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United States
Environmental Protection
Agency

Region 10
1200 Sixth Avenue
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Oregon Environmental Quality Profile 1978

PREFACE

This is a report for the people of the State of Oregon. Its purpose is to describe progress in restoring and safeguarding an environment that is the envy of the nation.

Through technology, much progress has been made in recent years in reducing air and water pollution from industrial and municipal sources. While problems remain, the long-term challenge to a healthy and clean environment lies in the way we manage our resources, in our forestry and agricultural practices, in urban land use and water planning, and in the types of transportation systems we use.

While Federal agencies such as the U. S. Environmental Protection Agency have important responsibilities, the prime responsibility for solving environmental problems has been assigned to the States by Federal law. Keeping the faith of the businesses, industries and municipalities that have voluntarily met their environmental responsibilities requires a vigorous enforcement effort against those polluters that would unfairly profit by not assuming theirs.

Looking ahead, it is clear that the Northwest must accommodate a growing population and that this must be accomplished while maintaining a reasonable balance between economic benefits and the need for healthful air, clean water, and the other unique qualities of life that characterize the Northwest.

This report provides information gathered from a number of sources—State environmental agencies, local government, various Federal agencies, and universities. The assistance of these persons, institutions, and agencies is gratefully acknowledged. Additional technical information can be provided by the Region 10 Office of the U. S. Environmental Protection Agency and is available to any person who may wish to explore a particular topic in greater depth. The Region 10 Office of EPA intends to issue future reports with improvements and expansions on the information as appropriate. Comments and suggestions for improvements are welcome.

Donald P. Dubois
Regional Administrator, Region 10
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Seattle, Washington

December, 1978

OREGON ENVIRONMENTAL QUALITY PROFILE
CONTENTS

AIR QUALITY

Improving air quality in the Northwest has been a cooperative effort among Federal, State and local environmental agencies, industry, and a concerned and informed public. Since the 1970 Clean Air Act Amendments, there has been a considerable expenditure of time and money to find solutions to the most pressing air pollution problems.

National air quality standards have been established to ensure that the goal of a clean and healthful environment is attained. The States, with Federal assistance, have developed a variety of regulatory, enforcement, and administrative programs in an attempt to reduce pollutants to such a level that these air quality standards would be attained and maintained. State efforts have been augmented by Federal regulation of pollutants from stationary sources such as power plants and factories and by the Federal program to reduce air pollution emissions from motor vehicles.

Throughout the Northwest, State, Federal and local environmental quality control agencies maintain monitoring networks to scientifically measure air quality. The Seattle Regional Office of the Environmental Protection Agency annually evaluates data submitted by these air pollution control agencies. This analysis allows an assessment of the degree to which the air quality of the Northwest has been changing and the degree to which air quality standards are being achieved.

Overall, air quality in Oregon, as well as the other states in Region 10, has improved during the past five years.

Air Quality Standards

The Clean Air Act of 1970 directed EPA to establish ambient air quality standards for the principal and most widespread classes of air pollutants as shown in Table 1. The standards are divided into two categories: **primary standards** which are set at levels required to protect the public health; and more stringent **secondary standards** which are set at levels which would reduce other undesirable effects of air pollution. The primary standards were established by evaluating medical data and are designed to reduce adverse health effects from particulate matter, sulfur oxides, hydrocarbons, carbon monoxide, photochemical oxidants, and nitrogen oxides. The health effects of hydrocarbons are not listed in Table 1 because hydrocarbons, in themselves, do not pose a direct health problem. Rather, they react in sunlight to form oxidants. For this reason, the standards for hydrocarbons serve as a way of controlling oxidants and for attaining the oxidant standard.

Some pollutants exhibit both chronic and acute effects depending on the duration of exposure and the concentration of the pollutant. For this reason, the standards for some pollutants require the concentration of the pollutant in the air to be averaged over various lengths of time.

TABLE 1

HEALTH EFFECTS OF AIR QUALITY STANDARDS VIOLATIONS

Pollutant	Health Effect at Concentrations above the Primary Standard
Total Suspended Particulates (TSP)	Aggravation of asthma and chronic lung diseases, increased cough, chest discomfort, restricted activity, aggravation of heart and lung disease symptoms in the elderly, increased death rate;
Sulfur Dioxide (SO_2)	Aggravation of asthma, aggravation of heart and lung disease symptoms in the elderly, increased lung illness, increased death rate;
Carbon Monoxide (CO)	Interference with mental and physical activity, reduced capacity in persons suffering from heart and other circulatory disorders;
Photochemical Oxidants (O_3)	Aggravation of asthma and chronic lung disease, irritation of the eye and of the respiratory tract, decreased vision, reduced heart and lung capacity;
Oxides of Nitrogen (NO_x)	Increased chronic bronchitis.

Measuring Air Quality

The average number of days per year in which the primary air quality standards were exceeded in the period 1974 to 1976 has been used in this report to characterize air quality. A three-year running average is used to project trends because it minimizes year-to-year deviations due to weather and climate.

For various reasons, including sampling frequency requirements and the cost of collecting air quality samples, data is not collected for all days of the year, at all monitoring stations, and for all pollutants. However, there is sufficient data to make reliable estimates of the total days of standards violations for most types of pollutants.

Monitoring stations selected in each county for the three-year average are those showing the greatest number of days exceeding the standard. Accordingly, the figures are not representative of the entire county in which the station is located. Attainment of the secondary standards was not addressed in this report since the major emphasis in most areas of the Northwest is still on attainment of the primary health standards.

OREGON AIR QUALITY

Figures 1, 2, and 3 on the next pages show various aspects of Oregon air quality.

In Figure 1, all the counties of the State have been color coded according to the degree to which standards are being violated in at least one monitoring site within the county. Counties shaded yellow are exceeding one or more of the primary standards, while the counties shaded blue are attaining all standards. Counties with green shading are not currently being monitored.

Figure 2 shows in more detail where and how often the primary standards were exceeded in monitoring counties. During the three-year period ending in 1976, 9 of Oregon's 36 counties experienced recorded concentrations of pollutants that exceeded the allowable maximum specified by primary air quality standards.

Particulate matter (TSP) was the most widespread cause of an exceeded standard. Concentrations above the primary particulate standard occurred in all but one county in which the standards were not met. The carbon monoxide standard (CO) was exceeded in Marion, Lane, Jackson and Multnomah Counties. The standard was exceeded 15 percent of the days in a year in Multnomah County and 5 percent of the days in a year in Jackson County. The oxidant standard (O_3) was exceeded in Marion, Lane, Jackson, Multnomah and Clackamas Counties. Violations occurred in Jackson County on about 8 percent of the days in a year and in Clackamas County on about 3 percent of the days in a year.

Oxidant problems which are detected in one county may originate in another. Hydrocarbons, which are converted to oxidant by sunlight in the atmosphere, may be emitted in an area upwind of the monitoring site. The atmospheric conversion of hydrocarbons to oxidants takes place as the pollutants are transported downwind. For example, an oxidant problem in Clackamas County may be a result of hydrocarbon emissions in Multnomah County on a day the wind is from the north.

Figure 3 shows the severity of violations for these same counties. The degree of risk from exposure to pollution varies according to both the concentration and the length of exposure time. As the concentration increases above the primary standard, it eventually reaches what is called the "alert" level, at which there is a significantly higher health risk. Figure 3 indicates that approximately one-quarter of all instances in which health standards were exceeded in Oregon involved concentrations at or above the alert level. All of the more serious conditions occurred in the more populated or industrialized counties located in the valleys between the coastal and Cascade mountains.

