The Ninth Annual Report on Progress in Implementing the King County Countywide Planning Policies

King County

King County Benchmarks

2005 Environment

Highlights

Better, but is it Good Enough?

King County residents can be proud of their record in residential recycling, in reducing water consumption, in conserving energy in our residences and workplaces, and in preserving the quality of our rural streams, lakes, and habitat. In addition, noise at our airports has been reduced significantly, largely due to federal regulation, and we are conserving and regenerating our forests, reducing flooding and improving stormwater runoff.

We are justly proud of our environmental record. Yet, it is evident that in some areas, we are just barely holding the line. In other cases the progress we are making is too slight to stem the tide of environmental decline.

- Despite redevelopment of urban land, and better building and landscaping practices, the rate of increase in impervious surface may still be accelerating.
- More of us are walking or biking to work, or working from home, but single-occupancy vehicle commuting remains the choice of 69% of commuters. (See Transportation Bulletin)
- Greenhouse gas emissions (GHGs) from large and small combusters have increased, as have total GHGs in King County.
- Gasoline usage peaked in 2002 and has declined slightly in the past two years. Diesel consumption continues to increase. Per capita use of automotive fuel has increased 7% since 1996, partly due to less efficient vehicles. Vehicle emissions are the greatest source of air toxics, and GHGs.

We are indeed, making progress on many fronts. Nevertheless, vigorous, proactive efforts are still needed to improve air quality, reduce climate-changing emissions, and adequately protect streams, lakes, shorelines, and salmon habitat in King County.

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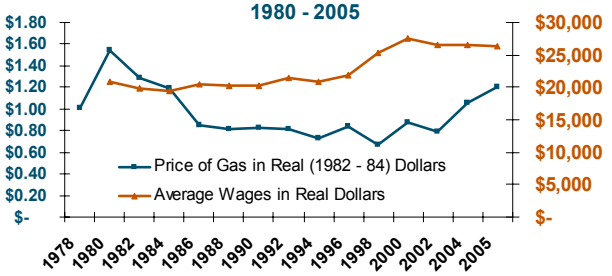
The Real Cost of Gasoline and Our Environmental Future

While each of us may be driving about the same number of miles as we did 10 years ago, a growing population means that the total vehicle miles driven in King County continues to climb. At the same time, there has been little reduction in the percent of commuters who drive to work alone. These habits are costly to our environment and economy: they affect our air quality, contribute to climate-changing emissions, impact water quality, and cost millions of dollars in productive time lost to traffic congestion.

It may be time to ask whether gasoline is too cheap. At $2.30 per gallon, and an average of 24 mpg, a King County worker who drives 24 miles to and from work each day, can expect to spend about $50 per month on gasoline. This, of course, is a relatively small percentage of the cost of auto commuting, which includes maintenance and insurance for the vehicle, parking, and the time spent at the wheel. But given rising real wages, these costs are rarely enough to change the habits of the determined auto commuter.

Gas Prices and Annual Wages in Real Dollars: 1980 - 2005



There is an irony in posing this question in a year that has seen a significant increase in the real (after inflation) cost of gas. However, as the chart shows, after a sharp spike in 1978 - 1982 real gas prices have remained low and relatively steady through the late 1980s and the 1990s. In fact, for most of these years the real cost of gas remained steady or dropped, while real wages increased.

The relative cheapness of gasoline in the U.S. in comparison to income has influenced our choice of housing locations, and consequently our patterns of land use. Long distance commuting from distant suburbs may cost us in time, but the cost of operating a vehicle is not seen as a detriment, especially when it is weighed against less expensive housing.

Higher real gasoline costs may remind us of the much larger environmental costs of long, lonely commutes, and stimulate our efforts to bring jobs and housing closer together, to create affordable housing within our cities, and to experiment with new modes of commuting.

Indicator Flags

- There has been a long-term trend in a positive direction, or most recent data shows a marked improvement
- There has been a long-term negative trend, or the most recent data shows a significant downturn
- There has been little significant movement in this Indicator, or the trend has been mixed
- There is insufficient reliable trend data for this Indicator

Outcome: Protect and Enhance Natural Ecosystems

Indicator 9: Land Cover Changes in Urban and Rural Areas Over Time

The only addition to this indicator since last year is Fig. 9.3, a 2002 Land Cover map.

Countywide Planning Policy Rationale

"The land use pattern for the County shall protect the natural environment by reducing the consumption of land and concentrating development. Urban Growth Areas, Rural Areas, and resource lands shall be designated and the necessary implementing regulations adopted." (FW-6) "All jurisdictions shall protect and enhance the natural ecosystems through comprehensive plans and policies, and develop regulations that reflect natural constraints and protect sensitive features. Land use and development shall be regulated in a manner which respects fish and wildlife habitat in conjunction with natural features and functions, including air and water quality. Natural resources and the built environment shall be managed to protect, improve and sustain environmental quality while minimizing public and private costs." (FW-4)

Background

This examination of land cover change in King County draws on data derived from 1994 and 2001 USGS Landsat Thematic Mapper images. Each pixel of 900 sq. m. or 1,076 sq. yds is given a classification based on the dominant land cover within its area. For instance, a classification of "impervious" or "high intensity urban" will contain at least 75% of impervious (paved or built) surface. Landsat images are registered, intercalibrated, and corrected for atmosphere and topography to ensure accuracy of land cover change assessment. However, given the difficulty of achieving complete comparability between the classification of images taken in different years, there is a margin of error.

The measurements of increase in Fig. 9l1 are given for King County only, although the map (Fig. 9.2) shows areas outside of King County. The map in Fig. 9.3 is a 2002 Landsat Thematic Mapper image provided by the University of Washington's Urban Ecology Research Laboratory. The classification system differs slightly from that used for the land cover change analysis, so that it cannot be used to update change from the 1994 or 2001 datasets. It is included for illustrative, rather than analytic purposes.

Key Trends

Change in Forest Cover

- About 2% of King County's forest cover was lost in the period between 1994 and 2001.
- Most of the loss was in the rural, forested areas, but some has also been the result of development just inside the urban growth boundary. Much of the loss in the rural forest area probably occurred before 1996.
- According to the 2001 land cover data, there are about 29,400 acres of recently-regeneratedforest, equal to about 3.4% of the total forested area. It shows just 6,150 acres of recent clear-cut, amounting to 0.7% of the total forest cover. It appears that forest regeneration is proceeding at a rate well over that of recent clear cutting.

Fig. 9.1

Increase in Impervious Surface and Loss of Forest Cover in King County : 1994 - 2001

	Acres Gained or Lost*	Chg as % of total Cty land area	Estimated Total Acres in this category in 1994	1994 Total as % of Urban Area	Estimated Total in 2001	2001 Total as % of Urban Area
Impervious Surface (gain)	15,524	1.1%	75,576	25.7%	91,100	31.0%
Forest Cover (net loss)	(26,772)	-2.0%	897,772		871,000	

*This analysis depends on classification of Landsat data. The method used identifies the landcover type at a resolution of about 1,075 sq. yards or 20% of an acre. It detects changes in classification (i.e. predominant land cover) for areas about that s

- Vegetative cover, especially forest, performs significant ecological functions. Forests and other types of vegetation absorb, filter, and slow surface water flow. They provide wildlife habitat, clean air, and recreation area. Fish and wildlife depend upon continuous, undisturbed habitat. When ecosystems become fragmented and lack connectivity, fish and wildlife are prevented from meeting their need for food, water, cover, and space.

Change in Impervious Surface

- The rate of increase in impervious surface appears to have accelerated over the last 20 years in the urban area of King County. By 1994, over 25% of the urban area was already paved or built, and by 2001, it had reached 31%.
- When the land in a watershed reaches 10 - 15 percent impervious surface (paved or built development, not permeable by water), the area undergoes long-term, and often irreversible, loss of aquatic system functions. This loss results in greater and more frequent flooding, decreased base flows from groundwater into streams, and increased water level fluctuations in wetlands and small lakes. These changes in flows have adverse impacts on plants, fish, and wildlife.
- Keeping any change to impervious surface to a strict minimum in the rural areas is essential for protecting habitat, preventing flooding, and maintaining the "air cleaning" qualities of forest cover (i.e. creating "carbon sinks" which offset the negative effects of the CO_2 emissions which drive climate change.

The **King County *Countywide Planning Policies* Benchmark Program** is a program of the Metropolitan King County Growth Management Planning Council. Reports on the 45 Benchmark Indicators are published annually by the King County Office of Budget. A companion to these reports is the **King County Annual Growth Report.** All reports are available on the Internet at http:// www.metrokc.gov/budget/benchmrk . For information, please contact Rose Curran, Program Manager (206) 205-0715, King County Office of Budget, 701 Fifth Ave, Suite 3200, Seattle, WA 98104, or e-mail: rose.curran@metrokc.gov.

King County Office of Management and Budget

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Fig. 9.2

Map: Land Cover Change (237kb PDF)

Fig. 9.3

Map: Land Cover in 2002 (warning: large file—6.69Mb PDF)

Outcome: Improve Air Quality

Indicator 10: Changes in Air Quality

Countywide Planning Policy Rationale

"All jurisdictions, in coordination with Puget Sound Air Pollution Control Agency* and the Puget Sound Regional Council, shall develop policies, methodologies and standards that promote regional air quality, consistent with the Countywide Policy Plan." (CA-14)

*Now the *Puget Sound Clean Air Agency*

Background

Air quality evaluation is a complex issue, involving measurement of short-term impacts on visibility, medium-term impacts on health and quality of life, and long-term impacts on climate. In this indicator we consider 1) the six traditional air pollutants which determine the daily air quality index (AQI); 2) air toxics which contribute to cancer and other health risks; and 3) greenhouse gases which contribute to climate change.

- The Air Quality Index (AQI), also known as the Pollutant Standards Index (PSI), provides a nationally uniform method of reporting daily air quality levels.
- There are six major pollutants that are considered in determing the AQI: 1. particulate matter (PM_{10} and $PM_{2.5}$); 2. carbon monoxide (CO); 3. sulfur dioxide (SO_2); 4. ozone (O_3); 5. nitrogen dioxide (NO_2); and 6. lead (Pb).
- The concentration of each of these pollutants on a given day determines the Index value; and the pollutant with the highest Index value determines the AQI on that day. These are then translated into "good", "moderate", unhealthful for sensitive groups" and "very unhealthful" categories.
- Air quality in western King County is primarily determined by the levels of particulate matter, sulfur dioxide, and carbon monoxide, rather than by lead, nitrogen oxide, or ozone.
- Ozone forms slowly, downwind of pollution sources, and contributes to smog. In King County, it travels southeast with the wind, and elevated levels are sometimes seen at the Enumclaw monitoring station, but typically not in the north and western parts of the County.

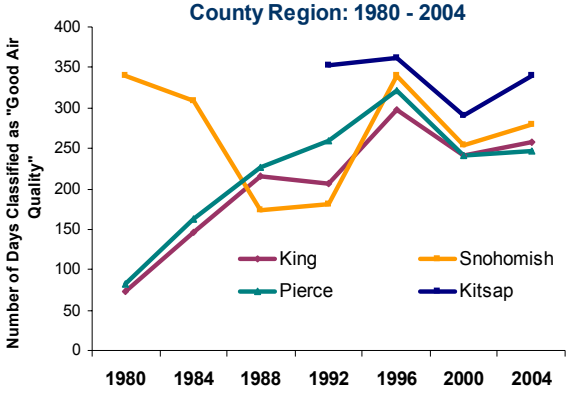
Key Trends

I. Traditional Air Pollutants

- Compared to 2002, there were 5 fewer "good" air quality days, and 2 more days that were "unhealthy for sensitive groups", in 2004.
- Since 2000 there has been a slight improvement in air quality based on the total number of good air quality days.

