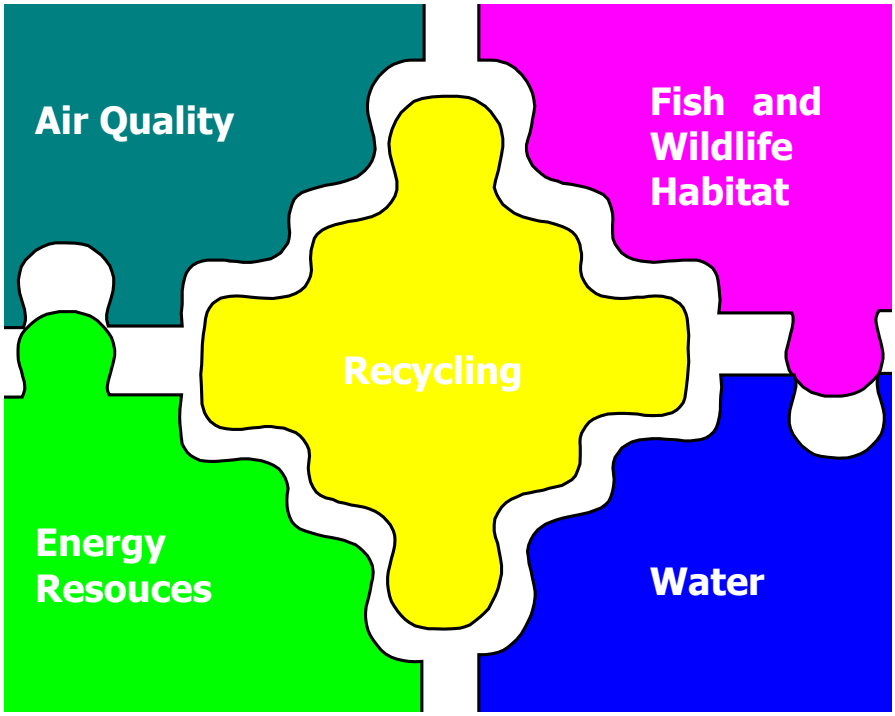


Introduction

I. Purpose of Environment Indicators

The Key Outcomes of the Countywide Planning Policies' (CPP's) environmental policies are to:

- Protect and enhance natural ecosystems that support the diversity of plants and wildlife,
- Improve air quality
- Protect water quantity and quality, and
- Use non-renewable energy resources with restraint

The following twelve indicators for the environment were chosen because they represent many of the critical environmental issues facing King County today. The presence of a healthy and intact environment is an asset to this region. A productive economy and a high quality of life are inseparably linked to the natural environment.

The purpose of establishing indicators for the environment is to evaluate progress toward the goals and outcomes outlined in the Countywide Planning Policies. With the help of these environmental indicators the Growth Management Planning Council will be able to evaluate the effectiveness of the Countywide Planning Policies, monitor trends and recognize successes and potential shortfalls.

Data Sources and Policy Rationale for each of the Indicators are cited at the end of the Chapter.

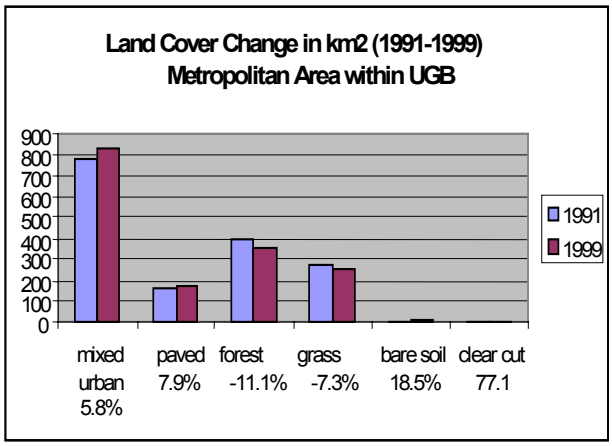
II. Definitions

Definitions are given along with the notes for each Indicator, since there are very few terms common to more than one of the environmental indicators.

Outcome: Protect and Enhance Natural Ecosystems

INDICATOR 9: Land cover changes in urban and rural areas over time.

Fig. 9.1



Background

This year, data presented for this Indicator relies on a study completed at U.W. comparing 1991 and 1999 Landsat images, in order to determine the degree of change in land cover. In future years, new Landsat images will be analyzed using the same methodology, so that an accurate assessment of land cover change over time will be available.

The land cover change project developed by the University of Washington Urban Ecology Research Laboratory for the Puget Sound Water Quality Action Team provides a first assessment of land cover change between 1991 and 1999 in Central Puget Sound at several scales (landscape, sub-basins, and 90m grid window) relevant to regional and local decision makers. Land cover data are derived from USGS Landsat Thematic Mapper images of Central Puget Sound.

Landsat data were registered, intercalibrated, and corrected for atmosphere and topography to ensure accuracy of land cover change assessment. The final classification includes eight classes: >75% impervious, 15-75% impervious, forest, grass, clear cut, bare soil, and water.

Land cover change is identified using the direct spatial comparison of classified images derived independently for each time period.