FIGURE 1

AIR QUALITY STATUS MAP — BY COUNTY

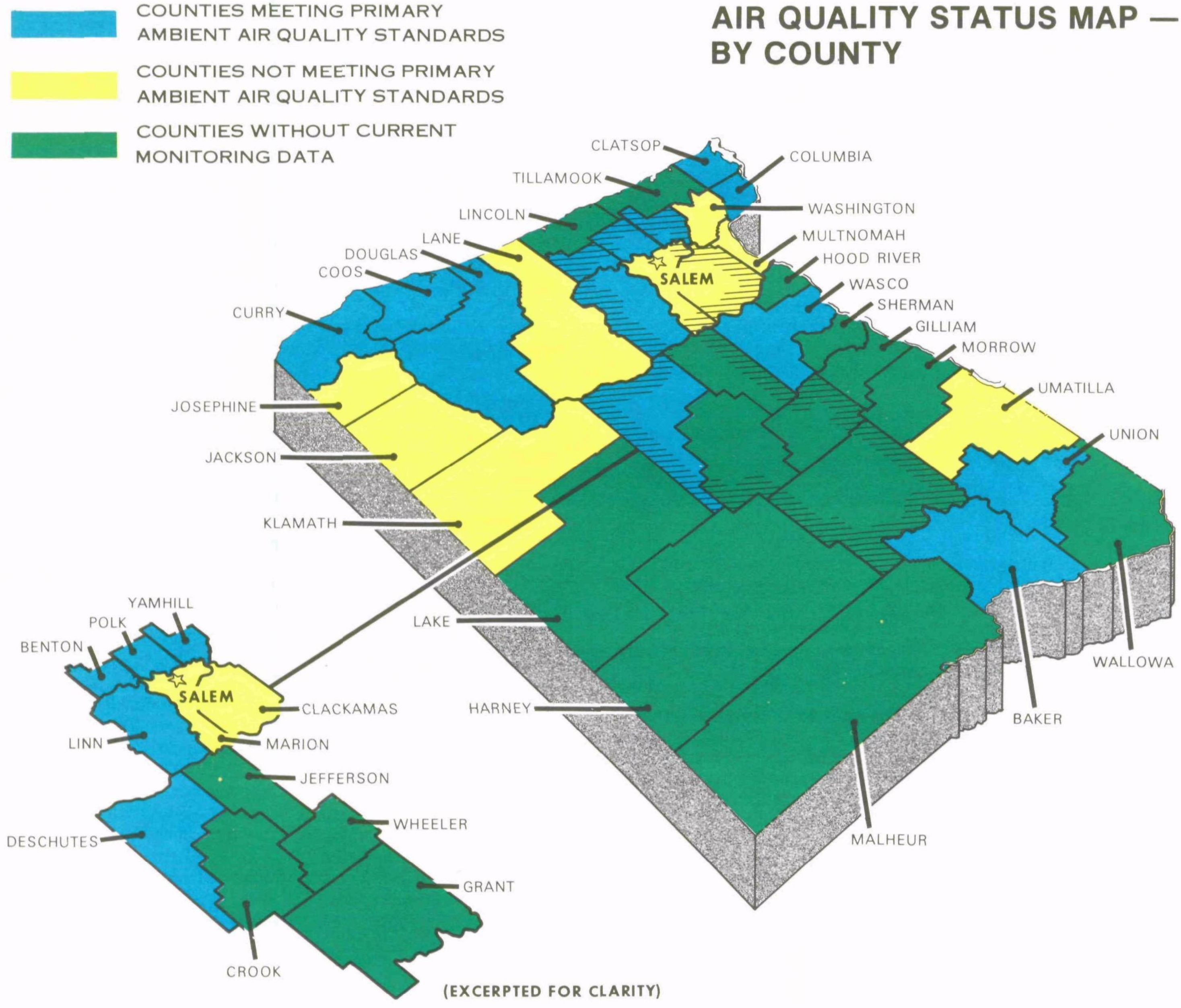


FIGURE 2

ANNUAL AVERAGE NUMBER OF DAYS HEALTH STANDARD EXCEEDED — BY POLLUTANT

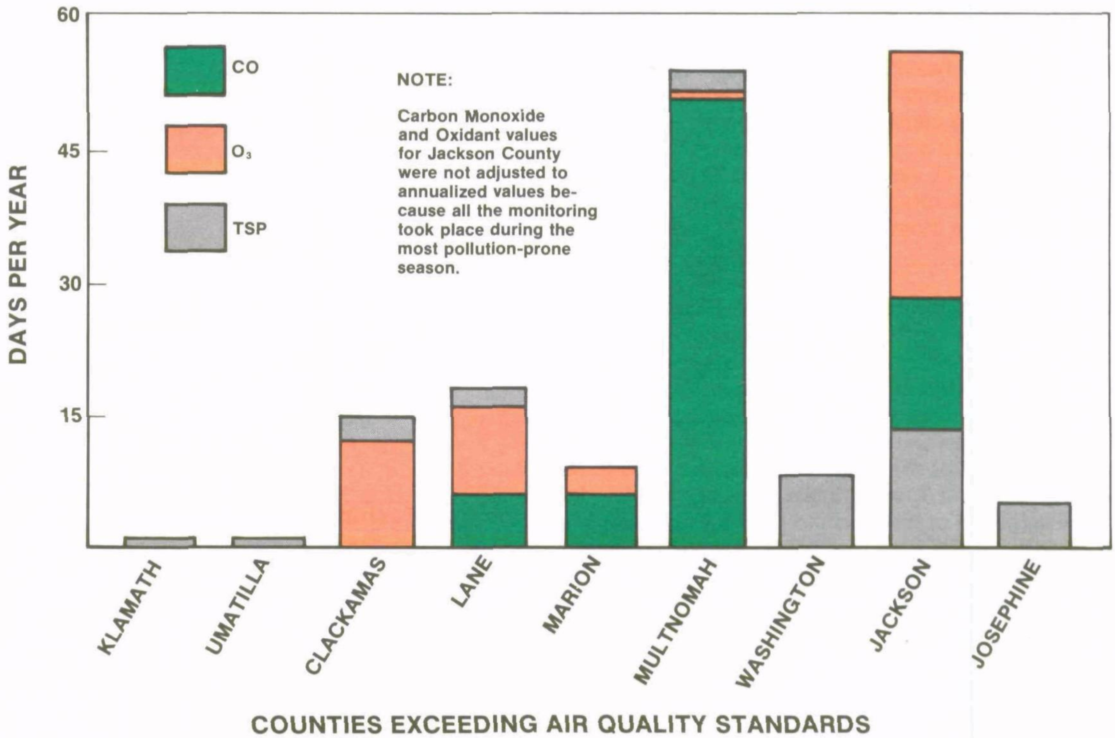
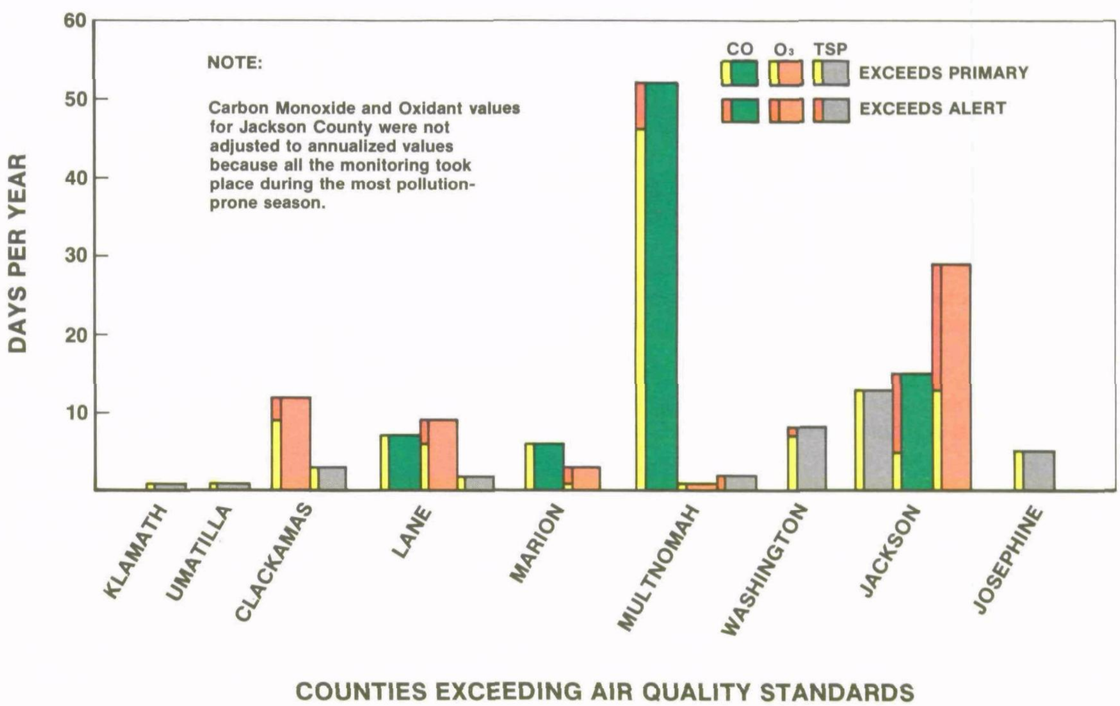


FIGURE 3

ANNUAL AVERAGE NUMBER OF DAYS HEALTH STANDARD EXCEEDED — BY SEVERITY



A REGIONAL OVERVIEW

As shown in Table 3 on the facing page, air quality violations occur in every State in Region 10. Standards for four of the major pollutants were exceeded in the State of Washington for the three-year period ending in 1976. Idaho and Oregon exceeded standards for three of the major pollutants and Alaska exceeded standards for two.

Region 10 has relatively few heavily populated urban centers. There are only 6.5 million total residents in the four states combined. Where there are major urban centers, air pollution problems exist. Violations in the 14 Region 10 communities shown in Table 3 accounted for 79 percent of all violation-days and 74 percent of all alert level violation-days in the Region. While pollution is not confined to urban areas, it is most severe where human activity is heavily concentrated.

Much of Region 10's air pollution can be attributed directly to automobile exhaust as shown in Table 2 on this page. Eighty percent of standards violations in Oregon, 65 percent in Washington, 23 percent in Idaho and 50 percent in Alaska were due to carbon monoxide and/or photochemical oxidants in urban areas. In turn, 80 percent to 90 percent of these pollutants can be traced to automobile exhausts. Because over half of the Region's population lives in or near the cities shown in Table 2, automobile exhaust must be viewed as a significant public health problem in the Pacific Northwest and Alaska. EPA is working closely with the States of Alaska, Idaho, Washington and Oregon to reduce both emissions from vehicles and the number of vehicle miles traveled in urban centers having high carbon monoxide pollution levels.

Both western Oregon and Washington have oxidant concentrations over the health standard. Control efforts in this area are just beginning, because the creation of oxidants is an extremely complex phenomenon, involving reactions of hydrocarbons and other chemicals to sunlight.

The suspended particulate problem is widespread and results from both industrial and non-industrial sources such as dust from roads and streets and home oil heating. Controls for suspended particulates have been installed on many industrial plants, and some plants are scheduled to reduce emissions in the near future. When new facilities are constructed, the best available pollution controls are required. Many localities need to reduce particulates from non-industrial sources, but in some cases, solutions are technically or economically difficult to achieve. Examples include grass burning in western Oregon and eastern Washington, wind-blown dust, dust from dirt roads, and the re-suspension of dust from paved roads. The automobile is a significant, indirect contributor to some of these problems.

In communities such as Tacoma, Washington, and Kellogg, Idaho, air pollution is largely attributable to industry. Heavy metals and particulate emissions from smelters have long been problems in these areas.

Sulfur dioxide (SO_2) pollution is primarily caused by emissions from large stationary sources, and controls are being installed as required by law.

TABLE 2

PERCENT OF TOTAL AIR QUALITY VIOLATION DAYS ATTRIBUTABLE TO AUTO EMISSIONS *

Alaska	**50%**
Anchorage	68%
Fairbanks	88%
Idaho	**23%**
Boise	96%
Oregon	**80%**
Portland	96%
Salem	100%
Medford	77%
Washington	**65%**
Seattle	99%
Spokane	80%
Tacoma	55%
Yakima	75%
Region 10	**54%**

*assumes all CO and O_X violation days result from automobile-related emissions but excludes auto related particulates

TABLE 3

AIR QUALITY STATUS IN SELECTED URBAN AREAS

Urban Areas	Pollutants Exceeding Standards: Carbon Monoxide	Photo Oxidants	Suspended Particulates	Sulfur Dioxide	Total Violation Days: Primary Standard	Alert Level
Alaska	•		•		**240**	**69**
Anchorage	•		•		37	6
Fairbanks	•		•		108	28
Sitka			•		24	10
Idaho	•		•	•	**467**	**143**
Boise	•		•		112	23
Kellogg			•		133	17
Pocatello			•	•	83	50
Soda Springs			•		65	32
Twin Falls			•		29	7
Oregon	•	•	•		**169**	**43**
Eugene	•	•	•		18	3
Medford	•	•	•		57	26
Portland	•	•	•		55	8
Washington	•	•	•	•	**355**	**62**
Seattle	•	•	•		98	8
Spokane	•		•		131	19
Tacoma	•	•	•	•	22	2

AIR QUALITY TRENDS IN OREGON

The trend in air quality is an indication of whether air pollution control activities have been effective. Figure 4 shows trends in each Oregon county based on air monitoring records for the period 1974 through 1976. An upward arrow indicates that measured concentrations of the specified pollutant appear to be increasing. A downward arrow indicates that concentrations appear to be decreasing. A horizontal arrow depicts unchanging conditions.

Oregon's air quality improved between 1974 and 1976. Of those counties exhibiting a trend, all but one is either improving or remaining the same.

Figure 4 also shows whether air quality standards are being violated in the Oregon counties. Blue boxes indicate that there is no evidence that the specified air quality standard has been exceeded. Yellow boxes indicate that a standard has been exceeded without concentrations reaching the alert level, and red boxes show areas where the alert level was exceeded. Where circles occur within the box, the degree of attainment of standards was deduced from a knowledge of pollutant sources rather than actual measurements.

FIGURE 4

AIR QUALITY STATUS AND TRENDS

COUNTY	PARTICULATE	CARBON MONOXIDE	PHOTO OXIDANTS	SULFUR DIOXIDE	NITROGEN DIOXIDE
CROOK	Blue ○	Blue ○	Blue ○	Blue ○	Blue ○
DESCHUTES	Blue ⇨	Blue ○	Blue ○	Blue ○	Blue ○
HOOD RIVER	Blue ○	Blue ○	Blue ○	Blue ○	Blue ○
JEFFERSON	Blue ○	Blue ○	Blue ○	Blue ○	Blue ○
KLAMATH	Yellow ⇩	Blue ○	Blue ○	Blue ⇨	Blue ○
LAKE	Blue ○	Blue ○	Blue ○	Blue ○	Blue ○
SHERMAN	Blue ○	Blue ○	Blue ○	Blue ○	Blue ○
WASCO	Blue ⇩	Blue ○	Blue ○	Blue ○	Blue ○
BAKER	Blue ⇩	Blue ○	Blue ○	Blue ○	Blue ○
GILLIAM	Blue ○	Blue ○	Blue ○	Blue ○	Blue ○
GRANT	Blue ○	Blue ○	Blue ○	Blue ○	Blue ○
HARNEY	Blue ○	Blue ○	Blue ○	Blue ○	Blue ○
MALHEUR	Blue ○	Blue ○	Blue ○	Blue ○	Blue ○
MORROW	Blue ○	Blue ○	Blue ○	Blue ○	Blue ○
UMATILLA	Yellow ⇩	Blue ○	Blue ○	Blue ⇨	Blue ○
UNION	Blue ⇨	Blue ○	Blue ○	Blue ○	Blue ○
WALLOWA	Blue ○	Blue ○	Blue ○	Blue ○	Blue ○
WHEELER	Blue ○	Blue ○	Blue ○	Blue ○	Blue ○
CLATSOP	Blue ⇨	Blue ○	Blue ○	Blue ⇨	Blue ○
LINCOLN	Blue ○	Blue ○	Blue ○	Blue ○	Blue ○
TILLAMOOK	Blue ○	Blue ○	Blue ○	Blue ○	Blue ○
BENTON	Blue ⇩	Blue ○	Blue ○	Blue ⇧	Blue ○

LEGEND

- Blue: NO EVIDENCE PRIMARY STANDARD EXCEEDED
- Yellow: EXCEEDS PRIMARY LEVEL
- Red: EXCEEDS ALERT LEVEL
- ○ DESIGNATION BASED ON JUDGMENT
- ⇩ DECREASING STANDARDS VIOLATIONS
- ⇨ LEVEL OR NO APPARENT TREND
- ⇧ INCREASING STANDARDS VIOLATIONS
- (empty box) INSUFFICIENT DATA TO DETERMINE TRENDS

COUNTY	PARTICULATE	CARBON MONOXIDE	PHOTO OXIDANTS	SULFUR DIOXIDE	NITROGEN DIOXIDE
CLACKAMAS	Yellow ⇩	Blue ○	Red ⇨	Blue ○	Blue ○
COLUMBIA	Blue ⇨	Blue ○	Blue ○	Blue ○	Blue ○
LANE	Yellow ⇩	Yellow ⇨	Yellow ⇩	Blue ⇨	Blue ○
LINN	Blue ⇨	Blue ○	Blue ○	Blue ○	Blue ○
MARION	Blue ⇨	Yellow ⇨	Red ⇨	Blue ⇨	Blue ○
MULTNOMAH	Yellow ⇩	Red ⇩	Yellow ⇨	Blue ⇨	Blue
POLK	Blue ⇨	Blue ○	Blue ○	Blue ○	Blue ○
WASHINGTON	Yellow ⇨	Blue ○	Blue ○	Blue ○	Blue ○
YAMHILL	Blue ⇨	Blue ○	Blue ○	Blue ○	Blue ○
COOS	Blue ⇩	Blue ○	Blue ○	Blue ○	Blue ○
CURRY	Blue ⇨	Blue ○	Blue ○	Blue ○	Blue ○
DOUGLAS	Blue ⇨	Blue ○	Blue ○	Blue ○	Blue ○
JACKSON	Yellow ⇨	Red	Red	Blue ⇨	Blue ○
JOSEPHINE	Yellow ⇨	Blue ○	Blue ○	Blue ○	Blue ○