Fig. 10.2

Number of Good Air Quality Days in Four County Region: 1980 - 2004



- The trend in the air quality index (AQI) has been generally upward since 1980, although the number of good days dipped between 1998 and 2000 because stricter federal standards for particulate matter were put into effect in 1999.
- An average of five days per year have been classified as "unhealthy for sensitive groups" since this category was created in 1999.
- Fig. 10.2 shows that both King and Pierce County improved significantly from 1980 - 1998, dipped with the new standards in 1999, and are once again seeing improvement in the AQI.
- Particulate matter is a significant pollutant and health hazard in King County. Particulate matter (PM) refers to the very small solid particles and liquid droplets formed when carbon fuels are burned.
- Exposure to elevated levels of particulate matter aggravates asthma, chronic pulmonary disease, and heart disease. Asthma disporportionately affects the very young, the very old, and the very poor. It is a leading cause of school absenteeism.
- Motor vehicles are by far the largest overall contributers to air pollution, responsible for about 55% of the total. Vehicles also contribute to ozone, greenhouse gas emissions and other air toxics.

Fig. 10.1

Number of Days Per Year in Each Air Quality Category: King County 1980 - 2004

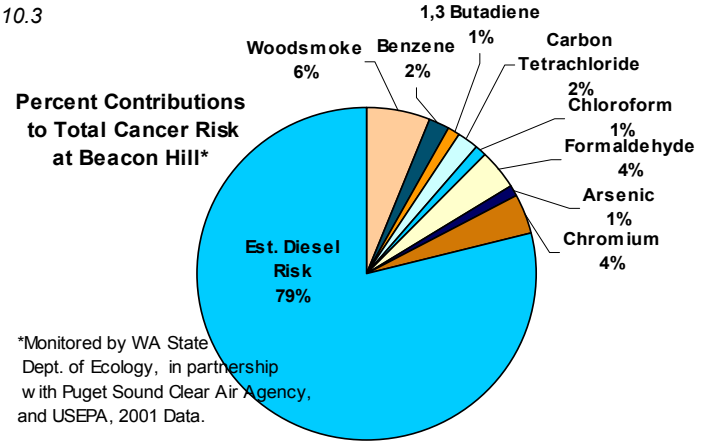
Indicator 10 (continued)

II. Air Toxics

There is no trend data available yet for air toxics in King County, although PSCAA is beginning to develop a baseline.

- "Air toxics" is a broad category of chemicals that covers over 400 air pollutants along with woodsmoke and diesel particles. They are of concern because of potential dangers to human health.
- The primary health concern from many of these chemicals is cancer - particularly lung, nasal and liver cancers, and leukemia. Respiratory and heart disease may also be aggravated by some of these same pollutants.

Fig. 10.3



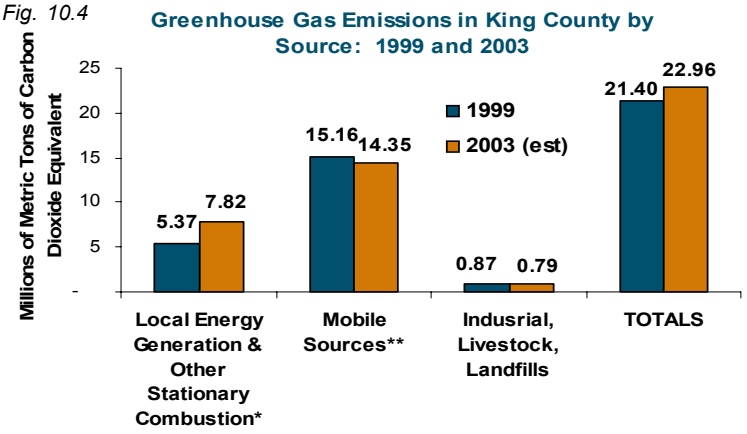
- The average cancer risk from these sources for a life-time resident of King County is in the range of 400 to 700 in a million. This would mean a risk of 2 to 3.5 cases out of 5,000 residents, or 700 - 1300 cases in a population of 1.8 million. Public health experts consider this unacceptably high.

III. Greenhouse Gases (GHGs)

Greenhouse gases are released when humans burn fossil fuels to generate electricity and to power vehicles, as well as when waste is disposed. GHGs are of concern because of their long-term effect on climate change, rather than because of their immediate impact on air quality. For the first time, data are available for GHG emissions in the King County geographic area. Some general observations on global climate change are included here as well. Many of the same activities that produce traditional pollutants also produce GHGs and toxics.

- Total greenhouse gas emissions (GHGs) in the King County geographic area rose from 21.40 million metric tons of CO_2 equivalent in 1999 to 22.96 in 2003, an increase of 7.3% in four years.

Fig. 10.4



*Stationary Combustion includes large and small non-mobile engines, such as lawn and garden equipment, wood and gas fireplaces, and waste burning; ** Mobile sources include marine, aircraft, and off-road mobile sources, as well as cars and trucks.

- Mobile sources (including marine, aircraft, and off-road vehicles, as well as cars and trucks) have declined as a proportion of all GHGs, from 70.8% in 1999 to 62.5% in 2003.
- However, mobile sources remain by far the largest source of GHGs.
- Industrial emissions also declined, but emissions from large and small combustors increased from 25% of the total in 1999, to 34% in 2003.
- Greenhouse gases are warming the earth and causing climate disruptions. Scientists project that, due to rising temperatures the Pacific Northwest can expect higher temperatures, wetter winters, drier summers, reduced river flows, increased coastal flooding and erosion and decreased forest health and productivity.
- Snowpack - the region's natural storage system for water supply and hydroelectricity - is likely to decline by half within our children's lifetimes.
- The sea level rose by 4" to 8" in the last century. It is predicted, by conservative estimates, to rise at least one foot by 2050, causing major coastal disruption in many parts of the world, and displacing millions of persons.

For Comparison

- The nine warmest years on record, since data collection began in the 1860s, have occurred in the last ten years.
- Global mean surface temperatures are predicted to rise from 1° to 4.5° F in the next 50 years.

What We Are Doing

- Reducing diesel emissions through the Diesel Solutions program, a partnership among King County, Seattle, the Boeing Company, Durham School Services, and Phillips Petroleum, to bring cleaner diesel vehicles and fuels to our region.
- Promoting transit ridership, creating bicycle trails and lanes, and designing pedestrian-friendly urban environments to reduce fuel consumption.
- Encouraging proximity of jobs and housing to reduce commute distances and fuel consumption.
- Maintaining bans on outdoor burning and use of wood stoves or fireplaces. Replacing wood stoves or fireplaces with natural gas or propane which burn many times cleaner than wood.
- Preserving and regenerating urban trees and rural forest land to increase "carbon sinks" and counteract climate-changing $C0_2$ emissions.
- Educating business and industry on green building principles to reduce energy consumption.
- Updating greenhouse gas emissions inventories and setting targets for emissions reduction.

Outcome: Improve Air Quality

Indicator 11: Energy Consumption

Countywide Planning Policy Rationale

"In cooperation with water and electricity providers, local jurisdictions, including sewer and water districts, shall encourage programs for...power conservation in public facilities and in the private sector." (ED - 11) "Aggressive conservation efforts shall be implemented to address the need for adequate supply for electrical energy and water resources, and [to] achieve improved air quality. Efforts shall include, but not be limited to, public education...conservation credits, and energy efficiency in new and existing buildings." (CO, 6)

Key Trends

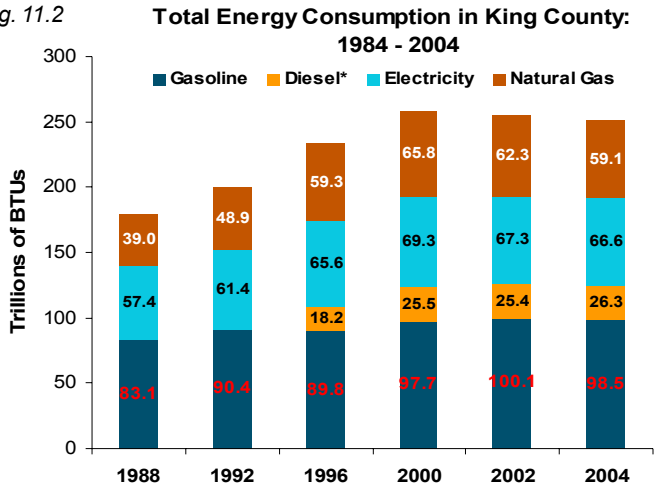
I. Washington State, U.S. and World

- Washington State's per capita consumption of energy fell by nearly 20% between 1990 and 2001. We have moved from being a relatively high-consumption state to consuming at just about the national average per person.
- Washington's rank for per capita consumption among all states improved from 20th highest in 2000 to 27th highest in 2001.
- In terms of total energy, in 2001 Washington State consumed just slightly less than in 1990.
- During the same period, U.S. total energy consumption increased by 14.5%, while its per capita consumption fell by just 0.1%.
- Total annual consumption for the world is up 16% since 1990, while its per capita consumption is down 0.7%.
- Washington State consumes 0.5% of all the world's energy, with 0.1% of the world's population. The U.S. consumes about 24% of the world's energy per year with 4.6% of the world's population.

II. King County

- King County's total energy consumption increased about 10% from 1990 to 2004, excluding diesel. Data on diesel usage was not collected until 1996. Total consumption has declined significantly since its high point in 2000.
- Of the four main types of energy consumed, all have increased since 1990, but the use of automotive fuels has risen more rapidly than electricity and natural gas. Consumption of the latter has remained stable since 1996.

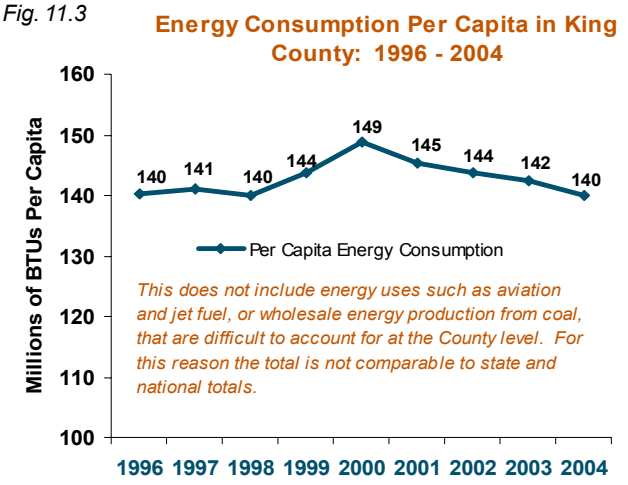
Fig. 11.2



**Diesel data was not collected until 1996. Improved data collection methods may be partly responsible for the sharp rise in diesel usage from 1996 - 2000.*

- Per capita consumption in King County is now at about the same level as it was in the mid-1990s, after peaking between 1999 and 2002.
- Per capita consumption in residential and commecial energy (electricity and natural gas) has declined by nearly 7% since 1996, indicating that energy-efficient buildings, appliances, and other conservation measures are having a positive impact.