Principal Investigator for this project was Marina Alberti, UW Dept. of Urban Design and Planning, along with Robin Weeks, Stefan Coe, Derek Book, and Kristina Hill. The study was commissioned by the Puget Sound Water Quality Action Team, and is available aon the PSQAT web site: www.wa.gov/puget_sound

About This Indicator

- Developed area is defined as both paved urban land (> 75% impervious) and mixed urban land (between 25% and 75% impervious).
- Using 1991 as a baseline, the area covered by development within the entire Central Puget Sound Region increased respectively by 28 (± 4) km^2 and 162 (± 24) km^2, representing a 6.7 percent increase in paved urban and a 7.8 percent increase in mixed urban areas.
- Overall the region has added 1% of the total area to development. Forest cover has declined by 628 (± 94) km^2, an 8.2% decline over the same period. Overall the region has lost forest cover corresponding to 5% of the total area.
- Almost half of the land conversion to development has occurred in the Seattle metropolitan area with about 80 (± 12) km^2 of land converted to mixed and paved urban, a 6% increase in overall developed area since 1991.
- The most intense development has occurred primarily within the urban growth boundary (UGB) where the increase in paved area accounts for 13 (±1.9) km^2, a 7.9 percent increase.
- The increase in mixed urban area adds to 45 (±6.7) km^2, a 5.8 percent increase over the 1991 baseline. This represents a 2.6 percent increase in the total metropolitan area within the UGB now being mixed urban area
- About 1 percent more of the total metropolitan area within the urban growth boundaries is now paved.
- Forest areas have declined by about 44 (±6.6) km^2 within the UGB boundaries, an 11.1% change over the same period.

Outcome: Improve Air Quality

INDICATOR 10: Air quality.

The evaluation of air quality in King County is complex. Up until recently attention has focused primarily on six traditional air pollutants. In the past two years more information has become available on the impact of other air toxics on human health. This year's report on Air Quality includes three separate sections –the first on the traditional air pollutants, the second on other toxic emissions in the air that directly impact human health, and the third on "greenhouse gases" that have a long term effect on the atmosphere and climate.

I. TRADITIONAL AIR POLLUTANTS

Background

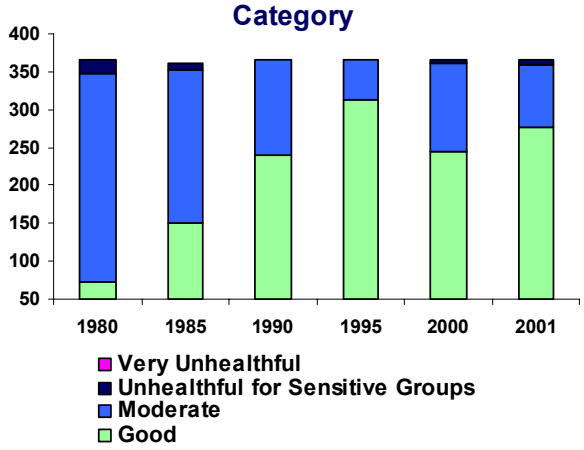
- The Pollutant Standards Index (PSI) provides a nationally uniform method to report daily air quality levels. The concentration of each pollutant on a given day determines an Index value and the pollutant with the highest Index value determines the PSI on that day. These are then translated in "good", "moderate", and "unhealthful" categories.
- There are six major air pollutants that are considered in determining the PSI (also known as the AQI, or Air Quality Index). They include: 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).
- With the conversion to unleaded gasoline, lead levels along roadways are no longer a concern.
- Air in the immediate Seattle area is largely free of ozone pollution as well. Ozone forms slowly over time, downwind of pollution sources, and contributes to smog. Auto and truck emissions and other point sources (e.g. power plants, industrial boilers, refineries, and chemical plants) in the western and northern parts of the County travel southeast with the wind, and contribute to somewhat elevated ozone levels detected at the Enumclaw monitoring station. Among these emissions, nitrogen dioxide plays an essential role in the photochemical reactions that produce ozone. These reactions occur most readily on hot summer days.
- The PSI as measured in the immediate Seattle area (as illustrated in Fig. 10.1 and Fig. 10.2) is primarily determined by the levels of particulate matter, sulfur dioxide, and carbon monoxide, rather than by lead, NO_2 or ozone.
- Particulate matter refers to very small (invisible to the naked eye) solid particles and liquid droplets formed when carbon fuels are burned. The major sources are motor vehicles, diesel trucks, and wood burning.

About This Indicator

- The number of good air quality days in the greater Seattle / King County region was 276 in 2001. There were 83 days that were rated as "moderate", and six as "unhealthy for sensitive groups". This represents an improvement over 2000.

Fig. 10.1

Number of Days in Each Air Quality Category



- The number of good days increased from 73 in 1980 to 343 in 1998. The decline to 245 good days in 2000 and 276 good days in 2001 reflects a higher federal standard for particulate matter adopted by the Seattle area beginning in 1999. This also explains the rise in the number of "moderate" days, and the days designated as unhealthy for sensitive groups.

Fig. 10.2

Number of Days in Each Air Quality Category by Year

	1980	1985	1990	1995	2000	2001
Good	73	150	239	313	245	276
Moderate	275	202	126	52	116	83
Unhealthful for Sensitive Groups	18	10	0	0	5	6
Very Unhealthful	0	0	0	0	0	0

INDICATOR 10:

(continued from previous page)

- When exposed to **fine particulate matter** people with existing heart or lung diseases – such as asthma, chronic obstructive pulmonary disease, congestive heart disease, or ischemic heart disease – are at increased risk of premature death or admission to hospitals or emergency rooms.
- Even a small rise in PM concentrations in the air, below the new National Air Quality Standard of 15 micrograms per cubic meter, appears to lead to increased asthma attacks.
- New cases of asthma are increasing rapidly, with victims projected to double to 29 million individuals by 2020. It disproportionately affects the very young, the very old, and the very poor. The hospitalization rate for children in Seattle's inner city was more than 600 per 100,000, while it was 100 per 100,000 for suburban children. It is the leading cause of school absenteeism.
- **Ozone** also impairs the normal functioning of the lungs. Sensitive populations are people of all ages who are active outdoors. People with respiratory ailments are particularly at risk.
- Motor vehicles are by far the largest contributors to overall air pollution with 55% of the total, followed by industry with 21%, outdoor burning with 12%, and wood stoves and fireplaces with 12%. Outdoor burning, wood stoves and fireplaces contribute to the amount of particulate matter in the air. Automobiles and trucks, as well as small engines such as gas-powered lawnmowers, contribute to ozone in the air.
- Many factors including increased fuel efficiency, higher emission standards and improved regulatory enforcement have contributed to long-term improvements in air quality.