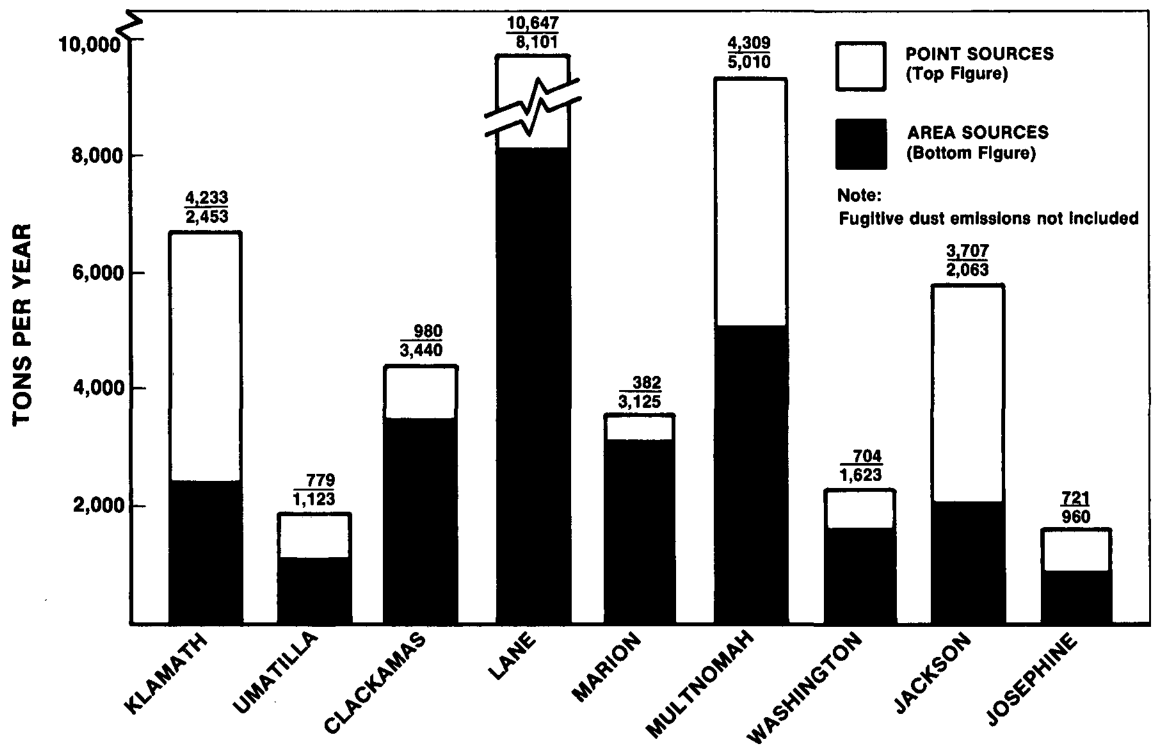
SOURCES OF AIR POLLUTION IN OREGON

The previous charts have expressed air quality in terms of the days of standards violations. Another way of describing the problem is in terms of the amount of pollution being put into the air and from where it is coming.

Figures 5 through 7 show emissions in those Oregon counties which violate standards. The emission totals are based on the latest emission inventory information including 1976 data where available. In preparing these charts, emissions from some sources had to be estimated and some of the smaller sources have not been included. Also, emissions attributed to a particular county may affect air quality in an adjoining county because the source is located close to the county boundary. Overall, however, the charts provide good perspective as to the extent, location, and sources of air pollution.

FIGURE 5

POINT AND AREA SOURCES — PARTICULATE EMISSIONS



AIR QUALITY

Suspended Particulates

Sources of particulate emissions can be grouped into two major categories: **point sources,** which are large stationary sources such as factories and power plants; and **area sources,** such as from the heating of homes and buildings, from transportation, and from wind-blown dust. For the period from 1970 to 1975 particulate emissions were reduced mainly by installation of control equipment on industrial processes, reductions in open burning, and through control programs such as the field burning smoke management program.

Figure 5 shows the distribution of particulate matter emissions by source category. Point sources accounted for most particulate emissions in only four of the counties, indicating the importance of controlling area sources. Point source particulate emissions amounted to about 26,000 tons of the more than 54,000 tons emitted.

A large portion of the particulate emissions to the atmosphere stems from a group of area sources referred to as "fugitive dust." These sources include such things as wind-blown dust, dust from dirt roads and re-suspended dirt from paved roads. It is difficult to correctly assess their impact. However, the Oregon Department of Environmental Quality has completed several studies which suggest that most of the violation-days in Klamath, Umatilla and Washington Counties are attributable to wind-blown or natural fugitive dust.

While point sources of particulates may be controlled with reliable, relatively inexpensive technology, fugitive dust is responsible for a large share of Oregon's particulates problem. Thus, even though the further control of point sources will reduce the frequency and severity of violations, air quality violations will continue until area and fugitive dust sources are also controlled.

Nitrogen Oxides

Nationally, nitrogen oxides emissions have increased mainly because of increased emissions from electric utility plants and increased industrial power generation. Emissions from electric utilities and industrial sources have risen because of increased power demands and little equipment has been installed on these sources specifically to control nitrogen oxides. Emissions of nitrogen oxides from vehicles have been essentially constant since 1972 because control devices have counterbalanced the increase in total miles traveled.

Carbon Monoxide

Nationally, some three-fourths of the carbon monoxide emissions comes from transportation sources, but as in many other urban areas, transportation is responsible for almost all of the emissions in the urban areas in Oregon. Carbon monoxide emissions have decreased partly because of the Federal emission standards on motor vehicles and because of less burning of solid waste. A reduction of over 14 percent in 1976 is credited to the Portland Inspection and Maintenance Program. This program requires a mandatory inspection of all light duty vehicles registered within the Portland Metropolitan Service District (approximately 550,000 vehicles). Each vehicle must successfully pass this exhaust emission test prior to renewal of the vehicle's registration. Some industrial emissions also have been reduced because of decreases in production, and the phasing-out of some obsolete processes.

Figure 6 shows the carbon monoxide emissions. Almost all of the CO emissions in Lane, Jackson, Marion and Multnomah Counties, those counties exceeding the ambient CO standard, stem from area sources and are primarily due to automobiles. The private automobile is responsible for more than 90 percent of carbon monoxide in those counties where the standard is not met.

Carbon monoxide emissions will be reduced as old autos are replaced with ones that incorporate improved pollution control devices. Reducing traffic in high density traffic corridors, reducing peaks in traffic, improving vehicle maintenance, and reducing total vehicle miles traveled through increased use of mass transit and carpooling, are other means of lowering carbon monoxide levels.

Oxidants and Hydrocarbons

Figure 7 shows the hydrocarbon emission inventory. Since hydrocarbon emissions are converted to oxidants, it is evident that the area sources are a primary cause of the oxidant problem. As in the case of CO, mobile or transportation related sources are significant contributors to hydrocarbon emissions. Other area sources, however, such as solvent evaporation and gasoline evaporation also make up a large portion of the hydrocarbon sources. In fact, the point sources and the evaporation sources mentioned above account for almost one-half of the emitted hydrocarbons in the state.

Significant reductions have been obtained from highway vehicles both as a result of the Federal emission standards and the Oregon Transportation Control plan. The Oregon control plan reduced hydrocarbon emissions about 7 percent in its first year of operation.

FIGURE 6

POINT AND AREA SOURCES — CARBON MONOXIDE EMISSIONS

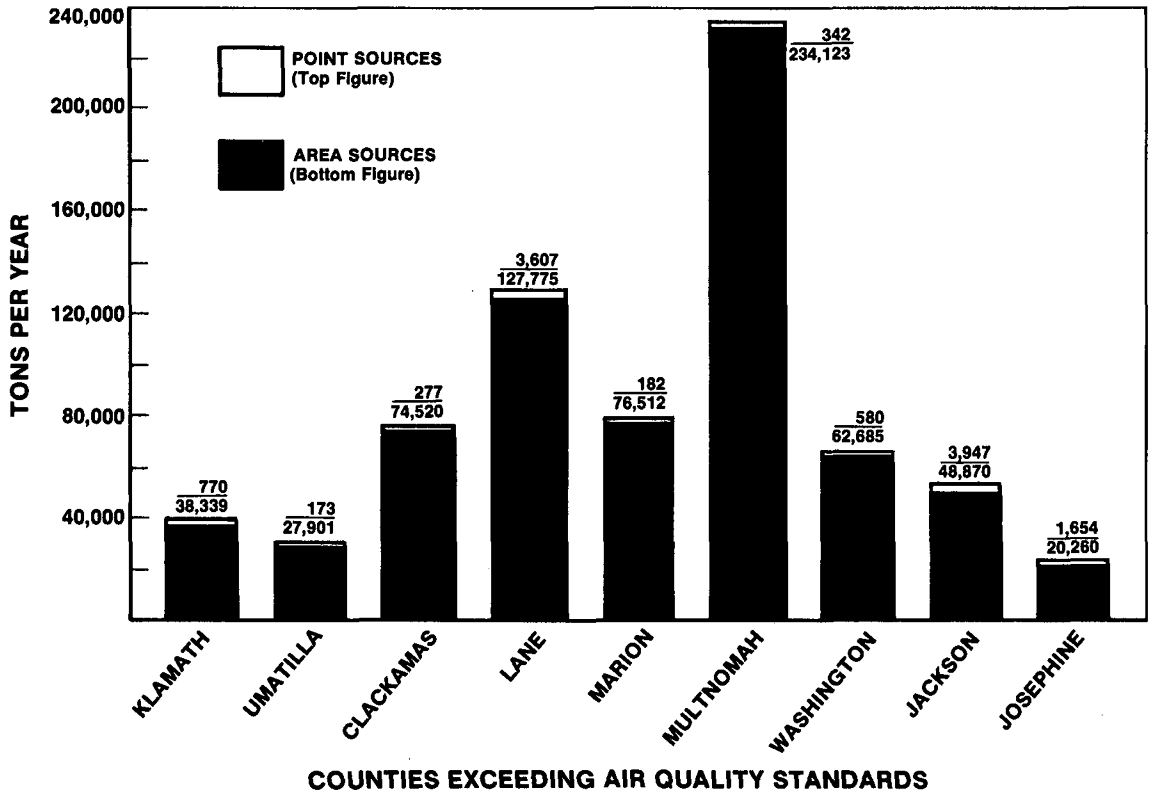
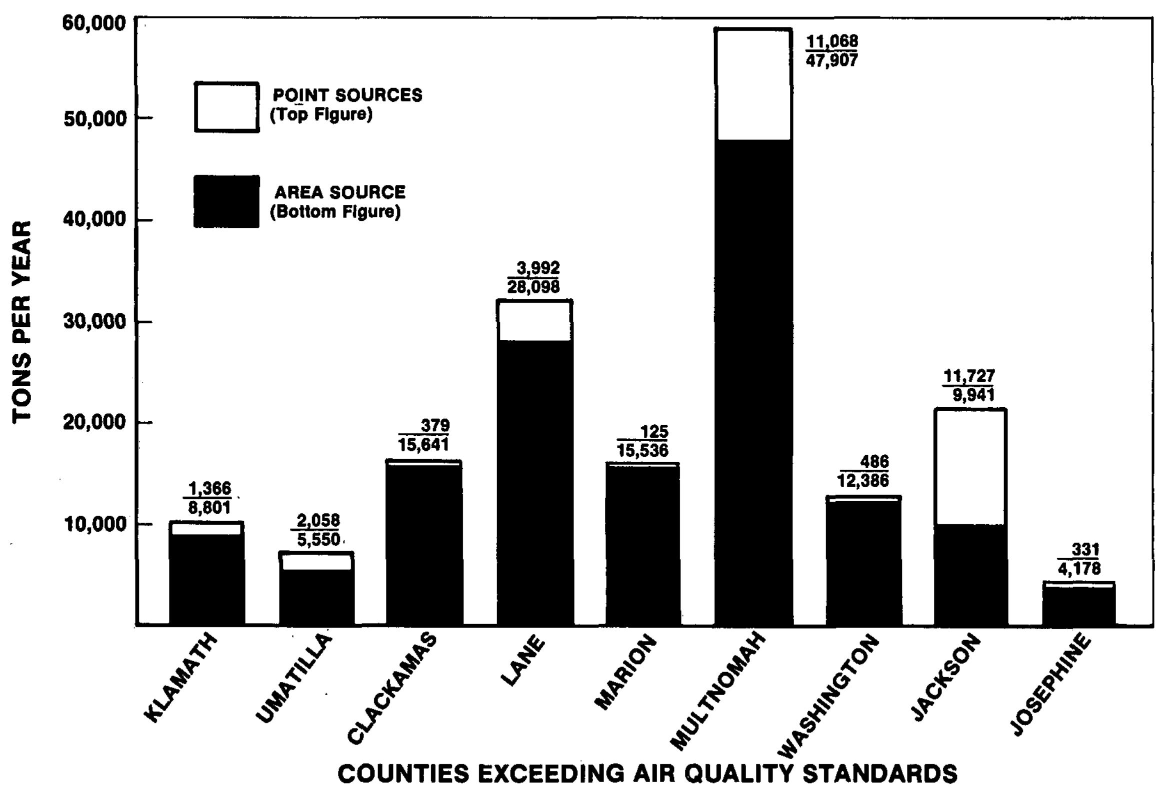


FIGURE 7

POINT AND AREA SOURCES — HYDROCARBON EMISSIONS



RIVER WATER QUALITY

In 1972, the United States Congress enacted amendments to the "Federal Water Pollution Control Act" which stimulated new cooperative Federal, State and local water quality improvement programs. Since 1972, various regulatory, enforcement, grant, and administrative programs have been developed to reduce pollutants entering the Nation's waters. This section of the report provides information on the current status and trends in water quality in the State of Oregon.