Fig. 11.3



(continued on page 8)

Fig. 11.1

Total and Per Capita Energy Consumption: Washington State, U.S. and World: 1990 and 2001

	Total Energy Consumed (in Trillions of BTUs)		Per Capita Energy Consumed (in Millions of BTUs)		Change in Per Capita Consumption	Percent of World Consumption	Rank in Per Capita Consumption)
	1990	2001	1990	2001	1990-2001	2001	2001-2002
Washington State*	2,064	2,034	424	340	-19.7%	0.5%	27th among U.S. states
United States	84,094	96,275	338	338	-0.1%	24%	6th among 70 countries**
World	348,400	403,900	66.0	65.6	-0.7%	100%	

*1990 and 2000 Total Energy for Washington State are revised numbers. **The 70 countries exclude the least developed countries whose energy consumption is extremely low. Ranking higher than the U.S. in per capita consumption are the United Arab Emirates, Bahrain, Kuwait, Norway, and Canada. Source: Statistical Abstract 2004-2005 and U.S. Dept. of Energy, Energy Information Administration (http://www.eia.doe.gov/emeu/states/_states.html)

Indicator 11 (continued)

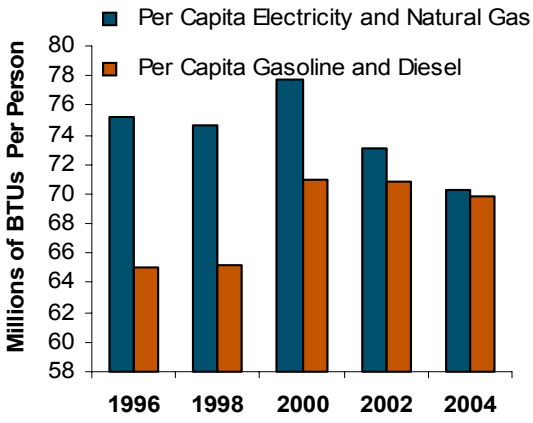
- On the other hand, per capita use of automotive energy (gasoline and diesel) has risen by over 7% since 1996. Diesel continues to increase, while gasoline consumption peaked in 2002, and has declined in the past two years.
- As the County's economic activity has grown, more miles are being driven in King County by commercial vehicles, often powered by diesel.

What We Are Doing

- Reducing diesel use in the King County Metro fleet through acquisition of non-diesel or clean diesel buses and other vehicles. Reducing emissions by retrofitting buses for fuel efficiency, and buying fuel-efficient cars.
- Promoting public transportation (buses, Sounder trains, light rail, and monorail) options to reduce fuel consumed by single-occupancy vehicles.
- Promoting "build green" practices in both public and private developments to make new buildings energy-efficient.
- Passing statewide legislation to require stricter vehicle emissions standards, comparable to California's, and passing a significant gas tax increase.

Fig. 11.4

Per Capita Consumption of Energy Sources for Buildings vs. Vehicles



Outcome: Improve Air Quality

Indicator 12: Vehicle Miles Traveled (VMT) Per Year

Countywide Planning Policy Rationale

"All jurisdictions, in coordination with Puget Sound Air Pollution Control Agency* and the Puget Sound Regional Council, shall develop policies, methodologies and standards that promote regional air quality, consistent with the Countywide Policy Plan." (CA-14) "The land use pattern for King County shall protect the natural environment by...concentrating development" (FW-6) "The land use pattern shall be supported by a balanced transportation system which provides for a variety of mobility options....(FW-18) The transportation element of Comprehensive Plans shall include pedestrian and bicycle travel as part of the transportation system....(T-7) "General capacity improvements promoting only single-occupant vehicle traffic shall be a lower priority." (T-8)

*Now the Puget Sound Clean Air Agency

Background

This indicator measures all vehicle miles traveled (VMT) in a given year on the streets and highways of King County, whether by commercial or private vehicles. It also measures per capita miles traveled to account for the growing population in the County. Because commercial vehicle miles are included, the degree of economic activity will influence the total, as well as the driving patterns of private households.

Key Trends

- In 2003 vehicles in King County traveled 16.2 billion miles, down from the 16.3 billion miles traveled in 2002, but nearly twice as high as in 1985.
- Miles traveled per capita were also down in 2003, to 9,124 miles per year. This is the lowest it has been since 1994. The decline in VMT per capita may be related to a rise in the cost of gasoline in 2003.

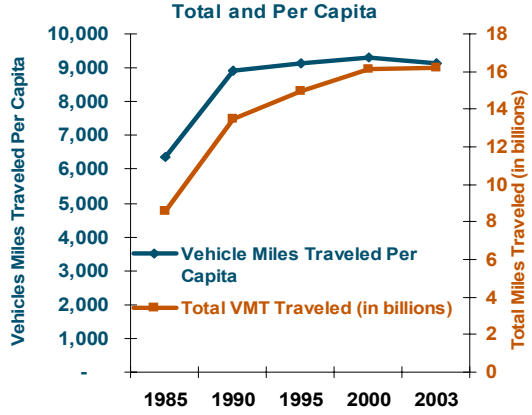
Fig. 12.1

Vehicle Miles Traveled: Per Capita and Total

Year	1985	1990	1995	2000	2003
Vehicle Miles Traveled Per Capita	6,344	8,933	9,154	9,322	9,124
Total VMT Traveled (in billions)	8.6	13.5	15.0	16.1	16.2

Fig. 12.2

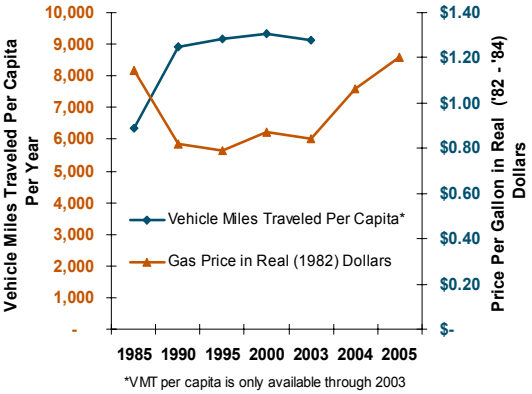
Vehicle Miles Traveled in King County: Total and Per Capita



- The rise in the real cost of gasoline, after more than a decade of stable gas prices (in real dollars), could lower the per capita VMT in 2004 - 2005, or hasten a return to more fuel-efficient vehicles.

Fig. 12.3

VMT Per Capita in Relation to Real Cost of Gas: 1985 - 2005



*VMT per capita is only available through 2003

Outcome: Protect Water Quality and Quantity

Indicator 13: Surface Water Quality

Countywide Planning Policy Rationale

"Natural drainage systems including associated riparian and shoreline habitat shall be maintained and enhanced to protect water quality, reduce public costs, protect fish and wildlife habitat, and prevent environmental degradation. Jurisdictions with shared basins shall coordinate regulations to manage basins and natural drainage systems which include provisions to: a. Protect the natural hydraulic and ecological functions of drainage systems, maintain and enhance fish and wildlife habitat, and restore and maintain those natural functions; b. Control peak runoff rate and quantity of discharges from new development to approximate pre-development rates; and c. Preserve and protect resources and beneficial functions and values through maintenance of stable channels, adequate low flows, and reduction of future storm flows, erosion, and sedimentation." (CA-9) "All jurisdictions shall implement the Puget Sound Water Quality Management Plan to restore and protect the biological health and diversity of the Puget Sound Basin." (CA-15) "Each jurisdiction's policies, regulations, and programs should effectively prevent new development and other actions from causing significant adverse impacts on major river flooding, erosion, and natural resources outside their jurisdiction." (CA-12)

I. King County Lakes: Background

Eutrophication is the acceleration of the loading of nutrients to a lake, by natural or human-induced causes. The increased rate of delivery of nutrients results in increased production of algae and consequently, decreased water transparency. Human-induced (cultural) eutrophication may be caused by input of treated sewage to a lake, deforestation of a watershed, or urbanization of a watershed. The King County lakes programs are designed to protect the beneficial uses of our lakes by minimizing cultural impacts on water quality.

Carson's (1977) trophic state index (TSI) is a method of quantifying this eutrophication on a scale of 0 - 100. With the TSI, lakes can be rated and compared according to the level of giological activity. Each major division (10,20,30, etc.) represents a doubling of algal biomass and is related to nutrients and water clarity. Lakes with values around 40 or less (oligotrophic) have high water clarity, lower algae values, and lower total phosphorus values.

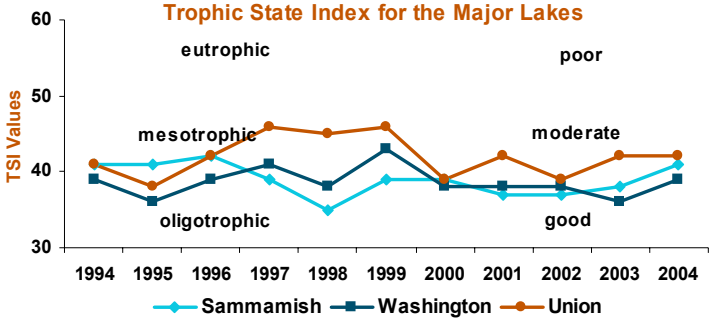
Lakes with TSI values between 40 and 50 (mesotrophic) have moderate water clarity, algae and phosphorus values. Lakes represented by TSI values between 50 and 60 (eutrophic) typically have lower water clarity, higher chlorophyll a values and higher total phosphorus values. Hypereutrophic lakes have TSI values greater than 60 and are very biologically productive. The TSI values are a continuum and hence some lakes may be in a borderline range, exhibiting some qualities of upper and lower classifications.

Key Trends

- All three of King County's major lakes are in moderately good condition, as measured by the trophic state index (TSI). The TSI values are in the same range as they were a decade ago.
- Conditions in Lake Union improved from 2003 to 2004, while those in Lake Washington and Lake Sammamish declined somewhat. (Note that lower scores on the TSI indicate improvement).

Fig. 13.1

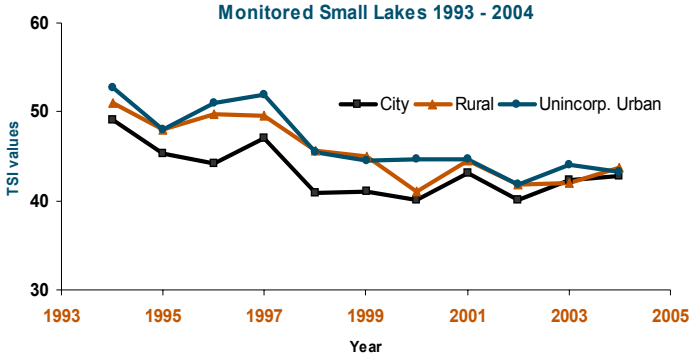
Summer Average (June-Sept) Trophic State Index for the Major Lakes



- There has been an overall improvement in the condition of monitored small lakes in King County over the past decade.
- Of the 50 small lakes monitored for their trophic state, 19 are in cities, 22 in unincorporated urban areas, and 9 in rural areas. While all categories showed improvement over the decade, the conditions in several rural lakes declined slightly from 2002 to 2004.

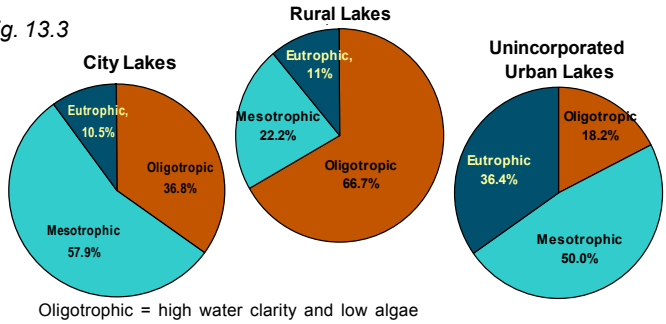
Fig. 13.2

Annual Average of Trophic State Index (TSI): Monitored Small Lakes 1993 - 2004



- As measured by the TSI, many more of the rural lakes have high water clarity and lower total phosphorus, than do the urban lakes. However, lakes in cities are generally in better shape than those in the unincorporated urban area.