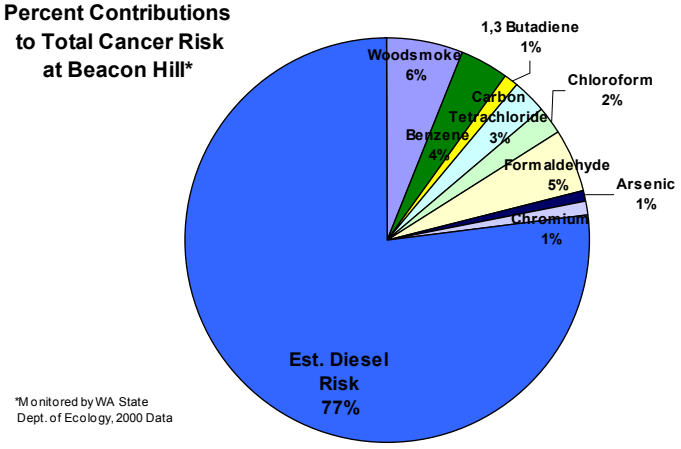
For Comparison

- While King County received a barely passing grade for ozone levels, its air is cleaner than the 333 counties out of 382 which received failing grades from the American Lung Association.

II. AIR TOXICS

- In addition to the six common pollutants described above, the Puget Sound Clean Air Agency (PSCAA) defines "air toxics" as "a broad category of chemicals that covers over 400 air pollutants along with woodsmoke and diesel particles." The EPA commonly refers to "air toxics" as a synonym for 188 hazardous air pollutants listed in the 1990 amendments to the Clean Air Act.
- The primary health concern from many of these chemicals is cancer - particularly lung, nasal and liver cancers, and leukemia. Respiratory and heart disease, as described above, may also be aggravated by some of the same pollutants. Along with diesel soot and woodsmoke, Benzene, 1,3 Butadiene, Carbon Tetrachloride, and Formaldehyde, are among the worst offenders.
- The average cancer risk estimates for King County range from 400 to 700 in a million over a lifetime of exposure.

Fig. 10.3



- Fig. 10.3 shows the percent contribution to total cancer risk by various air toxics, measured in 2000 at the Beacon Hill (Seattle) monitoring station (managed by the WA State Department of Ecology). Several different carcinogens may be present in diesel soot and woodsmoke, but they are identified in the pie chart as single (complex) toxic sources.
- In an earlier study, those two sources alone accounted for about 83% of the total cancer risk. A recent study published by the PSCAA estimated that diesel soot and other mobile-source related chemicals account for 85% to 95% of cancer risk.

INDICATOR 10:

(continued from previous page)

For Comparison

- Based on 1996 air samples, King County was ranked among the worst 5% of U.S. counties for airborne toxins. For instance, King County ranked high in levels of benzene, a known carcinogen which is found in gasoline. More recent monitoring shows improvement in the level of air toxics in this area, but cancer risks remain unacceptably high.

I. *GREENHOUSE GASES*

Greenhouse gases are of concern because of their long-term effect on climate change, rather than because of their immediate impact on air quality. Although local data on green house gases is not yet available, some general observations are included here, because many of the same activities that produce traditional pollutants also produce GHGs.

- Climate change is caused by increases in the concentration of "heat trapping" greenhouse gases in the atmosphere including carbon dioxide and methane.
- Greenhouse gases are released when humans burn fossil fuels to generate electricity and to power vehicles, as well as dispose of waste.
- Greenhouse gases are warming the earth and causing climate disruptions – more storms, more erratic weather, more rainfall and moisture, temperature changes and drought.
- 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.

For Comparison

- Global mean surface temperatures have increased 0.5-1.0°F since the late 19th century.
- The 20th century's 10 warmest years all occurred in the last 15 years of the century. Of these, 1998 was the warmest year on record.

What We Are Doing

- Reducing gasoline consumption by encouraging transit ridership, creating bicycle trails, promoting pedestrian-friendly urban design, and increasing availability of alternative transportation.
- Using alternative fuels in government fleets and using re-refined oil in county buses.
- Reducing diesel emissions through Diesel Solutions, a public/private program that will accelerate the introduction of low sulfur fuels into Western Washington. Encouraging use of non-diesel school buses, and more fuel-efficient private vehicles.
- Maintaining bans on outdoor burning and use of wood stoves when conditions warrant.
- Providing public education on ways to maintain and improve air quality.
- Promoting proximity of housing and jobs in order to reduce commute distances.
- Conducting greenhouse gas emissions inventories and setting targets for emissions reductions.
- Meeting all electric power needs for City Light customers with no net greenhouse pollution – the first electric utility in the world to make that choice.
- Educating business and industry on green building principles to reduce energy consumption and increase the use of recycled products in new buildings. Educating consumers on ways to conserve on household energy.
- Adopting energy efficient building codes for new construction and remodels.
- Reducing levels of heating and air conditioning in county buildings; turning off lights and computers.
- Using biosolids as an alternative to traditional fertilizers for local forests and eastern Washington croplands.