Ways of Measuring River Water Quality

Under the Federal Water Pollution Control Act, the States established water quality standards to protect the public water supply and the quality of water for wildlife, recreation, navigation, agriculture, industry, and the propagation of fish and shellfish. The Oregon Water Quality Standards, like those of the other States in Region 10, specify levels for parameters such as temperature, dissolved oxygen, bacteria and turbidity in river water.

In order to provide a means for reliably measuring and comparing water quality in the Northwest, a standardized set of parameters and associated criteria has been selected. These criteria, termed "Federal water quality goals" in the following discussion, are a synthesis of the State standards, national criteria, information in the technical literature, and professional judgment. The eleven parameters used to measure river water quality in this report are listed and explained in Table 4 below.

TABLE 4

CRITERIA/PARAMETER GROUPS[1] FOR THE WATER QUALITY INDEX

Criteria/ Parameter Group	Explanation
Temperature	Temperature of water influences both the nature of life forms and the rate of chemical reactions. Excessively high temperature is detrimental to cold water fish.
Dissolved Oxygen	Oxygen dissolved in water is essential to the life of aquatic organisms including fish. Low levels of oxygen can be detrimental to these organisms.
pH	Measure of acidity or alkalinity of water. Extreme levels of either can imperil fish life and speed corrosion.
Bacteria	Bacteria indicate probable presence of disease-related organisms and viruses not natural to water.
Trophic	Indication of the level of algal activity in water. Excessive activity is characterized by very murky, turbid water and nuisance-levels of algae which impair recreational uses of water. Algal decomposition process can adversely affect dissolved oxygen levels in water bodies.
Aesthetics	Refers to detectable oil, grease and turbidity which is visually unpleasant.
Solids	Dissolved and suspended material in water. Excess dissolved solids adversely affect water taste, industrial and domestic use. Excess suspended solids adversely affect fish feeding and spawning habits.
Total Dissolved Gas	Measure of concentration of gases in water. Can affect the metabolism of aquatic life forms.
Radioactivity	May be in water resulting from radioactive waste discharges or fallout. Excess levels could result in a direct threat to aquatic and other life forms.
Organic Toxicity	Includes pesticides and other poisons that have the same effects and persistence as pesticides.
Inorganic Toxicity	Heavy metals and other elements. Excess concentrations are poisonous to aquatic and other life forms.

[1]A total of 80 criteria/parameters were evaluated and condensed to the eleven shown here. More detailed information will be provided as requested.

While water quality can be discussed in terms of the degree to which each of these eleven parameters deviate from the selected criteria, it is helpful to be able to express the quality of a stream or river by means of a single, overall measure. In order to accomplish this, a "water quality index" (WQI) has also been formulated. This index is simply a weighted aggregation of the eleven parameters shown in Table 4 and provides index numbers ranging from 0 to 110. The way the WQI is calculated is described in the insert on page 14. An index number from 0 to 4 means the river water essentially meets Federal water quality goals. A number between 4 and 11 means the river provisionally meets goals, while a number above 11 means the water fails to meet goals. In the graphs shown in this section of the report, these index number ranges are colored blue, yellow and red respectively.

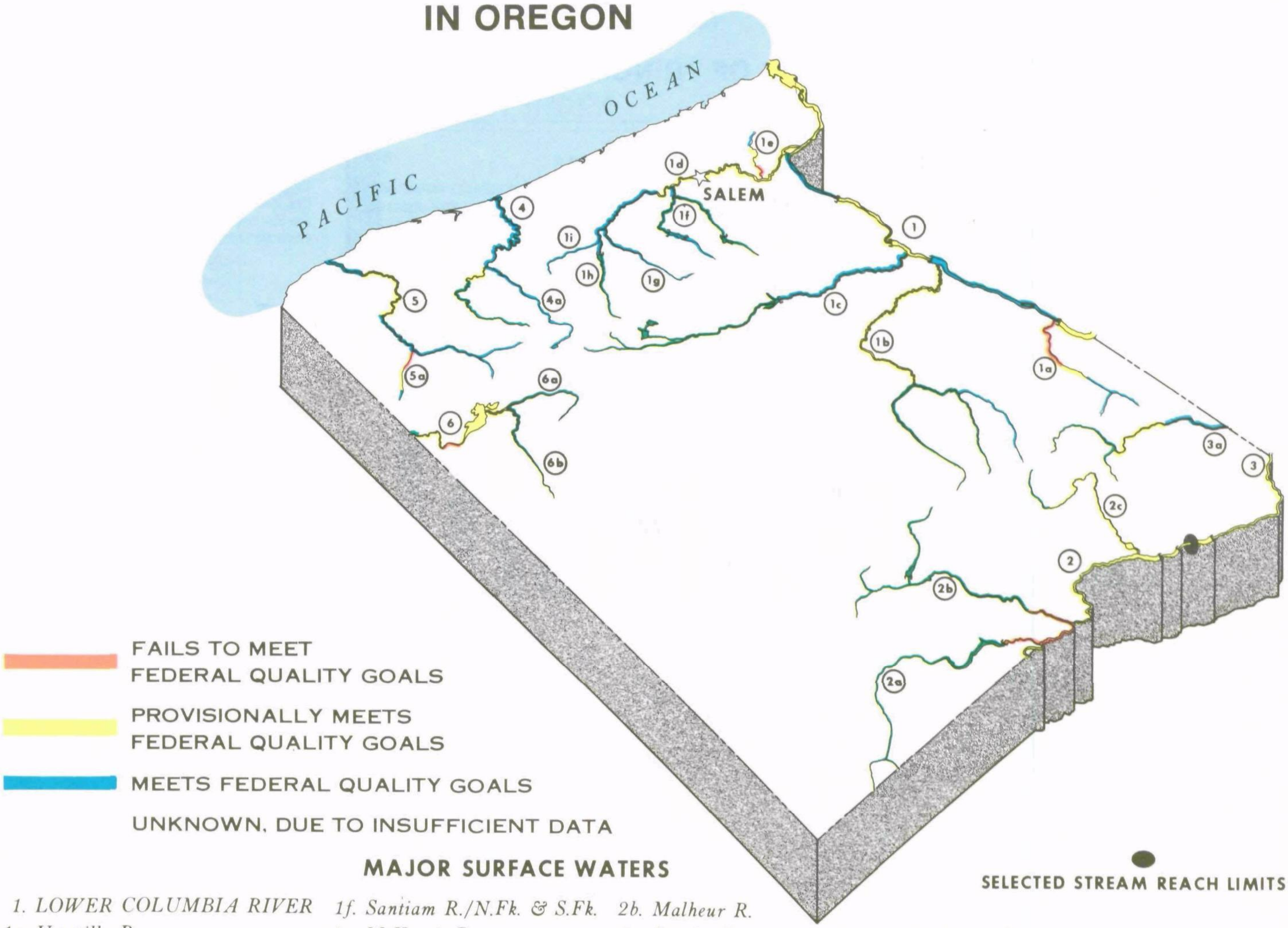
THE QUALITY OF OREGON'S PRINCIPAL RIVERS

Figures 9 and 10 show that of 19 Oregon rivers, eight are partly polluted and another seven have some or all of their reaches only provisionally meeting Federal quality goals.

The lower reaches of the Malheur River and Owyhee River, with an average Index number greater than 11.0 (Figure 9) are probably too polluted to meet Federal goals for water quality sufficient for propagation of salmonid fish and unrestricted recreational use. Ten streams, nearly one-half of those evaluated, provisionally meet Federal water quality goals. Portions of five of those streams, mainstem Middle Snake, Klamath, Bear Creek, Umatilla, and Tualatin Rivers, have poor water quality. However, better water quality

FIGURE 8

WATER QUALITY STATUS OF PRINCIPAL RIVERS IN OREGON



MAJOR SURFACE WATERS

1. LOWER COLUMBIA RIVER
1a. Umatilla R.
1b. John Day R./N.Fk & M.Fk.
1c. Deschutes R.
1d. Willamette R.
1e. Tualatin R.
1f. Santiam R./N.Fk. & S.Fk.
1g. McKenzie R.
1h. Willamette R. Middle Fork
1i. Willamette R. Coast Fork
2. MIDDLE SNAKE RIVER
2a. Owyhee R.
2b. Malheur R.
2c. Powder R.
3. LOWER SNAKE RIVER
3a. Grande Ronde R.
4. Umpqua R.
4a. Umpqua R. North Fk.
5. Rogue R.
5a. Bear Cr.
6. Klamath R.
6a. Williamson R.
6b. Sprague R.

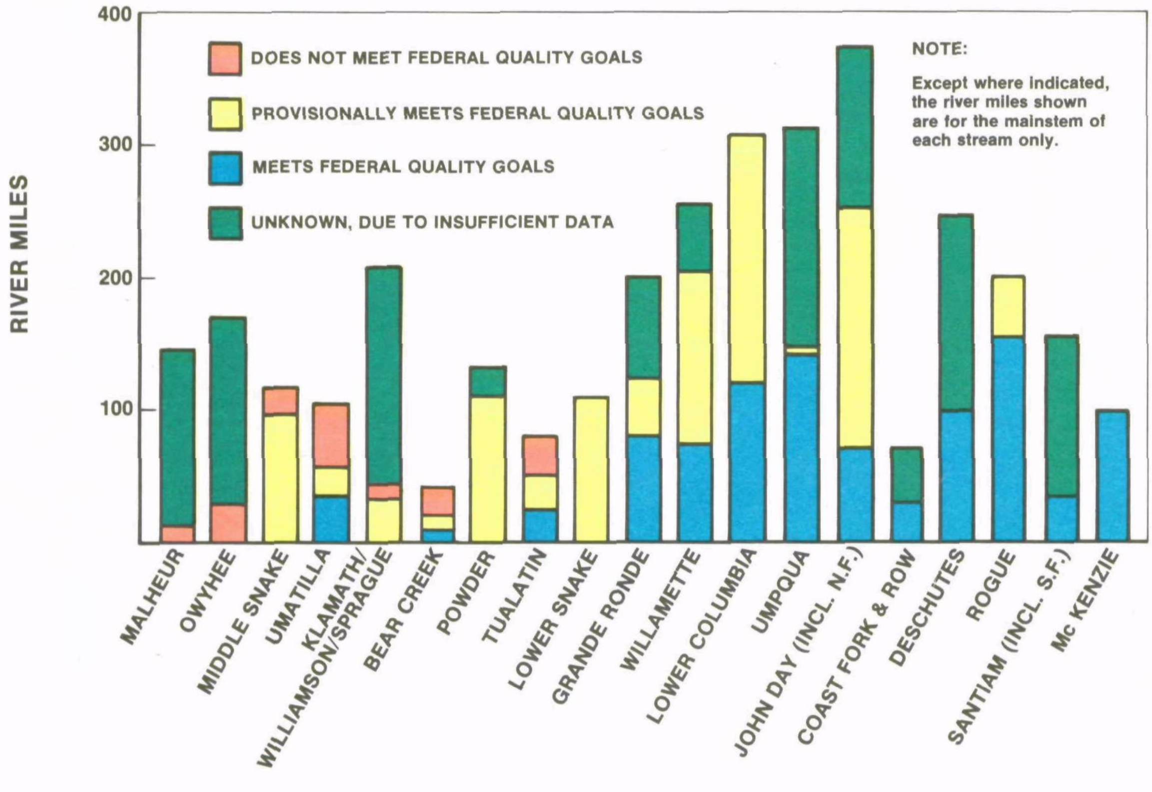
The Water Quality Index (WQI)

The WQI compares measured water quality during the last five years with the recommended Federal criteria. The data used to make this comparison come from various Federal, State and local agencies and are stored in EPA's computer systems. A number is calculated for every water quality sampling station with sufficient data. Sixty Oregon stations were used in this evaluation. Seasonal and other temporal data biases are significantly reduced by time-weighting the WQI calculation for each station. The final index number for each station is a summation of standard violations for each criteria/parameter group which are also weighted by the severity of the violation. The station WQI number spans a scale that may run from 0.0 (no measured evidence of pollution) to a theoretical maximum level of 110.0 (severe pollution in all eleven criteria/parameter groups at all times). Individual reaches of most Northwest rivers fall below a WQI of 30, and the average WQI for entire rivers is still lower.