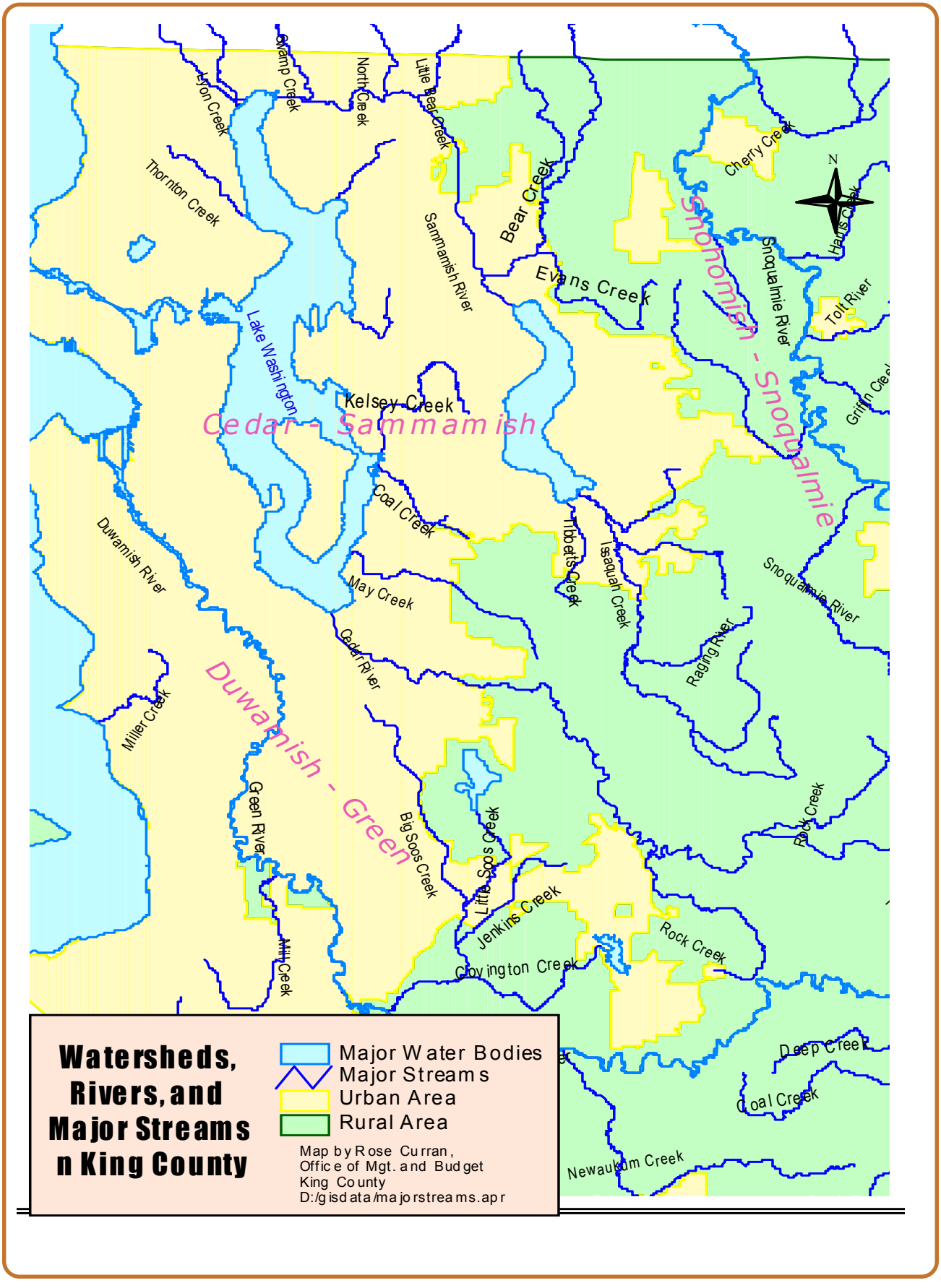
Fig. 13.3



Oligotrophic = high water clarity and low algae
Mesotrophic = moderate clarity and algae
Eutrophic = low clarity and higher algae and total phosphorus levels

(continued on page 10)

Fig. 13.4


Watersheds, Rivers, and Major Streams n King County
Major Water Bodies
Major Streams
Urban Area
Rural Area
Map by Rose Curran,
Office of Mgt. and Budget
King County
D:/gisdata/majorstreams.apr
Cedar - Sammamish
Duwamish - Green
Snohomish - Snoqualmie
Lake Washington
Kelsey Creek
Bear Creek
Evans Creek
Sammamish River
Thornton Creek
Ayon Creek
Swamp Creek
North Creek
Little Bear Creek
Cherry Creek
Harris Creek
Snoqualmie River
Tolt River
Griffin Creek
Coal Creek
Duwamish River
May Creek
Cedar River
Tibbetts Creek
Issaquah Creek
Raging River
Snoqualmie River
Miller Creek
Green River
Big Soos Creek
Little Soos Creek
Jenkins Creek
Covington Creek
Rock Creek
Mill Creek
Deep Creek
Coal Creek
Newaukum Creek
N

Indicator 13 (continued)

II. King County Streams: Background

King County Department of Natural Resources and Parks conducts routine monitoring on streams throughout the county.

Stream quality can be measured in a number of ways. Routine baseflow parameters which include temperature, dissolved oxygen, turbidity, total dissolved solids, pH, conductivity, and nutrients (ortho-phosphate, total phosphate, ammonia-nitrogen, nitrate+nitrite-nitrogen, total nitrogen) have been collected at many sites for over twenty years. Water samples are cultured for bacteria counts (both fecal coliform and E. coli) as well. Since 1986 the County has been collecting storm samples three to six times per year. Trace metals are analyzed in storm water samples in addition to the parameters listed above for baseline monitoring.

The Benthic Index of Biotic Integrity (B-IBI), reported for this indicator, is a kind of "report card" of stream health. The B-IBI measures the quantity of certain aquatic macro-invertebrates present in a stream sample. The number and condition of these macroinvertebrates yield 10 measures, each of which is assigned a score from 1 to 5. The rating scale from 10 - 50 indicates whether the stream is in very poor (score of 10 - 16), poor (18 - 26), fair (28 - 36), good (38 - 44), or excellent (46 - 50) condition.

B-IBI scores have been available for many King County streams since 1995, but sampling has been incomplete and sporadic. Because the 2002 sampling efforts included more data than all previous years combined, these data represent the best available baseline. Sampling for 2002 was conducted using a randomized design for streams in both incorporated and unincorporated King County. Streams in eighteen sub-basins were sampled at a total of 144 monitoring stations. In 2003 129 stream stations were sampled.

The King County Stream Sediment Monitoring Program was begun in 1987 in WRIAs 8 and 9 as part of the overall Lakes and Streams Ambient Monitoring Program. An updated 10-year program began in 2004 to monitor the effects of all sources (point sources and stormwater) to the streams. Additional parameters were added to the existing sediment monitoring program to better understand the range of contaminants that affect sediment quality.

Long term monitoring data is available on line at http://dnr.metrokc.gov/wlr/waterres/streams/streamsites.htm for Bear-Evans , Coal Creek , Forbes Creek , Issaquah Creek , Juanita Creek , Kelsey Creek , Lewis Creek , Little Bear Creek , Lyon Creek , May Creek , McAleer Creek , North Creek , Sammamish River, Thornton Creek , Tibbets Creek , Swamp Creek , and Yarrow Creek.

Fig. 13.5

Condition of King County Streams

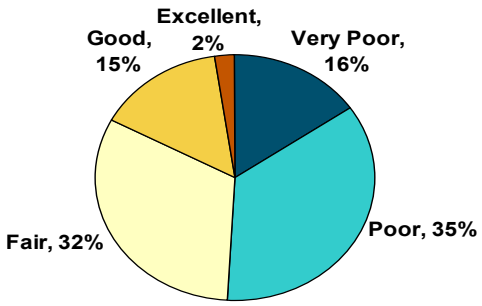
	2002		2003
	Number of Stations	Average Rating	Average Rating
Urban Area Streams			
Urban-Rural Fringe			
Mainly Rural			
Lake Washington / Cedar River Sub-Basins			
West Lake Washington	10	Poor	Very Poor
North & Swamp Creeks	5	Poor	Poor to Very Poor
East Lake Washington	9	Poor	Poor
Little Bear Creek	7	Poor	Fair
Evans Creek	9	Fair	Poor
Bear Creek	10	Fair	Fair
Sammamish River	10	Poor	Poor
Lower Cedar River	10	Fair	Fair
Lake Sammamish / Issaquah Creek Sub-Basins			
Lake Sammamish Tributaries	4	Poor	Poor
Issaquah Creek	7	Good	Fair-Good
Duwamish - Green River Sub-Basins			
Black River	9	Poor	Very Poor
Duwamish River Tributaries	5	Poor	Very Poor
Lower Green River Tributaries and Mill Creek	9	Poor	Poor
Jenkins Creek**	10	Fair	Poor
Covington Basin			Fair
Soos Creek	10	Fair	Fair to Poor
Newaukum Creek	8	Fair	Fair
Middle Green River	8	Fair	Fair
Deep and Coal Creeks	5	Good	Good

*There is a range of scores for the stations within each sub-basin. This is the mean score of all sampled streams in the sub-basin. **Included Covington Creek in 2002.

Key Trends

- In 2003, only 2% of the sampled streams in King County were in excellent condition, while 15% were in good condition, based on their B-IBI scores.

Percent of Stream Stations in Each Condition Category: King County 2003



- About one-third of the streams were in fair condition in both 2002 and 2003.
- Over 50% of sampled streams in King County were in poor or very poor condition. This is a slight improvement from 2002, when 52% were in poor or very poor condition.
- King County Department of Natural Resources (DNRP) set a target of reducing the number of poor and very poor stations to under 50%, and raising the number of stream stations rated as good or excellent to 18% by 2007. According to this most recent data it has made progress in that direction.
- Most of the sampled streams are within the Urban Growth Area. However, the results for the stream sub-basins in more-densely settled incorporated areas in King County were generally poorer than for the sub-basins which are on the fringe of the urban area.

(continued on page 12)

Indicator 13 (continued)

- Generally, the sub-basins that are completely within the urban (developed) area tend to be in poor or very poor condition, while those that flow mainly through rural areas are more likely to be in good or excellent condition. Those that are on the fringes of the urban area are likely to be in fair condition.
- Recent studies of the overall environmental quality of the King County sub-basins showed a high correlation between the B-IBI index scores, and two other measures of environmental health - 1) percent of vegetative cover; and 2) road density in the sub-basin.
- These studies found that the environmental quality of 88% of the acreage in the rural sub-basins is medium-high or high, while only 3% of the acreage in the urban sub-basins is of medium-high quality. (See Indicator 17 for habitat conservation values).

III. Marine Water Quality: Background

Marine water quality is monitored in several ways: 1) amount of dissolved oxygen; 2) marine sediment chemistry associated with adverse biological effects; and 3) presence of fecal coliform and Enterococcus bacteria in the marine environment.

Dissolved oxygen is an important measure for determining whether the waters are generally capable of sustaining various aquatic organisms, including sensitive fish and invertebrate species. The Water Quality Standard for dissolved oxygen is 7.0 mg/L. This standard is not attained at all times of the year, often due to naturally occurring conditions, so there is also a 5.0 Water Quality Guideline that is used as a warning limit, below which aquatic life may be harmed.

Many marine pollutants are not detected in water, but are attached to sediment particles. These can directly harm marine organisms or be reintroduced into the food chain. In 1997, WA State DOE began a cooperative program with the National Oceanic and Atmospheric Administration (NOAA) to monitor marine sediment quality at 300 stations in Puget Sound over a period of three years. A Sediment Quality Triad Index is used, based on three test parameters, to classify sites as 1) high quality; 2) intermediate/high quality; intermediate/degraded quality; and degraded quality. The results are reported below.