Outcome: Improve Air Quality

INDICATOR 11: Energy consumption.

Fig. 11.1

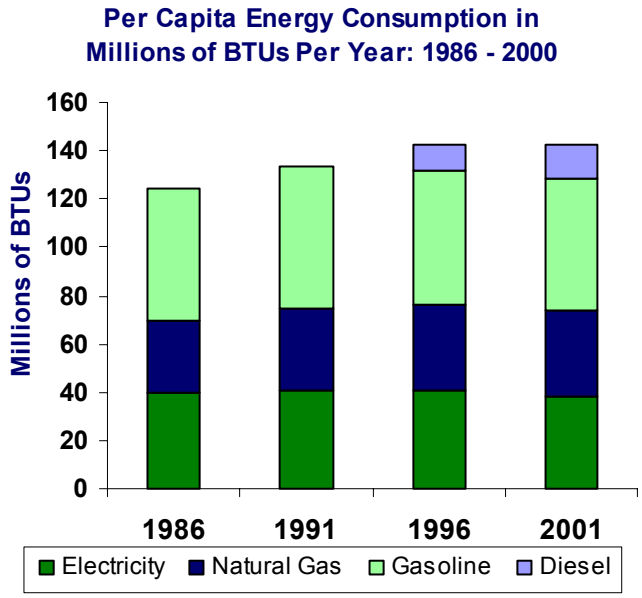


Fig. 11.2

Energy Consumption in Million BTU's per Capita by Energy Type: 1986 - 2001						
	1986	1991	1996	2001	% Chg. 1996 - 2001	% Chg 1986-2001
Electricity*	39.6	40.7	40.3	38.5	-4%	**-3%**
Natural Gas	30.0	34.1	36.4	35.2	-3%	**17%**
Gasoline	54.4	58.4	54.1	54.9	1%	**1%**
Diesel Fuel			11.0	13.7	25%	
Total Per Capita Energy Consumption**	124.0	133.3	130.8	128.6	-2%	**4%**

*Electricity includes both Seattle City Light and Puget Sound Energy consumption. **The Total Per Capita excludes diesel fuel because diesel data has only been collected since 1996.

Definitions and Notes:

1. *BTU=British Thermal Unit. 3.413 Million BTU = 1 MegaWattHour*
2. *Electricity includes both Seattle City Light and Puget Sound Energy consumption. Diesel fuel data was only collected for 1996 - 2001, so it is not included in the Total Per Capita for any year, or on Fig. 11.3.*
3. *Figures presented for electricity and natural gas include consumption in all sectors: residential, commercial, industrial, and government (street lights, etc). They do not include self-consumed, line loss or unbilled power. Numbers from Puget Sound Energy from 1999 are preliminary, and will be revised next year.*
4. *The electricity comes from both non-renewable and renewable sources, the former include energy derived from coal, oil, gas and nuclear power plants and the latter from hydroelectric plants.*
5. *Electricity supplied by Puget Sound Energy and Seattle City Light is generated in part in Washington State and in part, in other states, and in Canada and Mexico. Electricity generated outside King County, if it is derived from coal or oil power plants, affects air quality in those areas and not within the county. Electricity generated in hydropower plants impacts streams and watersheds, but does not affect air quality.*
6. *50% of the natural gas supplied by Washington Natural Gas is derived from domestic sources and 50% from Canadian sources.*

About This Indicator

- Per capita consumption of all energy sources other than diesel has increased 4% since 1986. This total does not include diesel fuel because it has only been tracked since 1996.
- When diesel is included, total energy consumption per person has remained almost the same as it was in 1996.
- Since 1996, per capita diesel fuel consumption has increased 25%. Total per capita consumption from all other sources declined by 2%.
- From 1986 – 1996 natural gas accounted for an increasing share of residential energy consumption. Over the 15 year period since 1986 per capita natural gas consumption has increased by 17%, while per capita electricity usage has declined by 3%. However, since 1996, both natural gas and electricity consumption have fallen by 3 – 4%, and their share of residential consumption has remained about the same.
- Industrial consumption of natural gas fell 42% from 1993 - 1997.
- Per capita usage of automotive gasoline has fluctuated throughout this 15 year period, but it is currently just 1% higher than it was in 1986. More efficient vehicles accounted for the stabilization between 1986 and 1996. However the increase in the last five years may be due to a growing number of less efficient vehicles on the road.
- Total energy consumption has increased 34% since 1986 due primarily to population growth and economic growth, but also to some increases in per capita consumption. (See Fig. 11.3)

INDICATOR 11:

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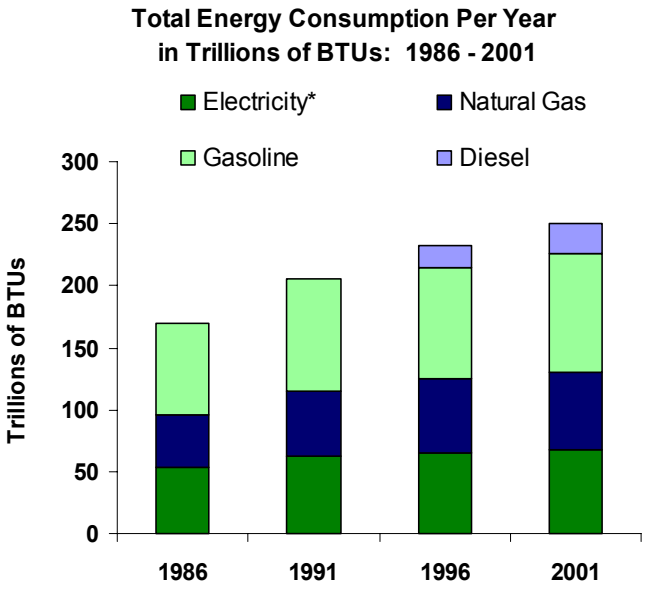
Fig.11.3



- Total consumption of diesel fuel has risen a sharp 32% since 1996 when tracking of its usage began. According to the Washington State Dept. of Transportation, this rise was due to an increase in commercial traffic, especially in the late 1990s.
- Emissions from diesel vehicles have been found to contribute to smog, respiratory illness, and cancer. There are several carcinogens present in diesel exhaust. (See Indicator 10).
- Energy providers have been actively promoting conservation since the 1980s. Some have installed thermal insulation in residences and promoted energy efficient appliances. Tiered billing systems aim to reduce usage as well.