Based on professional judgment as to the significance of the values and the known water quality status of regional streams, the entire scale of 0 to 110 is divided into several ranges. An index number greater than 11.0 (shown as red in the Figures) is considered to be characteristic of streams that do not meet the goals of the Federal Water Pollution Control Act. An index number less than 4.0 (blue) is considered to be equivalent to natural or minimally impaired conditions (meets goals of the Act). An index number between 4.0 and 11.0 (yellow) is indicative of streams which provisionally meet the goals of the Act. The color green is used in the charts when the water quality status is unknown due to an inadequate data base.

FIGURE 9

WATER QUALITY STATUS OF PRINCIPAL RIVERS IN OREGON



throughout the remaining portions of these rivers gives an Index value slightly lower than the more impaired reaches. The seven remaining rivers, mostly located in sparsely populated areas where the predominant land use is forestry, have the best water quality.

The most common causes of pollution in the Oregon rivers that were analyzed are high solids concentrations, low dissolved oxygen, and nutrient concentrations capable of causing nuisance growths of algae. These types of contamination are common to many of the rivers in the eastern, agriculturally oriented portion of the State, the more populated areas of the Willamette River system, and in Bear Creek. High temperatures occur mainly in waters of the State where intensive land use for irrigation exists and low summer flows are prevalent.

Organic toxicity from pesticides and inorganic toxicity in the form of heavy metals have a serious adverse affect on aquatic life. There is a lack of organic toxicity data on Oregon streams, even though pesticides are used in both agriculture and forestry activities throughout the State.

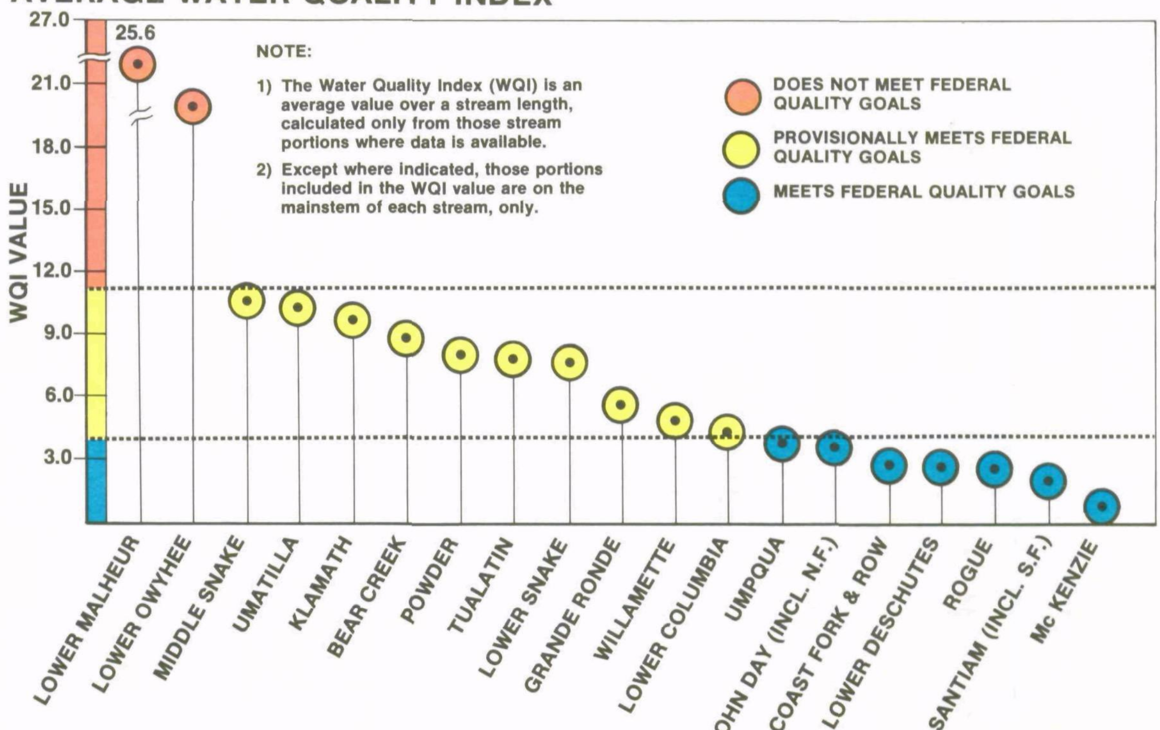
RIVER WATER QUALITY TRENDS

Figure 11 depicts the presence and trends of the 11 broad classes of water pollutants described in Table 4 for 1972 through 1976. Each pollutant trend represents the average condition of the river evaluated.

The blue box indicates that measurements for the indicated class of pollutant produced no evidence of violation of Federal criteria for water suitable for fish, wildlife, and recreation. Yellow and red boxes

FIGURE 10

PRINCIPAL RIVERS IN OREGON – AVERAGE WATER QUALITY INDEX



indicate minor and major violations of the criteria. The green box indicates that adequate water quality information is not available and no evaluation has been made.

An upward pointing arrow within the box indicates measurements that show either that the concentration of a particular pollutant is rising or that the frequency of criterion violations is increasing. A downward pointing arrow indicates a decline in measured pollutants. A horizontal arrow indicates that no significant change has occurred over the five-year period.

The most common criteria violations in Oregon are for temperature, dissolved oxygen, bacteria, suspended and dissolved solids, and excessive nutrient concentrations. Violations of these criteria occur mostly in eastern Oregon streams and other streams near high population centers. Toxic concentrations of heavy metals occur in several rivers of the State.

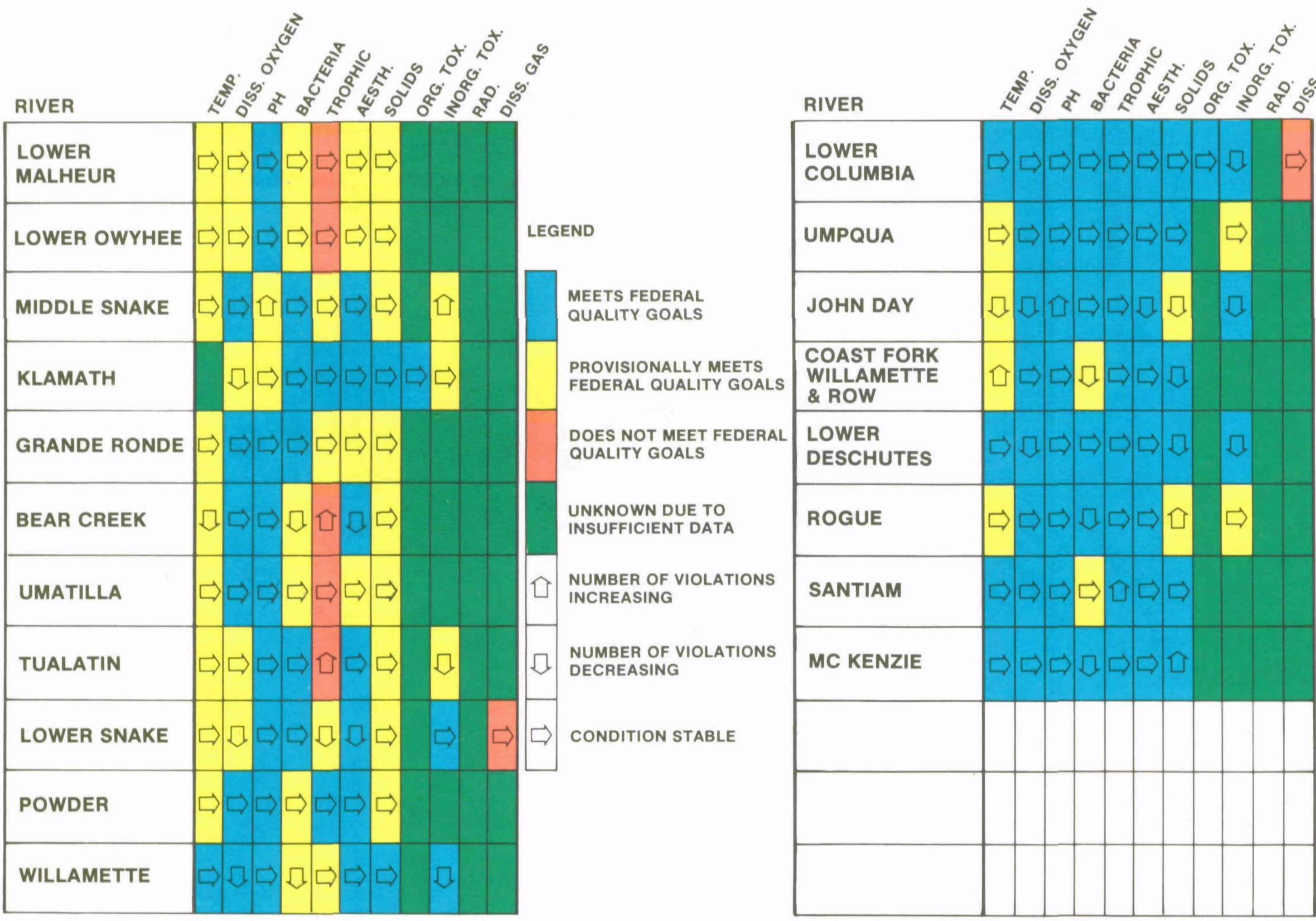
Dissolved gas supersaturation is the most serious pollutant in the Lower Columbia and Snake Rivers because of the potential catastrophic and widespread impact on salmonid fish populations. Gas supersaturation, which is primarily dependent upon high river flows and dam spillway discharges, has been prevalent over the last few years although low flows in 1977 kept the levels to a minimum.

Pesticide data (Organic Toxicity) does not exist even for agricultural areas where pesticide application is prevalent. Radiation information is also absent; however, except where shown otherwise, no criteria violations are expected.

Of the 209 individual river/criteria combinations shown in Figure 11 (19 evaluated rivers and 11 pollutant classes) 59 are unfavorable. In six of these cases (upward pointing arrow) pollution appears to be increasing; in ten it appears to be declining. The status of 63 are unknown at this time.

FIGURE 11

TRENDS OF FEDERAL CRITERIA VIOLATIONS



A REGIONAL OVERVIEW

The Water Quality Index (WQI) is used in Figure 12 to compare 25 major Pacific Northwest River Basins within Alaska, Idaho, Oregon, and Washington.

Figure 13 depicts the water quality by river mile for each river basin and Figure 14 shows similar information on a regional map.