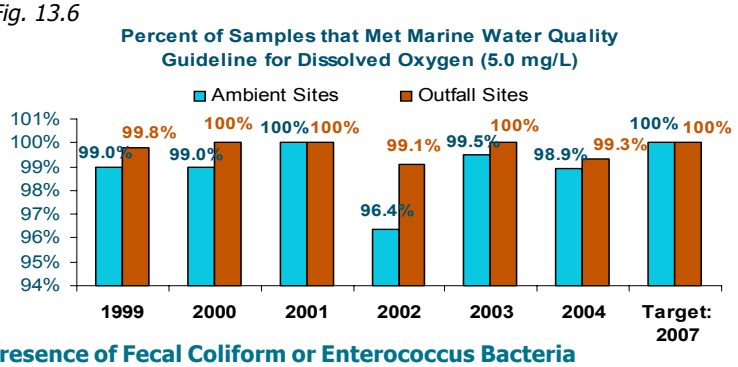
Measures of fecal coliform are indicators of fecal contamination from animals or humans which can be accompanied by pathogens harmful to human health. These bacteria can enter the aquatic environment in a number of ways, including stormwater runoff or untreated wastewater effluent. Outfall sites are those situated close to a known source of pollution, while ambient sites are those away from any known point source. For fecal contamination, offshore sites are measured separately from beach sites.

Key Trends

Amount of Dissolved Oxygen

- Marine water quality remains in good condition as measured by the dissolved oxygen guideline of 5.0 mg/L. Only 1.1% of samples from ambient sites, and 0.7% of samples from outfall sites fell below this standard in 2004. DNRP's target is that 100% of samples meet this standard by 2007.
- Many of the values below the 5.0 mg/L guideline were seen at the Elliott Bay sampling location, probably due to the influence of Duwamish River freshwater runoff. Lower levels were also observed at the South Plant outfall station and southernmost ambient station.
- 51.6% of samples at ambient sites and 57.8% of samples at outfall sites met the more stringent Water Quality Standard of 7.0 mg/L in 2004. DNRP's target is for 60% of all samples to meet the 7.0 mg/L standard by 2007.

Fig. 13.6



Presence of Fecal Coliform or Enterococcus Bacteria

- In 2004, as in 2003, 100% of offshore sites (both ambient and outfall sites) met the Class AA marine surface water fecal coliform standard. This standard addressses water quality requirements for classifying shellfish growing areas and for protecting primary contact recreational users.
- Beach sites are monitored for fecal coliform independently of offshore sites. The bacterial standard used by the state and by King County* addresses health effects from direct contact with marine waters during activities such as swimming, wading, SCUBA diving or surfing.
- 78% of samples from ambient beach (near-shore) sites and 71% of samples from outfall beach sites met the fecal coliform standard. The goal is that by 2007, the standard will be met by 90% of ambient site samples, and by 75% of outfall site samples.

*This standard is that the geometric mean of samples collected should not exceed 14 cfu/100ml.

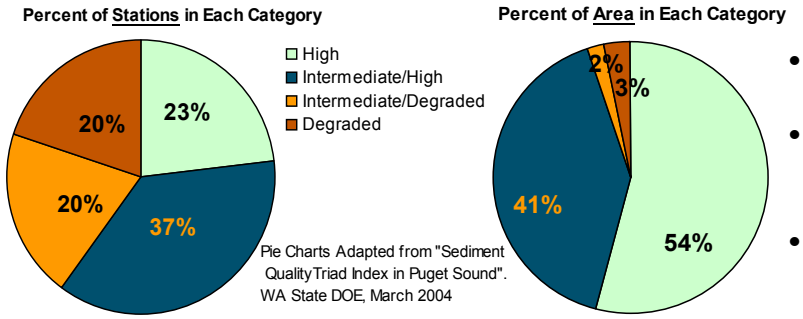
Marine Sediment Quality

- 95% of the monitored area of Central Puget Sound had high or intermediate/high sediment quality. This area includes the Sound between Seattle, Tacoma, and Bremerton, and surrounding Vashon and Bainbridge Islands.
- 2% of the area was classified as being "intermediate/degraded", while 3% was classified as degraded. The most problematic areas in this part of the Sound appear to be in Elliott and Commencement Bays.
- Ecologically, the higher degree of degradation in urban and harbor areas may disproportionately affect important fish, shellfish and aquatic plant species that depend on nearshore critical habitat.

(continued on page 13)

Indicator 13 (continued)
Fig. 13.7

Marine Sediment Quality in Central Puget Sound



- Overall, just 1% of the entire Puget Sound area appears to be degraded. This compares favorably with marine estuaries in other parts of the nation, although the size and natural characteristics of the Sound, and different levels of human activity, make such comparison difficult.

What We Are Doing

- Implementing and completing programs to eliminate sewer overflows into Lake Washington, Lake Union, and Elliott Bay during storms.
- Carrying out Lake Management Plans in five smaller lakes.
- Sponsoring the Basin Stewardship Program. Improving drainage systems and run-off in urban areas, and providing better flood control.
- Mitigating development activities that may affect surface water quality. Limiting new impervious surface in areas where stream health can be maintained or improved.
- Continuing to monitor marine outfalls to assure that we are treating wastewater effectively. Cleaning up degraded sites as part of the Lower Duwamish Waterway Superfund Project.

Outcome: Protect Water Quality and Quantity

Indicator 14: Water Consumption

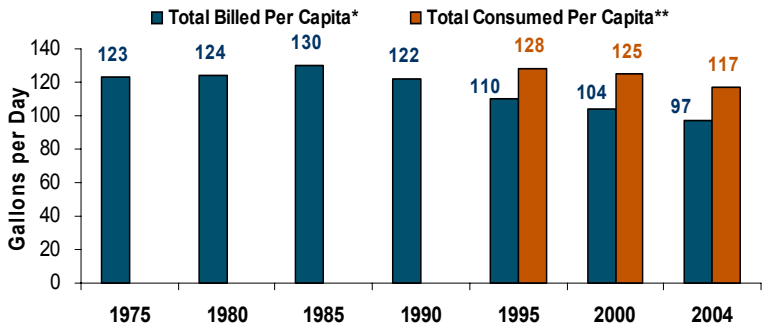
Countywide Planning Policy Rationale

"Water supply shall be regionally coordinated to provide a reliable economic source of water and to provide mutual aid to and between all agencies and purveyors. The region should work toward a mechanism to address the long-term regional water demand needs of all agencies and water purveyors." (CO-5) "Aggressive conservation efforts shall be implemented to address the need for adequate supply for...water resources....Efforts shall include...public education, water reuse and reclamation, landscaping which uses native and drought-resistant plans and other strategies to reduce water consumption..."(CO-6) "Water reuse and reclamation shall be encouraged, especially for large commercial and residential developments, and for high water users such as parks, schools, golf courses, and locks." (CO-7)

Key Trends

- Total water consumed per person in 2004 was lower than in either 1995 or 2000 for King County residents served by Seattle Public Utilities (SPU). SPU customers account for about 73% of King County's population.

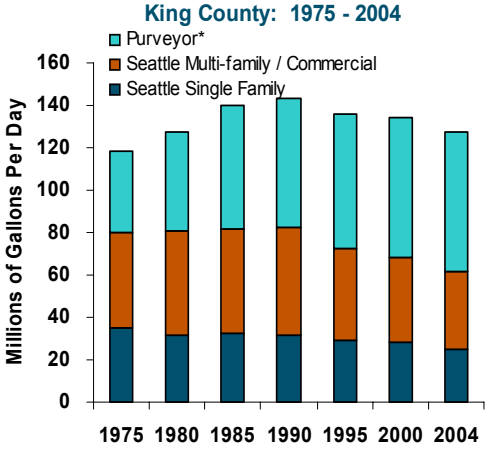
Per Capita Water Consumption in King County: 1975 - 2004



*This series was revised by SPU in 2005 so it differs slightly from previous reports. " Total billed" water includes all water paid for by customers, whether retail or wholesale (i.e. paid for by other purveyors). **"Total consumed" includes non-revenue water used up in transmission leaks, cleaning lines and reservoirs, etc. This number has only been tracked since 1995.

- With minor variations, per capita billed water consumption has showed a downward trend since 1985. Per capita billed consumption is now 25% lower than in its peak in 1985.
- Total water consumption is about the same as it was in 1980, despite a 41% increase in population during that period. However, this does not account for new water resources not conveyed by SPU.

Billed Water Consumption By Sector in King County: 1975 - 2004



- Consumption of SPU water has declined for both single family and multi-family / commercial users from 2000 to 2004, while sales to other purveyors have remained about the same.

Outcome: Protect Water Quality and Quantity

Indicator 15: Groundwater Quality and Quantity

Countywide Planning Policy Rationale

"All jurisdictions shall adopt policies to protect the quality and quantity of groundwater where appropriate..." (CA-5) "Land use actions should take into account the potential impacts on aquifers determined to serve as water supplies. The depletion and degradation of aquifers needed for potable water supplies should be avoided or mitigated; otherwise a proven, feasible replacement source of water supply should be planned and developed to compensate for potential lost supplies." (CA-6)

Background

Groundwater is a significant natural resource in King County, providing safe drinking water for approximately 30% of the county's population through thousands of water wells. 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.

King County looks for trends in groundwater quality by (1) tracking levels of the constituents (such as arsenic, lead and nitrate) identified in federally regulated primary drinking water standards, and (2) looking for statistically significant trends in nitrate levels, even if the levels are well below the drinking water standards. Nitrate is an appropriate constituent to evaluate because it is a good indicator of overall water quality changes caused by human activities, such as land use development, and because the necessary data are collected on a frequent basis.

Preservation of groundwater quantity is necessary to maintain the availability of water for potable use and the availability of groundwater that supports base flows in streams and other surface water bodies. Reductions in groundwater levels can put ecosystems and residents who rely on these water supplies at risk. Changes in land use and/or vegetation, increases in groundwater withdrawals, and climatic changes can adversely affect the quantity of groundwater. Systematic, long-term measurements of aquifer water levels (either taken from water wells or dedicated monitoring wells) are the best way to track changes in groundwater quantity.

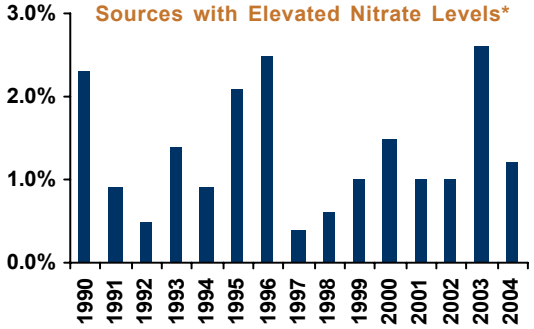
Key Trends

I. Groundwater Quality

- In 2004, all reporting public water supply sources (wells) in King County met the primary (health based) drinking water quality standards. These standards are adopted by the United States Environmental Protection Agency and by the Washington State Board of Health.
- The reported and measured levels of arsenic in 2004 appeared to be stable or decreasing. However, close to 12% of King County's public water supply sources could become out of compliance when the drinking water standard for arsenic is reduced from 50 ppb to 10 ppb in 2006. Arsenic is a naturally occurring element often found in deeper wells near bedrock.
- The past 15 years have seen fluctuations in the percentage of public water supply sources with elevated nitrate levels. In 2004, 1.2% of the sources reported elevated nitrate levels (above 5 mg/L).

Fig. 15.1

Percentage of Public Water Supply Sources with Elevated Nitrate Levels*



**Elevated nitrate levels are those greater than 5 mg/L, or 1/2 the drinking water standard.*

Notes:

These numbers include all nitrate monitoring results reported to the Washington State Department of Health by the public water supply groundwater sources.

High nitrate concentrations represent a health hazard to infants and susceptible populations.

- Although only 1.2% of the sources exceeded the standard of 5 mg/L, in most areas of the county the nitrate levels reported in 2004 had increased from previous years. The Redmond-Bear Creek Valley and Vashon-Maury Island Groundwater Management Areas showed the sharpest increase in reported nitrate levels.