What We Are Doing

- Reducing levels of heating and air conditioning in County buildings; turning off lights and computers.
- Reducing gasoline consumption by encouraging alternatives to single-occupancy vehicles, such as buses, heavy and light rail, vanpools, carpools, bicycling, and walking.
- Reducing diesel emissions through Diesel Solutions, a public/private program that will accelerate the introduction of low sulfur fuels into Western Washington. Encouraging use of non-diesel school buses, and more fuel-efficient private vehicles.
- Encouraging energy-efficiency in new non-residential buildings through incentives and regulations.

Outcome: *Improve Air Quality*

INDICATOR 12: Vehicle miles traveled (VMT) per year.

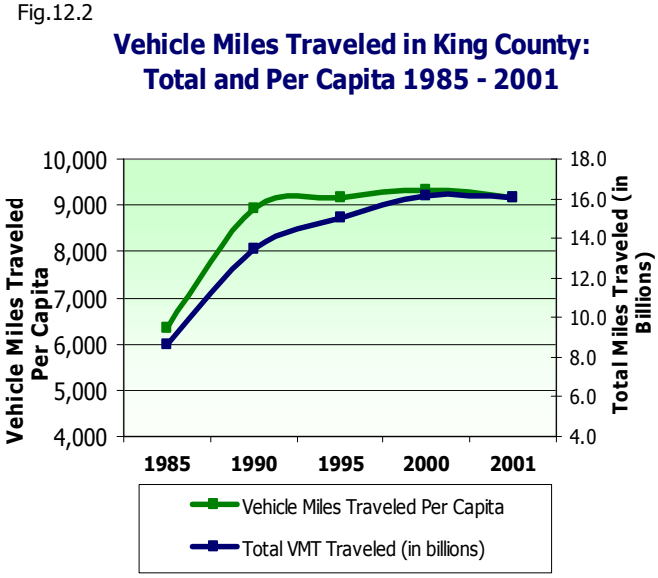
Fig.12.1

Vehicle Miles Traveled: Per Capita and Total					
Year	**1985**	**1990**	**1995**	**2000**	**2001**
Vehicle Miles Traveled Per Capita	6,344	8,933	9,154	9,322	9,155
Total VMT Traveled (in billions)	8.6	13.5	15.0	16.2	16.1

Definitions and Notes:

1. *Vehicle Miles Traveled (VMT) is a measure of the total miles traveled by all vehicles on the road in a given year for a given period of time.*
2. *Many of the total VMT are actually driven by non-residents of King County, including commuters from neighboring counties, commercial vehicles originating outside the County, or tourists passing through.*

Fig.12.2



INDICATOR 12:
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About This Indicator

- Vehicle Miles Traveled Per Capita in King County has risen just 2.5% from 1990 to 2001, after a rise of about 41% in the five years from 1985 to 1990. From 2000 to 2001 VMT Per Capita declined slightly to the same level as in 1995.
- Total vehicle miles traveled on County roads, has risen 87% over the 16 years from 1985 – 2001. The rate of growth has slowed significantly, from 57% during 1985 – 1990, to 19% from 1990 – 2001. There was a decline of .6% in total VMT from 2000 to 2001 probably due to the economic downturn and less commercial traffic.
- While the slower rate of growth in VMT per capita is welcome, the long term trend toward more total miles traveled poses serious threats to air quality in this region. (See Indicator 10.)
- VMT includes travel by commercial and public vehicles as well as private automobiles. The increase in per capita VMT is caused by a combination of factors, including
  - growth in population,
  - growth in County employment (at a rate considerably higher than population growth),
  - increased travel to King County job centers by residents of adjacent counties,
  - increased propensity to travel, and
  - more commercial traffic.
- The result has been more vehicles on the road, traveling many more total miles, and somewhat more per capita.
- Fuel efficiency on some vehicles increased during the 1985 to 1995 time period, making it possible to drive more miles with no more fuel being consumed. With this greater fuel efficiency, the increase in fuel consumed was less than the increase in miles traveled.
- However, the past five year period has once again shown an increase in gasoline consumed *per capita*, while VMT *per capita* has remained about the same. This may indicate a growing number of less fuel-efficient vehicles on the road.
- Motor vehicles are the major source of carbon monoxide and hydrocarbon air pollutants, as well as particulate matter and the carcinogen, benzene. The primary contributor to air pollution in the County, by a large margin, is the single occupancy vehicle. Lessening SOV travel, as measured by reductions in VMT, is essential for protecting the environment of our region.