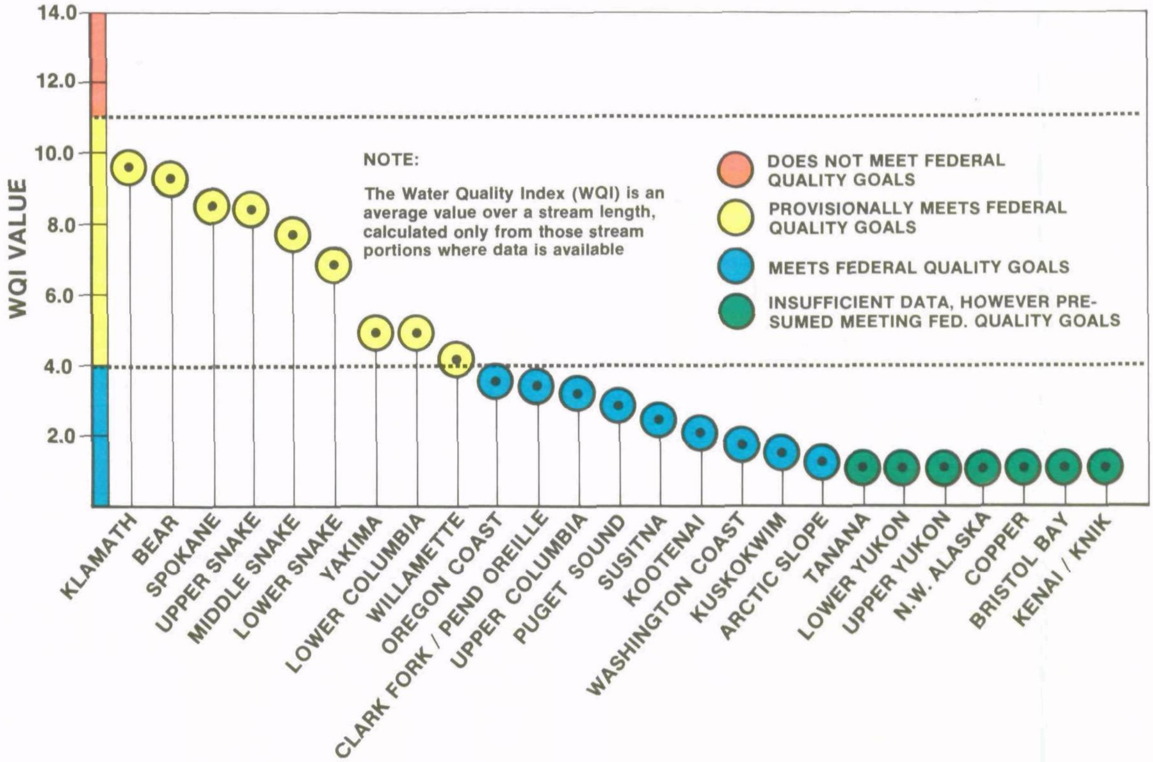
As Figure 13 indicates, portions of approximately one-third or nine of the river basins do not meet Federal water quality goals and another four only provisionally meet them. Most streams in Alaska fall into the unknown category. However, many of these waterways are located in remote areas unaffected by man. Future reports will show the results of water quality monitoring programs now in process in Alaska.

Regional water quality appears to be worse in the more arid and agriculturally oriented parts of the Region. Of the nine rivers which do not meet Federal water quality goals (Klamath, Bear, Spokane, Lower Columbia, Willamette, Yakima and the three Snake Basins) only the Spokane and Willamette Basins owe their high rating to industrial activities. In the Spokane Basin, water quality is affected by intense mining and smelting in the Coeur d'Alene, Idaho area and a municipal discharge in the Spokane, Washington vicinity. Water quality in the Willamette River Basin is affected by municipal and industrial discharges in the small Tualatin River tributary; however, its average WQI rating is so close to 4.0 that the Basin is considered to be meeting Federal water quality goals. Major coastal and Puget Sound rivers and the northeast river basins, Upper Columbia, Clark Fork/Pend Oreille, and Kootenai have relatively good water quality, with a few exceptions.

Although it is known that some streams in Alaska have localized water quality deterioration near major population centers and in the more remote areas where placer mining activities are occurring, water quality data for most areas is non-existent. The WQI, therefore, is somewhat conservative for the State since the calculations do not include these localized pollutants. The vast majority of fresh water in Alaska is considered to be of good quality.

FIGURE 12

PRINCIPAL REGION 10 RIVER BASINS – AVERAGE WATER QUALITY PER RIVER MILE



RIVER WATER QUALITY

The most prevalent criteria violations in Region 10 are: excessive concentrations of phosphorus and nitrogen, major nutrients responsible for eutrophication; suspended solids; temperature; and low dissolved oxygen levels associated with agricultural activities within the Region. High suspended solid levels from natural origins such as glaciers, mostly in Washington and Alaska, add to the difficulty in determining the actual causes of violations. High bacteria populations and pollutants that affect aesthetics (oil, grease and turbidity) account for most violations in the vicinity of large population areas.

Inorganic toxicants in the form of heavy metals are extremely high in the Spokane River Basin and are also present in moderate amounts in the Upper Snake Basin tributaries. Supersaturation of dissolved gas periodically occurs in the Lower Snake and Columbia Rivers from high river flows passing over dams. Because of low river flows, this problem has been less severe in the last few years.

An overall review of water quality trends in Region 10, shown in Figure 15, indicates some improvements in streams that provisionally met Federal goals between the years 1972 and 1976, and minimal improvements in streams identified as not meeting the goals. Alaska rivers are not included in the trend evaluation since adequate water quality data does not exist at this time.

Changes in Regional water quality over the last five years seem to indicate that programs to control municipal and industrial waste discharges have been effective in reducing the level of bacteria and oxygen degrading materials. However, dissolved gas saturation, suspended solids, temperature, nutrients, organic and inorganic toxicants which make up the majority of the problems, are relatively unaffected by these programs. An effective program to identify and control nonpoint sources within the Region must be implemented before further significant improvements in Regional water quality can be expected.

FIGURE 13

WATER QUALITY STATUS OF PRINCIPAL REGION 10 RIVER BASINS

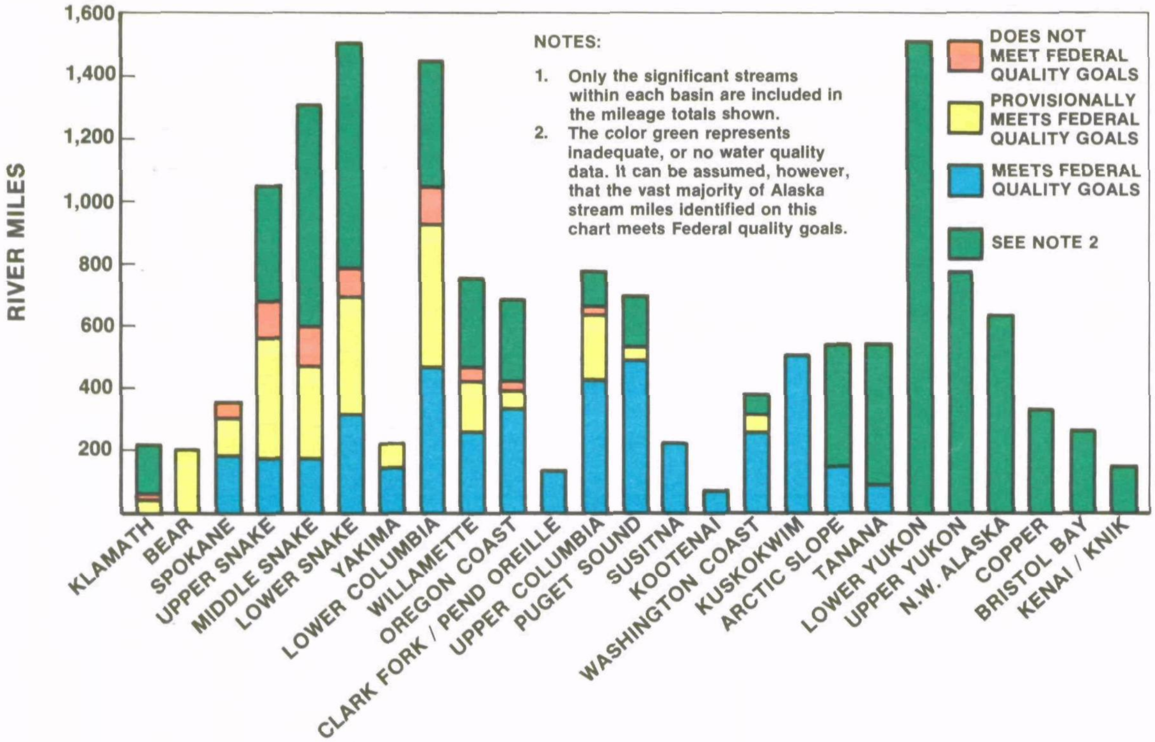
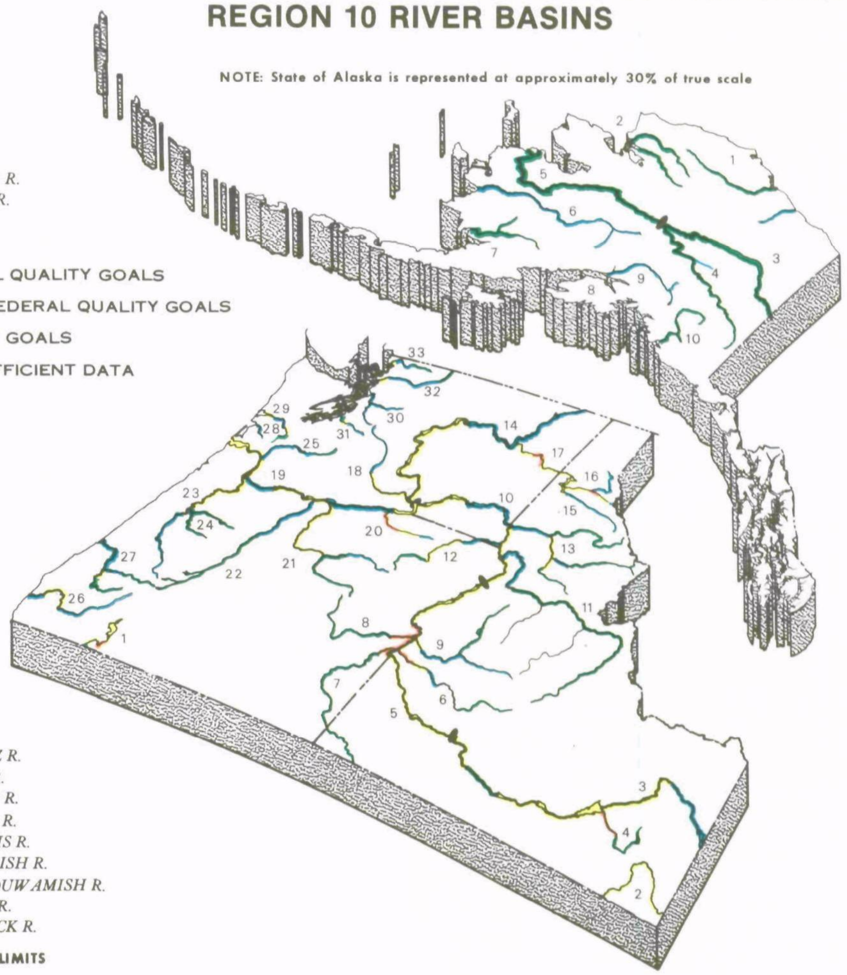


FIGURE 14
WATER QUALITY STATUS OF PRINCIPAL REGION 10 RIVER BASINS



MAJOR SURFACE WATERS AND DRAINAGE AREAS

1. *ARCTIC SLOPE DRAINAGE*
2. *NORTHWEST ALASKA DRAINAGE*
3. *UPPER YUKON RIVER*
4. *TANANA R.*
5. *LOWER YUKON R.*
6. *KUSKOKWIM R.*
7. *BRISTOL BAY DRAINAGE*
8. *KENAI-KNIK DRAINAGE*
9. *SUSITNA R.*
10. *COPPER R.*

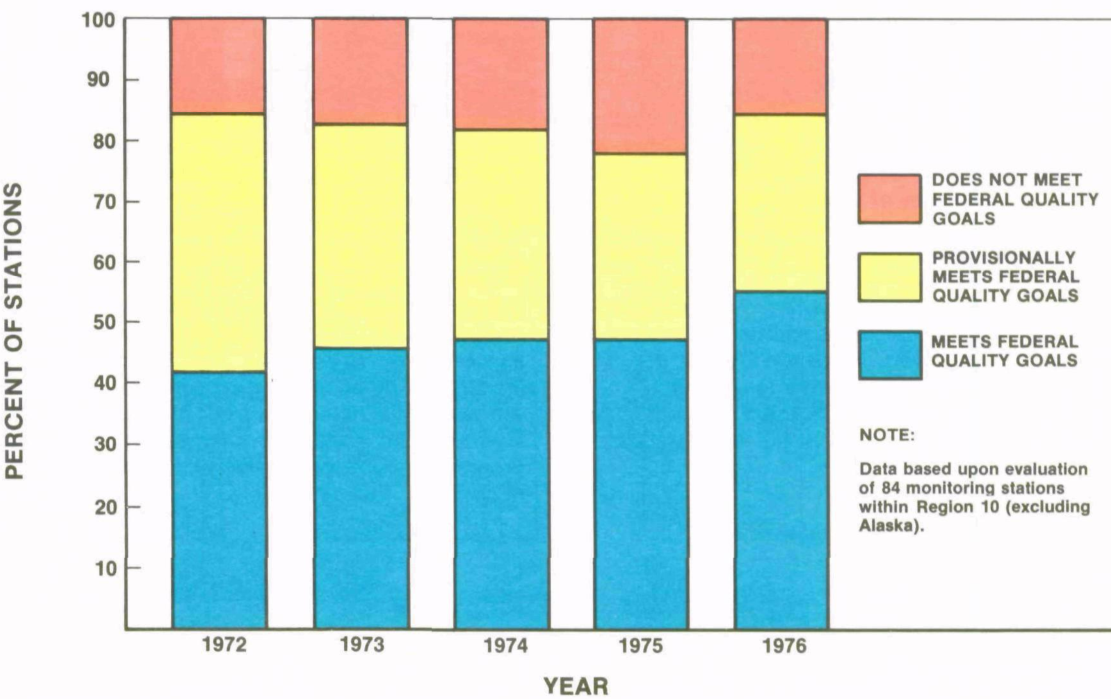
- DOES NOT MEET FEDERAL QUALITY GOALS
- PROVISIONALLY MEETS FEDERAL QUALITY GOALS
- MEETS FEDERAL QUALITY GOALS
- UNKNOWN, DUE TO INSUFFICIENT DATA