Fig.15.2

Percentage of Sources with Significant Changes in Groundwater Nitrate Levels

Area	Percent Increased	Percent Decreased	Percent Unchanged
East King Co.	12	2	87
Issaquah Creek Valley	7	16	77
Redmond-Bear Creek Valley	37	32	32
Vashon-Maury Island	20	5	75
South King Co.	12	19	69
Other	15	7	78
Countywide	**14**	**11**	**68**

Notes:

All changes are statistically significant at a 95% confidence rating and represent change when comparing 2004 data to a historic average.

A public water supply groundwater source had to have at least one sample in 2004 and at least three previously recorded nitrate levels to be included in this analysis.

- While there is an upward trend in groundwater nitrate levels, the vast majority of nitrate levels throughout King County were very low in 2004, with almost 81% of the reported values below 1.5 mg/L.
- The federally regulated drinking water standard for nitrate is 10 mg/L. None of the 2004 samples exceeded this standard.
- A number of public water supply sources in King County exceeded secondary drinking water quality

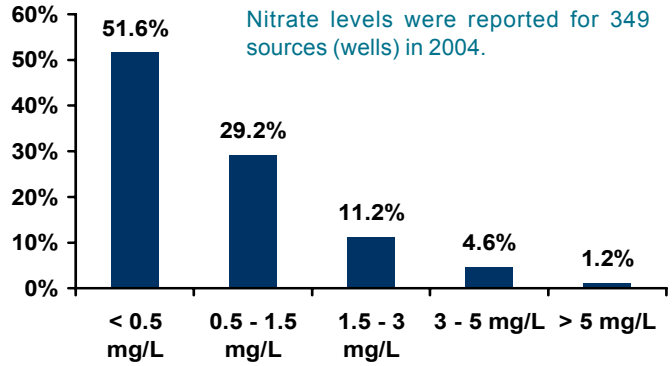
(continued on page 15)

Indicator 15 (continued)

standards in 2004. Water that exceeds these standards does not pose a health risk but may have undesirable aesthetic qualities, such as poor taste or color.

Fig. 15.3

Distribution of 2004 Nitrate Levels in Public Water



II. Groundwater Quantity

- There is currently insufficient water level data available within King County to track changes in water levels.
- A team of volunteers on Vashon-Maury Island records water levels monthly. These data show minor decreases in water levels over the past couple of years. These decreases may be caused by lower-than-normal aquifer recharge due to precipitation variations.

What We Are Doing

King County Department of Natural Resources and Parks, as lead agency for the county Groundwater Protection Program, along with support from the Department of Environmental Services and the Public Health Department, are leading several efforts related to this indicator:

- Investigating local groundwater concerns, as funding allows.
- Monitoring, modeling and analyzing Vashon-Maury Island's water supply in response to residents' concerns regarding water level and nitrate trends.
- Participating in a study along the Sammamish River that will provide better information on the relationship between groundwater and flows in the river. The Sammamish River currently has waterquality, temperature and low flow conditions that adversely affect fish populations.
- Monitoring water quality and quantity (water levels) at representative well locations in two King County Groundwater Management Areas and within other areas as funding permits.
- Restricting potentially dangerous land uses in areas considered highly susceptible to groundwater contamination.
- Limiting the amount of impervious surfacing and tree clearing in rural areas to protect aquifer recharge.
- Promoting low impact development and infiltration-based stormwater control to protect the quantity of aquifer recharge.
- Encouraging Best Management Practices that reduce the risk of chemical or biological contamination of groundwater.
- Educating homeowners about proper maintenance of septic systems in order to prevent groundwater pollution, and notifying well owners of water quality problems.
- Working with local Water Resource Inventory Area (WRIA) salmon conservation groups on groundwater components in habitat protection and restoration, and with ESA groups to include groundwater protection in species protection plans.
- Working with the WRIA 15 watershed planning group to develop protective actions to ensure long-term stable and adequate water supply on Vason-Maury Island.
- Supporting Groundwater Protection Committees made up of local stakeholder interests, in implementation of their local Groundwater Management Plans.
- Working with Seattle & King County Public Health, the King County Department of Development and Environmental Services, and other local and state agencies or programs to identify groundwater quality and quantity concerns and to coordinate response and protection efforts.
- Partnering with cities and water districts to cost share on high priority groundwater projects in their area.

Outcome: Protect Wetlands

Indicator 16: Change in Wetland Acreage and Functions

There is no new data for this indicator this year.

Countywide Planning Policy Rationale

"In the long-term, all jurisdictions shall work to establish a single Countywide classification system for wetlands." (CA-2) "Within each basin, jurisdictions shall formulate their regulations and other non-regulatory methods to accomplish the following: protection of wetlands; assure no-net-loss of wetland functions, and an increase of the quantity and quality of wetlands. The top class wetlands shall be untouched." (CA-3) "Implementation of wetland mitigation should be flexible enough to allow for protection of systems or corridors of connected wetlands. A trade-off of small, isolated wetlands in exchange for a larger connected wetland system can achieve greater resource protection and reduce isolation and fragmentation of weltand habitat." (CA-4)

Background

The base wetlands acreage data in Fig. 16.1 is derived from several sources: the National Wetlands Inventory, created in 1989 from photos taken in the 1970s and 1980s, and the King County GIS Wetlands Coverage, created in 1995 and updated in 2000. These two sources have many wetland areas in common, but each contains some wetlands not identified by the other source. The data and map (Fig. 16.2) on wetland gain and loss is derived from the 1992 and 2001 Landsat data. (See following page).

An accurate, current account of the number of acres in wetlands is very difficult to achieve. The numbers given in Fig. 16.1 are subject to several possible sources of error: a) Both the baseline datasets depend on surveys or photos which are likely to be somewhat out of date; b) Wetlands and open water areas (rivers, lakes, and bays) are often adjacent to each other so that it is difficult to separate one from the other – they change with the seasons and the year's weather conditions; c) the overlap in the two data sets makes it challenging to ascertain how much total acreage is in wetlands without double-counting or undercounting.

In addition, the effort to calculate change in wetland areas between one year and a later year is also fraught with difficulty. This analysis depends on classification of Landsat data. The method used identifies the landcover type at a resolution of about 1,075 sq. yards or 20% of an acre. It detects changes in classification (i.e. predominant land cover) for areas about that size. Although great care is taken to classify the wetland areas in the same way, some of the variation detected in wetlands from 1992 to 2001 may be due to variable conditions on the days images were taken. Wetlands may shrink or expand naturally, depending on recent rain, drought, or snow melt. The acreages given should be taken as broad estimates rather than precise measurements.

Fig. 16.1

Change in Wetlands in King County : 1992 - 2001

	Acres Gained or Lost*	Chg as % of total County land area
Est. Total Wetland Acreage c. 1992*	32,300	
Wet Areas Lost	2,375	0.17%
Wet Areas Gained	4,009	0.29%
Wet Areas (Net Gain)	1,634	0.12%
Est. 2001 Wetland Acreage	34,000	

*Open water is not included in the wetland acreage given here.

Key Trends

- King County has a total of about 32,000 - 34,000 acres of identified wetlands.
- It appears that there was no net loss of wetland area between 1992 and 2001.
- The 2001 Landsat data shows about 1,600 more acres of wetland than in 1992 (an increase of about 0.12% of County land area). However, it is likely that some of that gain is due to variable conditions on the particular days that the Landsat images were taken.
- Wetlands are valuable for many of the functions they provide. These include stormwater control, groundwater recharge, water quality protection and open space.
- From a biological perspective, wetlands are also highly productive ecosystems which are home to a vast diversity of species, including birds, fish, reptiles, invertebrates and mammals. The wetland habitat provides feeding, cover, nesting and breeding areas for these varied species.
- At least one-third of Washington State's threatened and endangered species require wetlands for their survival.

What We Are Doing

- Adopting statewide wetlands rating system, increasing buffers between wetlands and development activity, and strengthening related critical areas ordinances.
- Providing flood control, since unmanaged run-off is one of the greatest threats to healthy wetlands and streams.
- Providing the opportunity for wetland mitigation banking, which involves purchasing property and converting it to a wetland to compensate for wetland damage at another site.
- Combatting the growth of Purple Loosestrife, a non-native plant that overtakes wetland areas, replaces valuable native plants, and harms the habitat.
- Sponsoring the Small Habitat Restoration Program which rehabilitates streams and wetlands in small projects throughout the County.

(continued on page 17)

Indicator 16 (continued)

Fig. 16.2

Map: King County Wet Area Change, 1992 - 2001 (132kb PDF)

Outcome: Protect the Diversity of Plants and Wildlife

Indicator 17: Continuity of Terrestrial and Aquatic Habitat Networks

Countywide Planning Policy Rationale

"Adjacent jurisdictions shall identify and protect habitat networks that are aligned at jurisdictional boundaries. Networks shall link large protected or significant blocks of habitat within and between jurisdictions to achieve a continuous Countywide network. These networks shall be mapped and displayed in comprehensive plans." (CA-7) "All jurisdictions shall identify critical fish and wildlife habitats and species and develop regulations that a) promote their protection and proper management; and b) integrate native plant communities and wildlife with other land uses where possible." (CA-8) "Natural drainage systems including associated riparian and shoreline habitat shall be maintained and enhanced to protect water quality, reduce public costs, protect fish and wildlife habitat, and prevent environmental degradation." (CA-9)

Background

This year's report on Indicator 17 focuses on current efforts to identify lands with high ecological value, in terms of habitat health, uniqueness, and connectivity. Working in collaboration with the Trust for Public Land, the King County Greenprint Program is assessing how best to direct our limited financial resources towards the highest land conservation priorities, and to state the case for increasing the financial capacity to conserve critical lands.

Although it does not provide trend data, the Greenprint survey identifies the current number of acres meeting the criteria for high, medium, and low conservation priorities. It also provides the amount of conservation land that is currently publicly protected. This will provide a baseline for determining future success in acquiring high priority conservation lands. The maps on the following page, show the overall conservation vision, and the level of priority for various lands in King County. CIty-level data was not available for some of the types of land.

Establishing Priorities

- The Greenprint for King County provides guidance as to where the county needs to be targeting its program actions to protect water, land and habitat resources.
- A survey of existing publicly protected land shows that 46% of King County's total acreage is protected under public ownership.

Fig. 17.1

Public, Protected Land in King County

Managing Jurisdiction	Acres of Protected Land	Percent of Countywide Acres
Federal	354,200	26%
City	142,900	10%
State	97,500	7%
King County	31,800	2%
Total Protected	626,400	46%
Total Acres in County	1,363,776	100%

- The Greenprint analysis has identified the following regionally significant acquisition and conservation priorities for King County: 1) the forests of the Cascade foothills; 2) farmland; 3) river corridors and lakes; 4) Puget Sound Shoreline; 5) regional trails connections; 6) open space protection to maintain the Urban Growth Boundary. These are shown in Figure 17.3.
- In addition to forest, farmlands, and trails, the conservation vision identifies ecological lands - a category of open space that is defined by regionally significant aquatic or terrestrial natural resources.
- These "ecolands" or habitat networks have been prioritized on the basis of their value in protecting ecosystem functions, wildlife habitat, aquatic resources, and salmon recovery. An important consideration is their value as part of continuous habitat for terrestrial and aquatic species.