What We Are Doing

King County has a variety of policies designed to lower the level of vehicle traffic. They include everything from housing strategies to bike paths. Some of the current initiatives include:

- Allowing high density residential uses in cities and urban centers so that workers can live close to their jobs. For instance, raising building height limits can increase the viability of mixed use buildings close to economic centers, and promote affordable housing.
- Targeting urban centers to receive at least 50% of the new jobs in the County, so that these jobs remain close to population centers and accessible by public transportation.
- Continuing to provide high quality, affordable public transit, and to expand this through support of new rail, light rail and express bus services.
- Providing incentives for carpooling and vanpooling.
- Creating transit-oriented development through public/private partnerships. These programs aim to provide affordable residential opportunities close to transit centers.
- Working to maintain affordable ferry service with connections to public transit on land.
- Creating and maintaining bicycle paths throughout the County that serve commuters as well as recreational purposes.

Outcome: Protect Water Quality and Quantity

INDICATOR 13: Surface water quality.

A. King County Lakes

Fig. 13.1

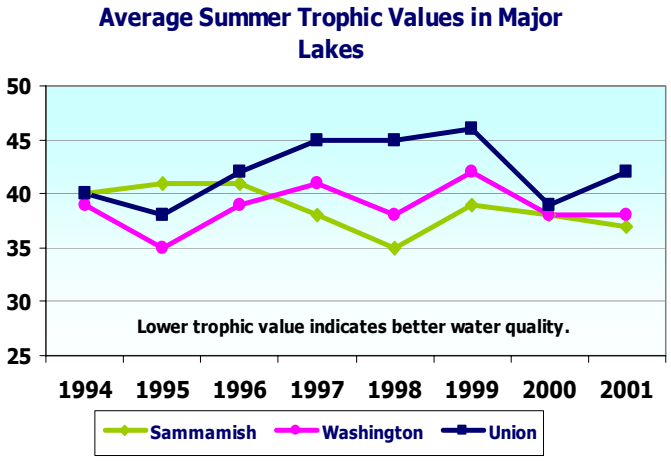

Fig. 13.2

Major King County Lakes					
Lake	Average Summer Trophic Index				Classification
	1995	1997	1999	2001	
Sammamish	41	38	39	37	Oligotrophic - Lower Levels of plant and animal activity resulting in high water clarity, low algal levels and low phosphorus concentrations
Washington	35	41	42	38	
Union	38	45	46	42	Mesotrophic - Moderate levels of plant and animal activity resulting in moderate water clarity, moderate algal levels and moderate phosphorus concentrations

Definitions and Notes:

1. *Eutrophication refers to the biological activity in a lake, reflecting the natural aging process. Lakes age over time and gradually fill in, becoming ponds, marshes, wetlands and eventually forests. Measuring lake eutrophication is one of the most common ways to assess lake health.*
2. *Carson's (1977) trophic state index (TSI) is a method of quantifying this eutrophication on a scale of 0 - 100. The index integrates secchi depth (water clarity indicator), total phosphorus (nutrient indicator), and chorophyll a (algae indicator) measurements into a single value.*
3. *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 poorer summer water quality including 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. They have wetland-type attributes.*
4. *The TSI values are a continuum and hence some lakes may be in a borderline range, exhibiting some qualities of upper and lower classifications.*

About This Indicator

- Factors that influence water quality vary significantly from lake to lake. Generally it is more useful to look at changes in a lake's water quality over time to assess the health of the lake. Comparing water quality among a group of lakes is also a useful evaluation method.
- **Lake Union** is unique among the three major lakes in the County in the character of its watershed due to the Fremont and Montlake cuts and the Hiram M. Chittenden Locks. In the past the lake has received sanitary discharges from houseboats and ships, industrial discharge from businesses along the shore, and fuel spills and discharges from ships and onshore facilities.
- The intrusion of salt water from the Ship Canal results in stratified lake conditions, limiting the amount of habitat available to fish. The lake and canal system are the only migration route for the salmonids in the Lake Washington, Cedar River, and Lake Sammamish drainages.
- Lake Union has historically been characterized as having moderate algal growth. The average TSI over the past few years is around 42, placing the lake in the mesotrophic category, with moderate algal, phosphorus and clarity values.
- **Lake Sammamish** has historically suffered from excess phosphorus loading with frequent algae blooms. In 1968 municipal wastewater discharge into the lake was diverted, and conditions improved. However, extensive development and loss of forest cover in the watershed in the last 20 years have led to increasing discharge of both nutrients and chemical contaminants. The average TSI rating of 38 for 2000 was slightly better than the past few years, earning it a rating of moderate for algal growth.

INDICATOR 13:
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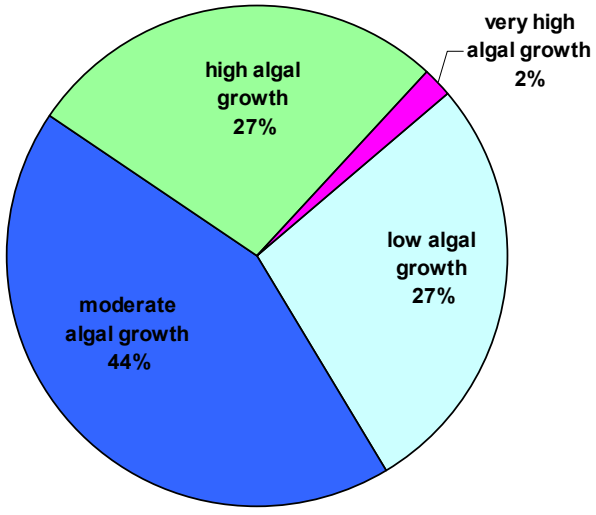
- **Lake Washington** is about twice as deep as Lake Sammamish, four times the area, and flushes about as frequently. Since the 1960's water quality improvements in Lake Washington have been much more dramatic than improvements observed in Lake Sammamish.
- The TSI values in Lake Washington for the past 7 years have averaged around 38 –39, placing it in the good water quality range.
- There are 49 **smaller lakes** that are monitored for trophic status. One lake, Allen, is classified as hypereutrophic, having very high algal growth. Fig. 13.3 shows the proportion of all lakes in each trophic status.
- During 1996 – 2001, swimming beaches on Lakes Sammamish, Washington, and Green Lake were surveyed for bacterial pollution and human health risk, and there were several beach closures during that time. In 2001 there was just one beach closure, at Juanita Beach, as the result of a sewer line being broken during construction work.