MAJOR SURFACE WATERS

1. *KLAMATH R.*
2. *BEAR R.*
3. *UPPER SNAKE R.*
4. *PORTNEUF R.*
5. *MIDDLE SNAKE R.*
6. *BOISE R.*
7. *OWYHEE R.*
8. *MALHEUR R.*
9. *PAYETTE R.*
10. *LOWER SNAKE R.*
11. *SALMON R.*
12. *GRANDE RONDE R.*
13. *CLEARWATER R.*
14. *UPPER COLUMBIA R.*
15. *ST. JOE R.*
16. *COEUR D'ALENE R.*
17. *SPOKANE R.*
18. *YAKIMA R.*
19. *LOWER COLUMBIA R.*
20. *UMATILLA R.*
21. *JOHN DAY R.*
22. *DESCHUTES R.*
23. *WILLAMETTE R.*
24. *SANTIAM R.*
25. *COWLITZ R.*
26. *ROGUE R.*
27. *UMPQUA R.*
28. *WILLIPA R.*
29. *CHEHALIS R.*
30. *SNOHOMISH R.*
31. *GREEN/DUWAMISH R.*
32. *SKAGIT R.*
33. *NOOKSACK R.*

● SELECTED STREAM REACH LIMITS

FIGURE 15
WATER QUALITY TRENDS – REGION 10



SOURCES OF RIVER WATER POLLUTION IN OREGON

The previous charts show that suspended solids, plant nutrients, and oxygen-consuming materials have the most significant impact on water quality in Oregon streams. The causes of these problems are varied. All occur naturally, and under certain conditions the natural contribution can be the major cause of the problem. However, they are also generated by man's activities such as point source discharges from urban or industrial areas or as nonpoint sources from various land use activities. The contributions from all of these sources, and the resulting effects, can be significantly altered by seasonal changes in stream flow, water temperature, and other factors.

Suspended Solids

Suspended solids include both organic and inorganic materials having a specific gravity very close to that of water. This characteristic prevents rapid settling of the material and promotes suspension and transportation over long distances. These materials can discolor the water, reduce light penetration, and, with gradual settling, smother fish-spawning areas.

The organic portion of the suspended solids is degradable and often leads to excessive oxygen demands. Suspended solids frequently carry high concentrations of nutrients and toxic materials, such as pesticides, which are ultimately released to the water.

Figure 16 shows total suspended solids in the streams compared on a monthly basis with suspended solids contributed by municipal and industrial sources. Most of the rivers evaluated carry large volumes of suspended solids resulting from land erosion during high river flows. Western Oregon streams (Willamette, Santiam, Umpqua and Rogue) are examples. However, high suspended solids in the Klamath and Tualatin Rivers, which are in predominantly agricultural areas, cannot be accounted for by the erosional process due to high river flow only (the lower reach of the Tualatin River lies in a highly populated area).

Thus, direct industrial and municipal waste discharges do not contribute significantly to suspended solids in Oregon streams, and erosion is the main source of the problem. The exception to this occurs in the Willamette River and to a lesser degree in the Santiam and Tualatin Rivers.

Nutrients

High concentrations of plant nutrients, primarily nitrogen and phosphorus, can lead to excessive growths of floating and attached algae that clog small streams, deplete oxygen when they decay, and generally create aesthetic and nuisance conditions. These effects can be especially severe in smaller bodies of water. Data previously presented show that most of the Lower Columbia and Coastal Oregon streams do not have high phosphorus levels. The streams in the Willamette Basin and southern and eastern Oregon, have phosphorus levels that exceed Federal criteria. As with suspended solids, there are a variety of point, nonpoint, and natural sources that contribute to the overall nutrient levels. In eastern Oregon, for example, a major source of phosphorus appears to be from agriculture and natural occurrences. Runoff in this area contributes a majority of the phosphorus in the mainstem Snake River and its tributaries.

Biochemical Oxygen Demand (BOD)

The consumption of oxygen by bacteria feeding on organic wastes has historically been a major source of water pollution both in Oregon and throughout the country. BOD is used as a measure of either the pollution potential of waste or the pollutant load in a stream. Excessive BOD concentrations result in diminished oxygen levels in streams and lakes with significant adverse impacts on fish populations and other biological activity. A variety of point and nonpoint sources can contribute to BOD loadings.

Figure 17 presents comparisons of instream BOD flows and point source BOD contributions for seven Oregon streams evaluated in this Profile. These comparisons bring out several interesting points. First, there is a wide variation in BOD levels directly related to stream flow. A major portion of oxygen-demanding material results from runoff during high river flows. In high flow periods, municipal and industrial waste represent a relatively small portion of the total load; however, during low flows, when the streams are unable to assimilate organic wastes effectively, municipal and industrial discharges account for a greater percentage of these wastes. In five of the seven rivers studied, the Umpqua, Tualatin, Umatilla, Willamette and Santiam, the highest municipal and industrial waste-related oxygen demand occurs during low flow periods. In the remaining two rivers (Rogue and Klamath), these waste discharges are less significant. They account for less than 30 percent of the total BOD during low flow periods. Even though municipal and industrial discharges account for much of the observable BOD in these rivers during low flows, most organic matter in these rivers results from runoff associated with urban and rural lands, and other natural and man-caused nonpoint sources.

Past water quality control efforts in Oregon have concentrated largely on elimination of point sources of organic pollution. With some localized exceptions, these discharges have been reduced significantly or eliminated, with resulting improvements in water quality. The remaining problem point sources are on schedules to install treatment. Further efforts to improve oxygen levels in streams and reservoirs must therefore focus on reducing nonpoint source contributions of organic matter and plant nutrients.

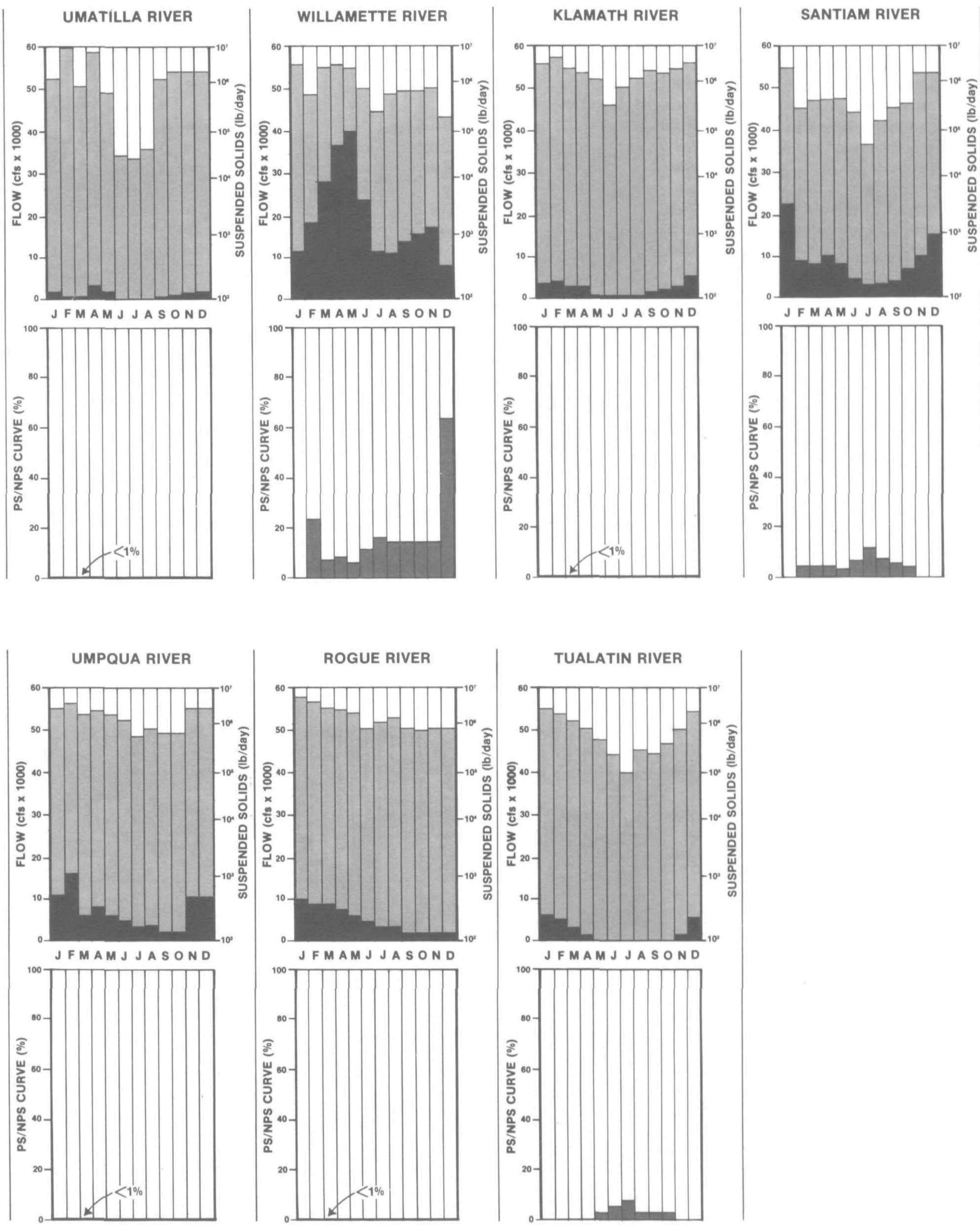
WATER QUALITY OUTLOOK

It appears that little significant change can be anticipated in the next three to five years.

With a few exceptions, the major water quality problems of Oregon do not stem from municipal and industrial waste discharges, which in the past were the primary focus of water pollution abatement programs. Water pollution in rivers and lakes in the State results from intense land and water use, reservoir conditions, and natural runoff. Waste treatment is already well advanced in the State; however, some water quality problems, especially in the more densely populated western portion of the State, still exist due to inadequate waste treatment. Further improvement in Oregon's waste treatment program is needed to achieve water quality in these areas as well as the main coastal areas where shellfish harvesting is jeopardized by bacteriological contaminations. Measures to reduce the water quality impacts from runoff, stream regulation, and improper land management largely remain to be defined, although programs are presently underway to determine the extent and magnitude of these impacts.

