increase for nitrates.
- During 2001-2002, a more detailed set of samples and analyses was done to evaluate nitrate levels in groundwater on Vashon Island. Almost all of the wells that had detectable nitrates in 1989 showed increases in nitrate concentration in the latest testing. Those results have been shared with individual residents on Vashon Island and with Vashon's Groundwater Protection Committee.
- In addition to the three above, samples were tested for the presence of copper, fluoride, chromium, sodium, iron, manganese and zinc, and for coliform bacteria.



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INDICATOR 15:

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- The analytical results for these chemicals were compared, on a well-by-well basis, between the old (1989-1995) sampling results and the new (2001-2002) data. In general, chromium and zinc show lower levels, but for the others there is no clear trend.

B. Comparison to Drinking Water Standards

Primary (Health-based) Drinking Water Standards

- The 2001-2002 sampling results indicate that overall groundwater quality in King County is good. Few of the samples exceeded health-based primary drinking water quality standards (adopted by the Environmental Protection Agency (EPA) and by Washington State Board of Health).
- The most significant human health concern comes from exceedances of **arsenic**, a cancer-causing element. In January 2002, the EPA lowered the national drinking water standard for arsenic to 10 parts per billion (ppb) for water systems with 15 or more connections. Samples from eleven out of 68 locations in King County (16%) exceeded this new standard. Most (8) of these wells were found in the East King County GWMA; two were on Vashon-Maury Island, and one was in Redmond-Bear Creek Valley. Arsenic is a naturally occurring element that is found in deeper wells and near bedrock. Although the exceedances are of concern, over time, the presence of arsenic appears to be stable or decreasing.
- Another drinking water concern is **nitrates**, which creates health risks for infants and susceptible populations. One sample exceeded the EPA standard of 10 parts per million (ppm). Nitrate tends to be higher in shallow wells, where the water may be susceptible to contamination from malfunctioning septic systems or agricultural chemicals.
- Lead** was detected in one location above the standard of 15 ppb, and in another location above half the standard. Chronic exposure to high lead levels can cause developmental problems in children. However, all other samples taken at these locations showed much lower concentrations of lead, so the exceedances are considered unconfirmed.
- Copper** can cause gastrointestinal distress or even liver and kidney damage, but was found

only at concentrations far below the drinking water standards and lower than it was previously.

- Chromium**, which can cause skin problems at high concentrations, was found only at levels far below the drinking water standard and lower now than a decade ago.
- Fluoride**, at high levels, may result in bone disease or mottled teeth in children. Concentrations of this constituent are well below the drinking water standard.
- Although usually considered a "secondary" standard, eighteen (26%) of the wells exceeded the **sodium** "recommended level", a health concern for those on a restricted sodium diet.

Secondary (Aesthetic) Drinking Water Standards

- A number of sources exceeded secondary water quality standards. Water that exceeds these standard does not pose a health risk, but may have undesirable aesthetic qualities, such as poor taste or color.
- 31 (46%) of the locations sampled exceeded water quality standards for **iron** and / or **manganese**.
- Occurrences and levels of **zinc** are generally lower than earlier tests.
- In all cases where the wells that had some contamination were used as sources of drinking water, King County notified the owner and provided information on possible follow-up with Public Health—Seattle and King County. Each public water system is required to test for contaminants on a periodic basis.
- Eleven locations had samples with **coliform bacteria**. Coliform contamination is commonly caused by surface water seeping past the well seal, and can cause gastrointestinal problems. Such contamination can be treated by disinfection. King County staff provided information on this treatment to well owners.

II. Groundwater Quantity

Definitions and Background

The water level in a groundwater well reflects the water level in the aquifer, which in turn indicates the volume of water in aquifer storage. When aquifer storage is low, streams will have low baseflows and may dry up altogether in dry summer months, eliminating fish and wildlife habitat. In addition, wells run dry if the aquifer level drops below the pump intake level.

The average water levels measured during the 2001-2002 monitoring rounds were compared to the average



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levels observed during the 1989 - 1995 sampling rounds to see if any long-term trends were apparent.

Some limitations of the existing data include: 1) the difference between new and old average water levels are often small compared to annual fluctuations in the same well. 2) there are likely be other effects from climatic effects, such as temporary high levels due to recent rainfall before a monitoring round, that have not been accounted for.

About This Indicator

- There is little evidence of any general change in groundwater quantities throughout King County since the earlier rounds of monitoring.
- **Changes of land use** in an aquifer's recharge area - for instance, from natural vegetation to impervious surfaces such as pavement or concrete - can permanently reduce recharge.
- **Increasing groundwater withdrawals to serve growing populations** that are dependent on water supply from wells may reduce water quantity in the aquifer systems.
- **Natural environmental conditions**, even some that are otherwise beneficial such as increased forest cover, may reduce recharge and lower water quantity in aquifers.
- Finally, **climatic variations**, such as drought or global warming effects, can cause aquifer levels to drop further. This drop in aquifer levels can put ecosystems and residents who rely on these water supplies at risk.

Implications of the 2001 Drought

- Early in 2001, Governor Locke declared the entire state to be in a **drought**. King County, along with state and other local governments, mobilized a drought response that included monitoring flow conditions in streams, and being prepared to trigger actions to save stream flows for migrating fish populations at critical times.
- At one point, it appeared as though actions would be necessary to reduce water diversions /withdrawals along Bear Creek in order for migrating fish to pass through to spawning grounds, but this situation passed without major actions necessary.
- The County received anecdotal information about drops in groundwater aquifers but there was no wholesale drop in water levels that generated any large-scale effort to provide alternative water to these areas. However, drought impacts sometimes take several years to be seen or felt.

What We Are Doing

- Investigating local groundwater issues, particularly suspected areas of contamination.
- Mapping known areas of high arsenic levels in surface soils (likely caused by discharges from the Asarco smelter in Tacoma) along with water quality sampling results. This comparison did not show any high arsenic levels in the ground water samples from those locations.
- Initiating a study along the Sammamish River that will provide better information on the relationship between groundwater and flows in the Sammamish River, which has water quality, temperature, and low flow conditions that adversely affect fish populations.
- Developing a comprehensive groundwater data collection and management system for planning and protection purposes.
- Encouraging BMPs that reduce the risk of chemical or biological contamination of groundwater.
- Limiting development activity in rural areas in order to protect aquifer recharge.
- Educating homeowners about proper maintenance of septic systems in order to prevent groundwater pollution, and notifying well owners of water quality problems.
- Providing water conservation education to groundwater consumers.
- Working with local WRIA salmon conservation groups on groundwater components in habitat protection and restoration, and with ESA groups to include groundwater protection in species protection plans.
- Organizing and convening Groundwater Protection Committees made up of local stakeholder interests.
- Supporting Groundwater Protection Committees in implementation of their local Groundwater Management Plans.
- Treating contaminated groundwater at King County sewage treatment plants to prevent further spread of contaminants.
- Working with Seattle King County Public Health and other local agencies and programs to identify groundwater quality and quantity concerns and coordinate response and protection efforts.
- Developing a long-term work plan for protection of King County's groundwater resources.