Fig. 13.3

King County Small Lakes
Percent of Monitored Lakes in Each Category by 1997-2001 Average Trophic States



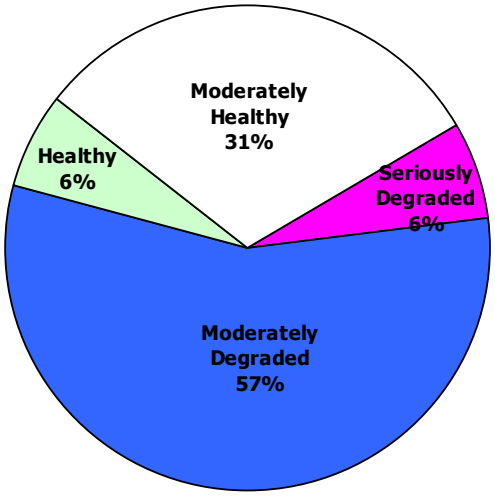
What We Are Doing

- Addressing the overflow of sewers into Lake Union through a Combined Sewer Overflow Control Program.
- Continuing to monitor lake water quality and beach safety to track changes due to storm sewer overflow events, system breakdowns, or shoreline activities.
- Tracking and mitigating development activities that may affect lake and stream water quality.
- Developing a coordinated water quantity and quality monitoring and modeling project, known as SWAMP. Using five RUSS ™ buoys to collect underwater samples for for Lake Washington and Lake Sammamish 24 hours a day. This data will contribute to developing models of the lakes and to ongoing water quality assessment.

B. King County Streams

Fig. 13.4

Proportion of King County Streams in Each Biotic (B-IBI) Status: 1995 - 2001



Definitions and Notes

1. *Stream quality can be measured in a number of ways. The Benthic Index of Biotic Integrity (B-IBI), reported here, and over the last several years, is an index which measures overall stream health. There are a number of other water quality parameters for which there are state or federal criteria. These include: turbidity, pH, summer temperature, summer dissolved oxygen, and presence of fecal coliform, e.coli, or Enterococcus bacteria. In the future, trend data on one or more of these measures may be available to complement the B-IBI data.*
2. *The B-IBI is a "report card" for the biological integrity of aquatic systems. Biological integrity is defined as "the ability to support and maintain a balanced, integrated, adaptive biological system having the full range of elements and processes expected in the natural habitat of a region".*
1. *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 (severe degradation) to 5 (little or no degradation). The total score thus ranges from 10 (severe degradation by all measures) to 50 (little or no degradation by all measures).*

INDICATOR 13:

(continued from previous page)

About This Indicator

- As the graph above illustrates, 63% of the monitored King County streams are designated seriously or moderately degraded based on the B-IBI score. Streams in the Snoqualmie Basin are not included in this monitoring effort.
- Average scores over several years from King County streams range from 14 (Little Soos Creek) to 45 (Lower Rock Creek). Monitoring of these streams only began in 1994-1995, so it is difficult to establish long-term trends. However, there appear to be notable differences in the biological integrity of the streams from one basin to the next.

Lake Sammamish/Issaquah Creek

- In the best condition are the tributaries of Issaquah Creek. All but two of its tributaries are classified as moderately healthy or healthy.

Lake Washington/Cedar River

- Of the six monitored tributaries of the Cedar River, only Lower Rock Creek is classified as healthy, and Upper Rock Creek and Taylor Creek are classified as moderately healthy. Upper Lower Peterson Creek, Lower Lower Peterson Creek, and Lower Walsh Creek are considered moderately degraded. The Cedar River and its tributaries contain much of the best remaining aquatic habitat in the Lake Washington system, although over half of the historic fish habitat has been lost or degraded.

Sammamish River Tributaries

- Bear Creek and Little Bear Creek flow into the Sammamish River, and from there into Lake Washington. Streams in these two basins are all moderately degraded. Water quality and fish habitat are in decline or threatened throughout the area. Many streams that supported substantial runs of salmonids one or two decades ago now support far fewer fish. The watershed contains a mix of land uses.

Green River/Soos Creek Basin

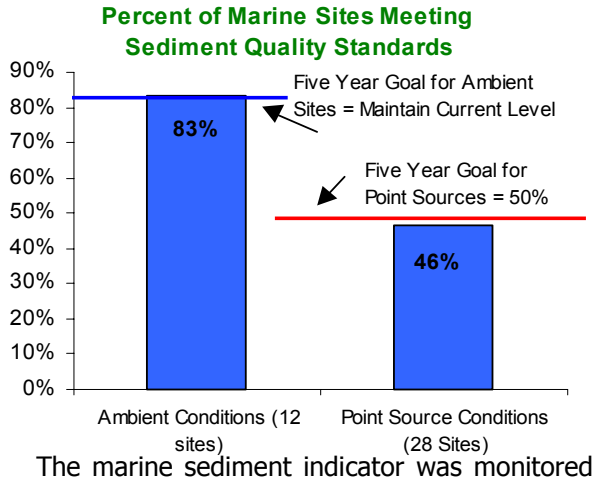
- Five out of eight monitored streams in the Middle Green River sub-basin are seriously to moderately degraded. Although the stream systems continue to support significant fish habitat, the urban designation of parts of these streams could lead to further degradation in water quality, stream flow, and habitat.