Fig. 17.2

Priority Conservation Values for Ecological Lands

Value	Total Acres	Acres Already Protected	Acres Not Protected	Acres Unprotected and Vacant**
5 High	163,562	129,241	34,321	**22,992**
4 Med-High	317,945	253,039	64,906	**37,870**
3 Medium	269,207	250,043	19,164	**13,249**
2 Med-Low	200,120	75,936	124,184	**90,154**
1 Low	260,721	13,377	247,344	**92,307**
0 Zero	252,761	2,394	250,367	**28,356**

Identified by Greenprint GIS Model **This column is a subset of the previous column

- As shown in Fig. 17.2, nearly 500,000 acres have been identified as having high or medium high conservation value. Of these 382,000 are already protected.
- About 100,000 acres of high or medium high priority are not currently protected. Of these, 61,000 acres are unprotected and vacant.
- Identifying these high value lands is the first step toward finding resources for their long-term protection.

What We Are Doing

The Department of Natural Resources and Parks protects water and lands resources on public and private properties using a variety of tools, including:

- Acquiring properties, resulting in full public ownership.
- Acquiring partial property interests, resulting in a county-owned conservation easement or development right, with underlying private property interests retained
- Implementing private property incentive programs, including reduced property taxes for private property owners who complete a county-santioned stewardship plan that results in resource conservation actions on the property (restoration projects, protection of critical areas, productive farmland, etc). CUT and Public Benefit Rating System are exemplary programs.
- Completing restoration projects (capital projects) ranging from very small to very large scale habitat enhancement or restoration projects. Funding sources for capital restoration projects are varied.

Fig. 17.3

Map: Conservation (111kb PDF)

(Continued on page 20)

Indicator 17 (continued)

Fig. 17.4

Map: Ecological Land Priorities (warning: large file—8.81Mb PDF)

Outcome: Increase Salmon Stock

Indicator 18: Change in the Number of Salmon

Countywide Planning Policy Rationale

"All jurisdictions shall identify critical fish and wildlife habitats and species and develop regulations that a) promote their protection and proper management; and b) integrate native plant communities and wildlife with other land uses where possible." (CA-8) "Natural drainage systems including associated riparian and shoreline habitat shall be maintained and enhanced to protect water quality, reduce public costs, protect fish and wildlife habitat, and prevent environmental degradation. Jurisdictions within shared basins shall coordinate regulations to manage basins and natural drainage systems which include provisions to: a) protect the natural hydraulic and ecological functions of drainage systems, maintain and enhance fish and wildlife habitat, and restore and maintain those natural functions; b) control peak runoff rate and quantity of discharges from new development to approximate pre-development rates; and c) preserve and protect resources and beneficial functions and values through maintenance of stable channels, adequatel low flows, and reduction of future storm flows, erosion, and sedimentation." (CA-9) "...Jurisdictions shall coordinate land use planning and management of fish and wildlife resources with affected state agencies and the federally-recognized Tribes." (CA-11)

Background

Salmon in Puget Sound have diverse life histories and rely upon different habitats at various points in their life history for spawning, rearing, feeding,and migrating. The abundance, geographic distribution, genetic diversity and productivity of salmon can be indicative of the overall health of both their marine and freshwater ecosystems. This indicator focuses only on information related to changes in the quantity of salmon returning to spawn in the freshwater lakes and streams of King County.

For salmon and steelhead stocks, the term ***escapement*** *refers to those mature fish that have survived all fisheries, have returned to freshwater, and constitute the spawning population for a given stock. All data presented in the graphs are adult salmon escapement data. The term* ***natural fish*** *refers to those fish that spawn naturally whether or not they originated in a hatchery or in the wild.*

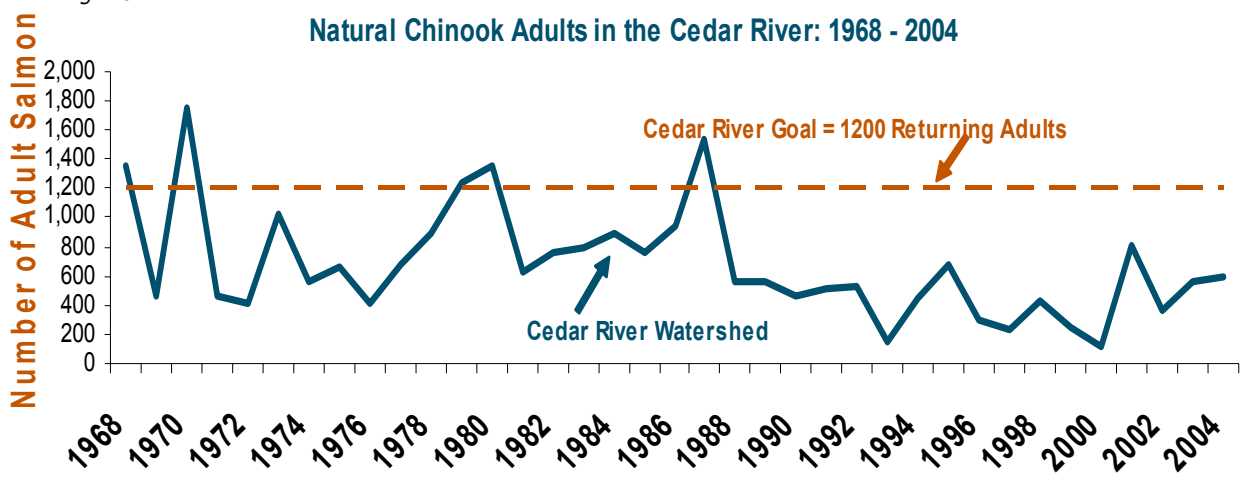
The Lake Washington System is comprised of the Cedar River and its tributaries; Lake Washington and its northern tributaries, the Sammamish River and Lake Sammamish and their tributaries (including Issaquah Creek). See Indicator #13 above for a map of King County watersheds. The Green River Watershed includes the Duwamish River and the Green River and its tributaries. The Snoqualmie-Snohomish Watershed includes the Skykomish, Snoqualmie, and Snohomish basins and their tributaries. Over one-half of this watershed lies in King County.

Key Trends

- The adult returns of native, natural-spawning salmon have declined dramatically in most King County watersheds over the last century.
- Some stocks, such as Coho in the Lake Washington watershed, have been reduced to under 15% of their historic numbers.
- Some of the variation in salmon returns is due to natural variability unrelated to human influences. However, the decline in natural-spawning Chinook, Coho, and Sockeye stocks is considerably more enduring than would be expected from natural fluctuations.
- The gravity of this decline has been confirmed by the listing of Chinook salmon and bull trout under the Endangered Species Act.
- Returns in the Snohomish watershed appear to be stable or even improving. Over the last few years, ocean conditions have been favorable, and much more stringent restrictions on both Canadian and American fisheries have improved adult returns in all watersheds.

(continued on page 22)

Fig. 18.1



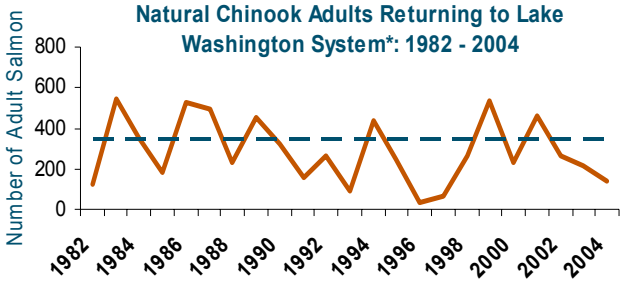
Indicator 18 (continued)

- Due to the high level of hatchery strays, low precision of natural escapement estimates, and a severely degraded estuary, it is difficult to establish any clear trends for the Green River watershed.

Chinook

- Fig. 18.1 on page 17 shows the level of returning adult Chinook in the Cedar River watershed over the last 35 years. While there are major fluctuations from year to year, the average runs over the last decade are about one half of what they were as recently as the 1970s and 1980s. Harvest has been reduced making this trend more alarming.
- About 143 adult Chinook returned to the Lake Washington's northern tributaries in 2004 (Fig. 18.2). Returns were already low in the 1980s when monitoring efforts began. Despite better returns in 1999 and 2001 the average count for 1993 - 2004 is about 20% lower than from 1982 to 1992.

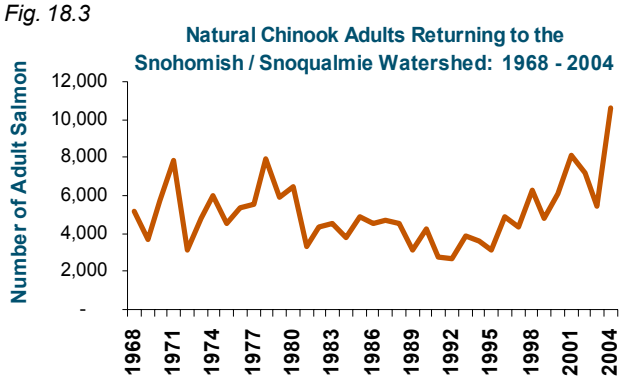
Fig. 18.2



*This represents the north tributaries to Lake Washington, distinct from the Cedar River Watershed.

- While the level of Chinook returns in the Snohomish/Snoqualmie watershed was particularly low in the 1980's to early 1990s, the numbers have rebounded, and are now consistent with the levels of the 1960's and 70's. This watershed runs through mostly rural areas with minimal freshwater habitat degradation.

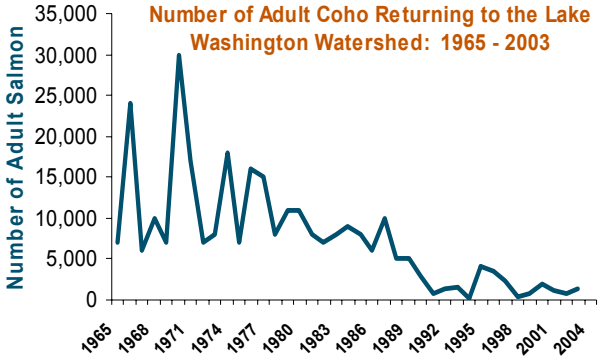
Fig. 18.3



Coho

- In 2003, 1,316 adult Coho returned to the Lake Washington watershed. This number includes escapement from the Cedar River hatchery program.
- As the graph shows, the decline of Coho in the Lake Washington watershed has been very severe.

Fig. 18.4



Sockeye

- The average annual return of Sockeye through the locks to the Lake Washington and Cedar River basins (Fig. 18.5) dipped somewhat during the 1990 - 1999 period, but recently has rebounded to the average level of 1970s and 1980s.

What We Are Doing

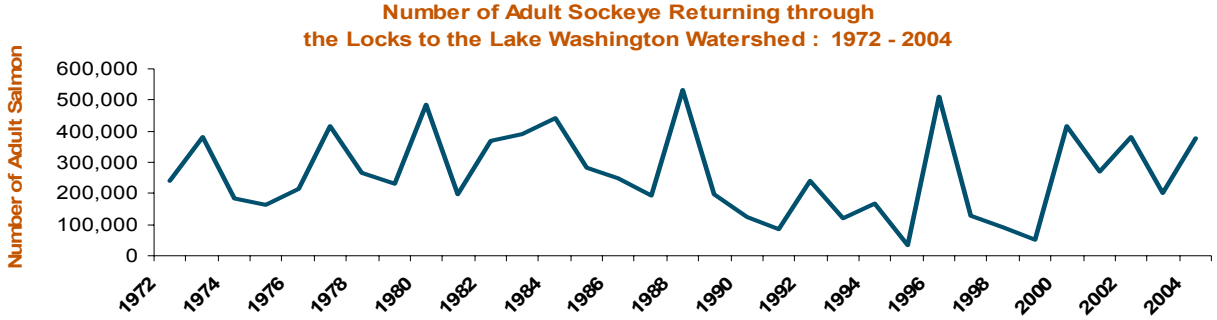
Locally

- Restoring access to 17 miles of additional spawning habitat above Landsburg dam on the Cedar River.
- Instituting broader stream buffers and limiting new development, particularly in the rural areas where habitat conditions are still relatively high quality and can be conserved.
- In urban and suburban areas, where natural salmon production continues to be constrained by poor freshwater habitat, working to restore and enhance habitat if it is feasible.
- Setting 50-year chinook recovery targets in Cedar/Lake Washington and Snohomish watersheds.

At the national and international level

- Controlling fisheries. Marine conditions and fisheries have the greatest impact on trends in the survival of adult salmon. Canadian fisheries, which intercepted 30 - 60% of Puget Sound Coho have declined to almost zero impact since 1995.
- The reduction of fisheries, coupled with improved marine conditions, has led to higher adult returns in some of the stocks in the last few years. However, this does not necessarily mean improvement in freshwater spawning conditions or production of young fish.

Fig. 18.5



Outcome: Decrease Noise Levels

Indicator 19: Change in Noise from Vehicles, Planes, and Yard Equipment

Countywide Planning Policy Rationale

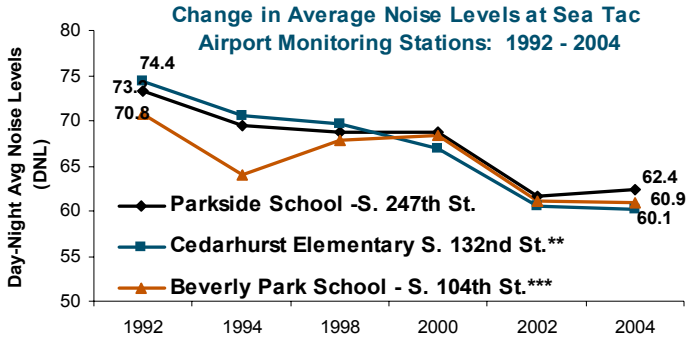
Although the Countywide Planning Policies do not contain specific policy direction for noise, the Benchmark Task Force added this Indicator because there were concerns about noise levels in King County. The Task Force also wanted to monitor how growth management issues affected noise levels.

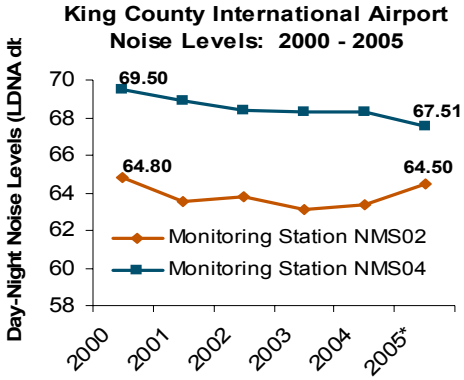
Background

Day-Night Average Sound Level (DNL) is a noise measure used to describe the average noise exposure levels over a 24-hour period. It is based on an A-weighted (dBA) sound level scale, which represents a sound generally as the human ear hears it, while excluding sound outside the human range.

The Federal Aviation Administration (FAA) certifies aircraft by noise levels. The noiser Stage 1 and 2 aircraft have been phased out of operation, and only the quieter Stage 3 aircraft operate today.

Generally, a DNL of 65 db or greater is considered significant noise exposure, while a DNL of 75 db or greater is considered severe noise exposure.





Key Trends

- At SeaTac International Airport there has been a notable improvement in average sound levels recorded at its monitoring sites.
- Noise levels in the early 1990s averaged in the range of 70 - 75 decibels (db) (DNL), while by 2004, those levels are averaging in the 60 - 63 db range. Much of this change is attributable to the phasing out of louder Stage I and Stage II aircraft, as required by the FAA.
- At King County International Airport, there has also been an improvement in noise levels at the Noise Monitoring Station (NMS) 02 over the past five years. NMS04 has shown less improvement.

Outcome: Decrease Waste Disposal and Increase Recycling

Indicator 20: Pounds of waste disposed and recycled per capita

Countywide Planning Policy Rationale

Although the Countywide Planning Policies do not include policy direction for reducing solid waste or promoting recycling programs, the Benchmark Task Force added this Indicator, because recycling and reductions in solid waste save resources and landfill space, and reduce the potential for soil and water contamination due to leakage from landfills.

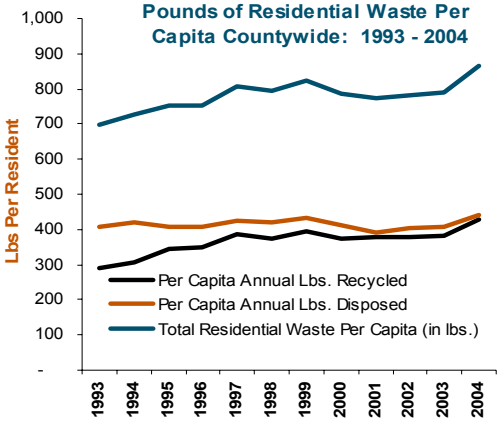
Background

King County Solid Waste Department monitors waste disposal and recycling for all of King County outside of Seattle, while Seattle monitors its own waste disposal and recycling. In King County residential recycling includes mainly single family curbside recycling including yard waste. In Seattle the apartment recycling program recyling is included in the residential recycling numbers. Residential yard waste and home organics are also included. Data on commercial waste disposed is available from Seattle.

Key Trends

- There has been a steady increase in the amount of total waste generated in King County during the 12 years from 1993 through 2004. The increase has been about 24% or roughly 2% per year.
- Fortunately, the number of pounds recycled per capita has risen more rapidly, increasing 47% over 12 years. However, the amount of garbage disposed per capita has also risen slowly, increasing by 8% from 1993 to 2004.

Fig. 20.1



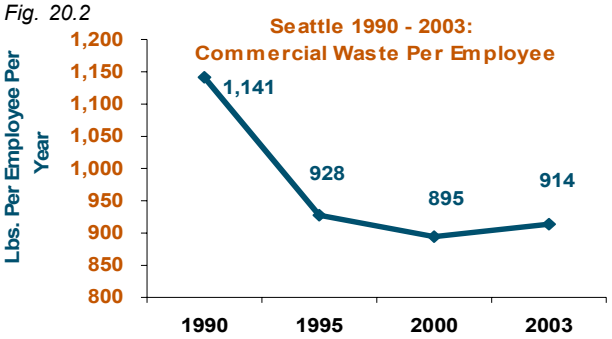
- The desired outcome is to decrease waste disposed as well as to increase recycling.
- In Seattle, the amount of commercial waste per employee declined sharply from 1990 to 1995. But the current level of 914 pounds per employee is just slightly under the 1995 level, and higher than it was in 2000.

(Continued on page 24)

Indicator 20 (continued)

- Commercial waste in Seattle varies with the economic cycles. The per employee figure factors in changes in employment level.

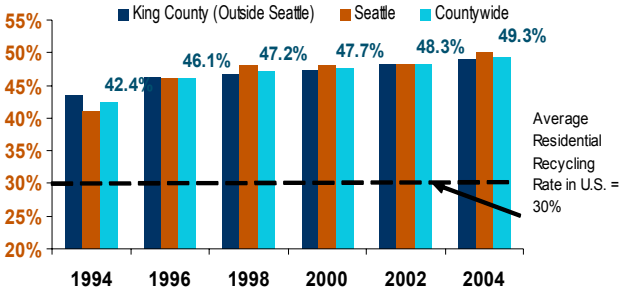
Fig. 20.2



- The residential recycling rate is improving gradually in both Seattle and King County outside of Seattle. Both areas have had very good success with their curbside residential recycling programs.
- The residential recycling rate reached 50% in Seattle in 2004. It is just under 49% in King County outside of Seattle. When aggregated, the countywide recycling rate in 49.3%.*

**There was a significant error in the reycling rates reported last year. They have been corrected in this report.*

Fig. 20.3 **Residential Recycling Rates in King County: 1993 - 2003**



- This rate compares very favorably with a U.S. average rate of about 30% for residential recycling.

What We Are Doing

- In King County, initiating programs to improve food waste collection for households and commercial users, and to increase materials that can be recycled.
- In Seattle, requiring by law that all recyclable materials be recycled rather than disposed.
- Working to reduce the disposal of commercial paper.
- Improving data collection efforts for multi-family and non-residential recycling.

Data Sources

Indicator 9: Percent of Land Developed

Data Sources: Data: King County Department of Natural Resources (DNRP), KC GIS Center: LandSat Image of Land Cover Change provided by Marshall and Associates, Inc. 2002 Map: University of Washington Urban Ecology Research Laboratory; Keck Sprectral Remote Sensing Lab, 2002 Land-cover Analysis of the Greater Puget Sound Region - King County portion.

Indicator 10: Air Quality

Data Source: Puget Sound Air Clean Air Agency The agency's website www.pscleanair.org has in-depth information on the region's air quality. It also includes links to the Washington State Dept. of Ecology and the U.S. EPA websites. Air Quality initiatives supplied by KC DNRP Air Quality Analyst. Global climate data from report of the Intergovernmental Panel on Climate Change (IPCC), 2001, and the Hadley Center for Climate Prediction and Research (www.met-office.gov.uk/research) "Our Warming World" Seattle P.I., June 2003; "Before the Flood", New York Times, May 9, 2005.

Indicator 11: Energy Consumption

Data Sources: Seattle City Light; Puget Sound Energy (formerly Puget Power); Washington Natural Gas; Washington State Departments of Transportation and of Energy; Energy Information Administration (EIA). U.S. Department of Energy; Statistical Abstract 2004 for worldwide energy consumption.

Indicator 12: Vehicle Miles Traveled

Data Source: Highway Performance Monitoring Reports 1981-2004, Washington State Department of Transportation. Vehicle Miles Traveled (VMT) per Year is based on approximate total miles traveled in King County. HPMS is not designed for use at the local jurisdictional level, but rather foruse in determining the needs for roadways at the State level. When aggregated at the county level, the figures may overstate the increase in VMT. VMT is a general measure of travel demand that is used for both air quality management and transportation demand management.

Indicator 13: Surface Water Quality

Data Source: King County Department of Natural Resources, Water and Land Resources Division.

Indicator 14: Water Consumption

Data Source: Seattle Public Utilities (SPU), 2003. SPU supplies water, primarily from the Tolt and Cedar River watersheds, to about 76% of King County residents and to residents of Edmonds and Olympic View. This includes water that is sold wholesale to hundreds of smaller water purveyors that serve outlying areas of the County. Water District 83, Redmond, and Highline are within the SPU service area, but have other sources of supply. Water from other sources amounts to about 7 million gallons per day which are not included in Fig. 14.1 or 14.2.

Indicator 15: Groundwater Quality and Quantity

Data Sources: King County Department of Natural Resources and Parks, Groundwater Protection Program, Director's Office. For more information about this program, call 206-263-6159

Indicator 16: Change in Wetland Acreage and Function

Data Sources: King County DNRP. LandSat Images and Analysis of Change in Wetlands from 1992 - 2001 provided by Marshall and Associates, Inc. and King County GIS Center. Best available countywide data on existing wetlands (c. 1990 - 1994) provided by National Wetlands Inventory and KC GIS.

Indicator 17: Continuity of Terrestrial and Aquatic Habitat.

Data Sources: King County Department of Natural Resources and Parks, *Greenprint for King County* prepared for Water and Land Resources Division in collaboration with the Trust for Public Land. by Jones & Jones and the Point Wilson Group.

Indicator 18: Increase Salmon Stock

Data Sources: Washington State Department of Fisheries, Washington Department of Wildlife, and Western Washington Treaty Indian Tribes. Initiatives undertaken: KC DNRP and DFW.

Indicator 19: Change in Noise Levels.

Data Sources: Sea-Tac Airport Noise Monitoring system and King County International Airport Noise Monitoring program.

Indicator 20: Waste Disposed and Recycled

Data Sources: King County DNRP: Solid Waste Division, Finance and Administration Section. Seattle Public Utilities, Resource Planning Division, Forecasting and Evaluation Section.