C. Marine Water Quality

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 marine environment.

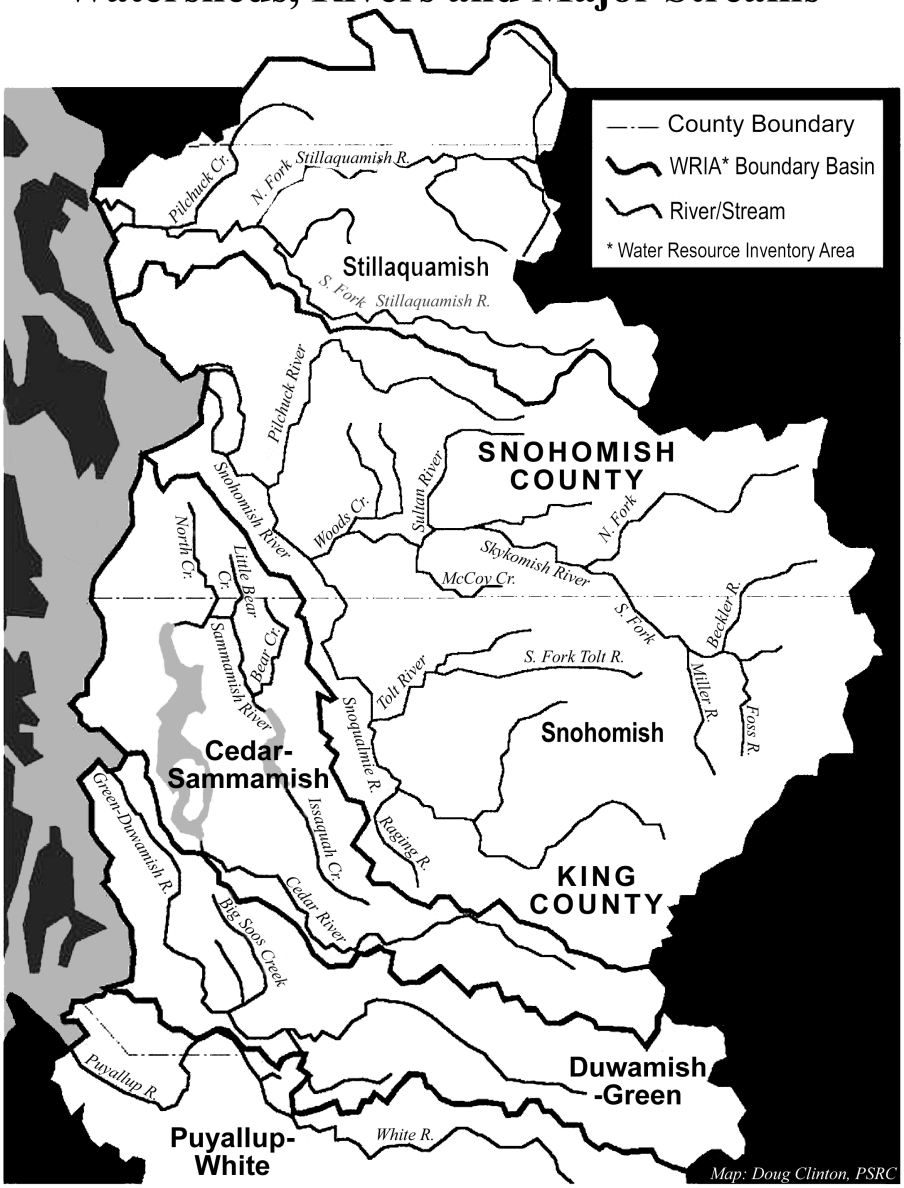
- Marine water quality in King County is generally good, particularly in terms of levels of dissolved oxygen. Nearly all ambient sites (away from a known point source of pollution) meet or exceed Washington State water quality standards.
- High amounts of dissolved oxygen (DO) support a healthy diversity of aquatic organisms. In 2001, 100% of King County ambient and point source sites had a dissolved oxygen level greater than or equal to the guideline of 5.0 mg/L. Over 99% of these sites had DO levels above 5.0 mg/l for the last nine years.

Fig. 13.5



- The marine sediment indicator was monitored at 40 sites. Fig. 13.5 shows that 83% of the ambient sites (10/12) and 46% of the point source sites (13/28) met the Washington State Marine Sediment Quality Standard. For ambient sites, King County has a goal of maintaining the current level of compliance with the standard. For point source sites, it has a five-year goal of meeting the standard at 50% of the sites.
- For fecal coliform bacteria, the state standard was met 80% of the time at ambient stations, and was met 100% of the time at offshore point stations.
- For Enterococcus bacteria, the state guideline was met 60% of the time at beach point source stations, and 92% of the time at beach ambient stations.

Watersheds, Rivers and Major Streams



INDICATOR 13:
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What We Are Doing

- Undertaking in-stream habitat restoration.
- Removing culverts that impede fish migration.
- Providing flood control.
- Enhancing and protecting streambanks with revegetation projects and rechannelization.
- Purchasing land at the headwaters of salmon streams and conserving it as "open space".
- Introducing wider stream buffers where needed to protect fish habitat.
- Providing incentives to protect wetlands through programs such as Wetland Mitigation Banking.
- Sponsoring volunteer and education programs such as the Hazardous Waste Education Program, Salmon-watchers, Lake Stewardship, Plant Partners Stewardship and Cedar Naturalist Program.