FIGURE 16

SUSPENDED SOLIDS LOADING GRAPHS
State of Oregon



LEGEND

MEAN MONTHLY AMBIENT LOADINGS

MEAN FLOW

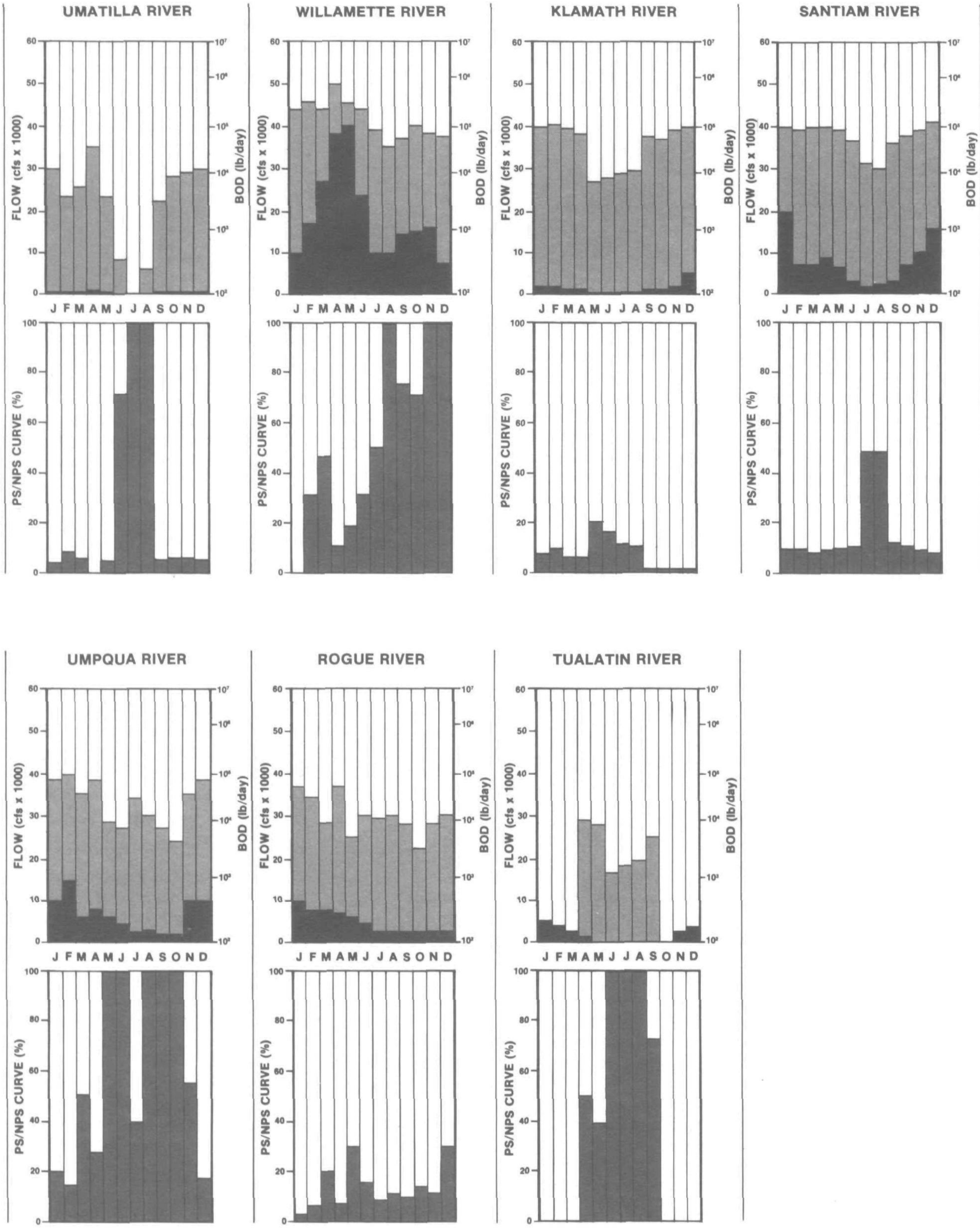
PS/NPS CURVE — This curve gives a general indication of the point source vs. nonpoint source loadings expressed as a percentage.

NOTE

Note that the logarithmic scale tends to greatly deemphasize the variations shown, thereby demanding considerable care in interpreting the graphs.

FIGURE 17

BIOCHEMICAL OXYGEN DEMAND LOADING GRAPHS
State of Oregon



LEGEND

- MEAN MONTHLY AMBIENT LOADINGS
- MEAN FLOW
- PS/NPS CURVE — This curve gives a general indication of the point source vs. nonpoint source loadings expressed as a percentage.

NOTE

Note that the logarithmic scale tends to greatly deemphasize the variations shown, thereby demanding considerable care in interpreting the graphs.

LAKE WATER QUALITY

Lakes and reservoirs play a major and vital role in Oregon's water quality picture. They affect the state's economy through recreational uses such as fishing, swimming, and boating as well as through agriculture and water supply. Power, navigation, irrigation and flood control are major benefits derived from dams and reservoirs constructed throughout Oregon to support and protect the life and livelihood of its inhabitants.

Measuring Lake Water Quality

Although a numerical "water quality index" has not been developed for lakes as for rivers, lake quality can be characterized in two ways: trophic status and the degree of impairment of beneficial use.

While eutrophication, the process of aging, occurs naturally in lakes and impoundments, man's activities may accelerate this process, resulting in "cultural eutrophication". Highly eutrophic bodies of water are characterized by dense algal blooms, floating mats of vegetation, and a murky appearance. Algae are naturally found in every body of water; however, when stimulated by abundant nutrients, sunlight, and warm temperatures, they multiply rapidly to become a nuisance to recreational users and seriously affect water quality for other uses.

Plant nuisances may directly curtail or eliminate water recreation activities such as swimming, boating, and fishing; impart tastes and odors to water supplies; and hamper industrial and municipal water treatment. These nuisance growths can also cause toxic conditions which adversely affect other aquatic life in the lakes. Possibly the greatest effect of eutrophication on water quality is the consumption of dissolved oxygen when algae die, sink to the bottom of the lake, and are decomposed by bacteria. This process reduces dissolved oxygen levels and can adversely affect fish and other aquatic inhabitants.

Water bodies with very little algae are said to be oligotrophic (often called pristine). Lakes are said to be mesotrophic if they have moderate algae productivity and meso-eutrophic if they are approaching fully eutrophic conditions.

In the case of use impairment, swimming, fishing, boating and aesthetics may be considered. An evaluation system which yields an impairment score is shown in Table 5.

TABLE 5

CRITERIA FOR EVALUATING IMPAIRMENT OF LAKES

Recreational Use	Degree of Impairment: None — Criteria	Score	Moderate — Criteria	Score	Significant — Criteria	Score
Swimming	Very low bacteria levels (Fecal coliforms geometric mean less than 50 per 100 ml)	1	Moderate bacteria levels (Fecal coliforms 50 to 200 per 100 ml)	2	Unhealthy bacteria levels (Fecal coliforms greater than 200 per 100 ml)	3
Fishing	No adverse conditions. Healthy fish population.	1	Slightly adverse conditions. Slight reduction in fish population.	2	Adverse conditions. Significant reduction in fish population.	3
Boating	Less than 10% of surface area affected by aquatic weeds	1	10% to 30% affected	2	More than 30% affected	3
Aesthetics	Objects visible in water to depth of 10 feet or more and low phosphorus (Secchi Disc at 10 feet; total phosphorus of less than 10 ug/l)	1	Objects visible from 1.5 to 10 feet and moderate phosphorus level (Secchi Disc at 1.5 to 10 feet; total phosphorus 10 to 20 ug/l)	2	Objects not visible beyond 1.5 feet or high phosphorus level (Secchi Disc at less than 1.5 feet; total phosphorus greater than 20 ug/l)	3
SCORE		**4** (No uses impaired)		**5-8** (All uses moderately impaired)		**9-12** (All uses significantly impaired)

LAKE WATER QUALITY

In this report, lake water quality has been assessed by totaling the individual use ratings shown in Table 5. The rating for each factor for minimum or no impairment is one, and the most severe impairment is rated three. Final ratings range from a low of four (minimum or no impairment), to a high of twelve (significant impairment). Professional judgment was used to determine the degree of impairment where data were not available.

TROPHIC CONDITIONS OF OREGON'S LAKES

High phosphorous contributions from sewage and industrial discharges and from fertilizers applied to surrounding lands, which reaches rivers and lakes during high runoff periods, have accelerated the natural lake eutrophication process in Oregon. Of the 15 lakes and reservoirs in Oregon (Table 6) which have at least 10 square miles of surface area (6,400 acres), five already are eutrophic and two more are meso-eutrophic—well on the way to becoming eutrophic. One lake is oligotrophic (relatively pristine) and two more are mesotrophic (moderate algal productivity). Five eastern Oregon lakes are too saline for trophic classification. Six of the seven lakes classified as eutrophic or mesotrophic are located in the semi-arid eastern and southern portions of Oregon where agriculture is the predominant land use. The other, Fern Ridge Reservoir, is a shallow body of water located west of the Cascades. Municipal, industrial, and agricultural discharges in the Upper Columbia and Snake Rivers share responsibility for eutrophication of the remaining reservoirs on these rivers.

USE IMPAIRMENT

In addition to excessive algae, other forms of pollutants such as bacteria, turbidity and oil also impair the beneficial uses of lakes and reservoirs. Table 7 depicts the degree of impairment of recreation lakes in Oregon. Of the 30 most-used Oregon recreation lakes and reservoirs, four have a significant or moderate degree of impairment. The remaining 26 lakes appear to be relatively pristine. Three of the four lakes and reservoirs classified as severely or moderately polluted are located in agricultural areas of the State. The other is Fern Ridge Reservoir, which experiences a moderate degree of impairment. It is located in a forested area of the State. The majority of more pristine lakes are deep and are located at high elevations in the less developed portions of the State. No treated domestic or industrial wastes are discharged to Oregon lakes.

A REGIONAL OVERVIEW

There are 145 lakes and reservoirs within Region 10 that equal or exceed 10 square miles in surface area and thousands of other smaller lakes and reservoirs. Each plays an important role in the ecosystem of the Pacific Northwest and Alaska.

Many Regional lakes and reservoirs are at or approaching a level of eutrophication unsuitable for their intended uses. Exceptions are the Alaska lakes, most of which are in remote areas.

Figure 18 presents a summary of trophic status of the Regional lakes by state.

Alaska, the least populated state, has the largest percentage of non-eutrophic (oligotrophic) lakes and even the moderately eutrophic lakes are probably the result of natural causes. About one-third of Idaho's lakes and reservoirs are still non-eutrophic; however, the remaining lakes are either moderately eutrophic or eutrophic because of intense land and water use in the more populated and agriculturally oriented portions of the State. Oregon and Washington, the most populated states in Region 10, have the lowest percentage of the non-eutrophic lakes and reservoirs. Even though the eutrophic

TABLE 6

TROPHIC STATUS OF OREGON LAKES AND RESERVOIRS 10 SQUARE MILES (6400 ACRES) OR GREATER

Lake or Reservoir	Surface Area in Square Miles	Trophic Status[1]			
		Eutrophic	Meso Eutrophic	Mesotrophic	Oligotrophic
Upper Klamath Lake	92	•			
Lake Abert*	57				
Malheur Lake*	77				
Goose Lake*	47				
Harney Lake*	41				
Summer Lake*	32				
Lake Umatilla (John Day Reservoir)	41		•		
Owyhee Reservoir	22	•			
Crater Lake	21				•
Wickiup Reservoir	17			•	
Fern Ridge Reservoir	16	•			
Bonneville Reservoir	16			•	
Lake Wallula (McNary Reservoir)	15		•		
Agency Lake	14	•			
Brownlee Reservoir	12	•			

Source of data: Oregon Department of Environmental Quality
EPA Environmental Research Laboratory
U. S. Army Corps of Engineers

Too saline for classification

FIGURE 18

TROPHIC STATUS OF MAJOR RECREATIONAL LAKES

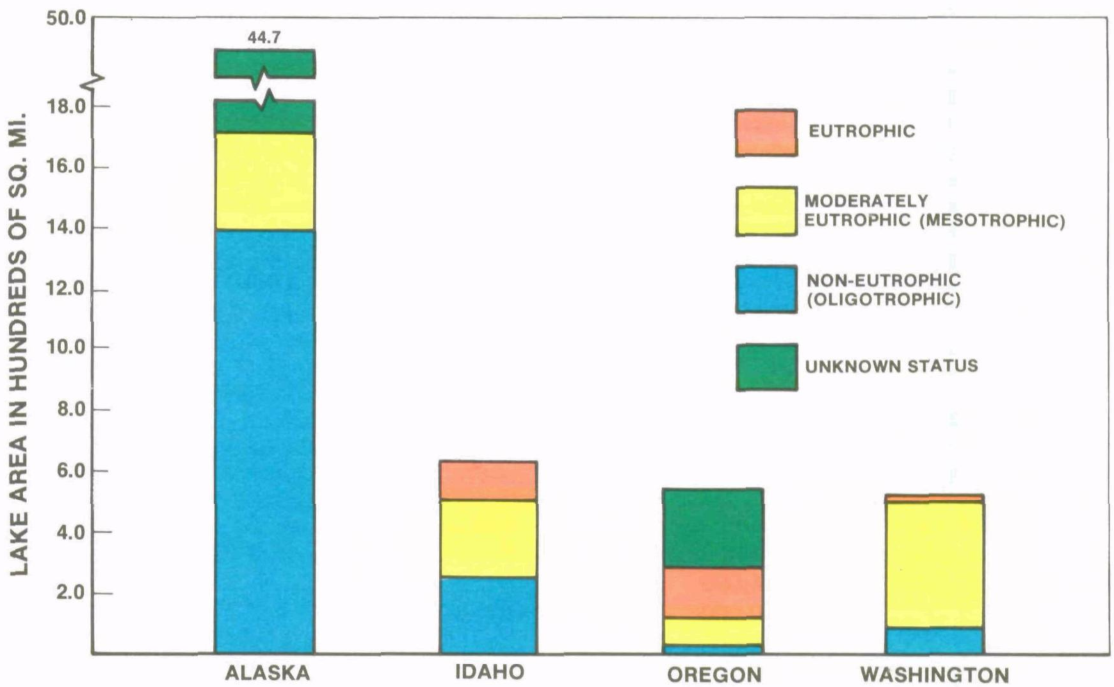
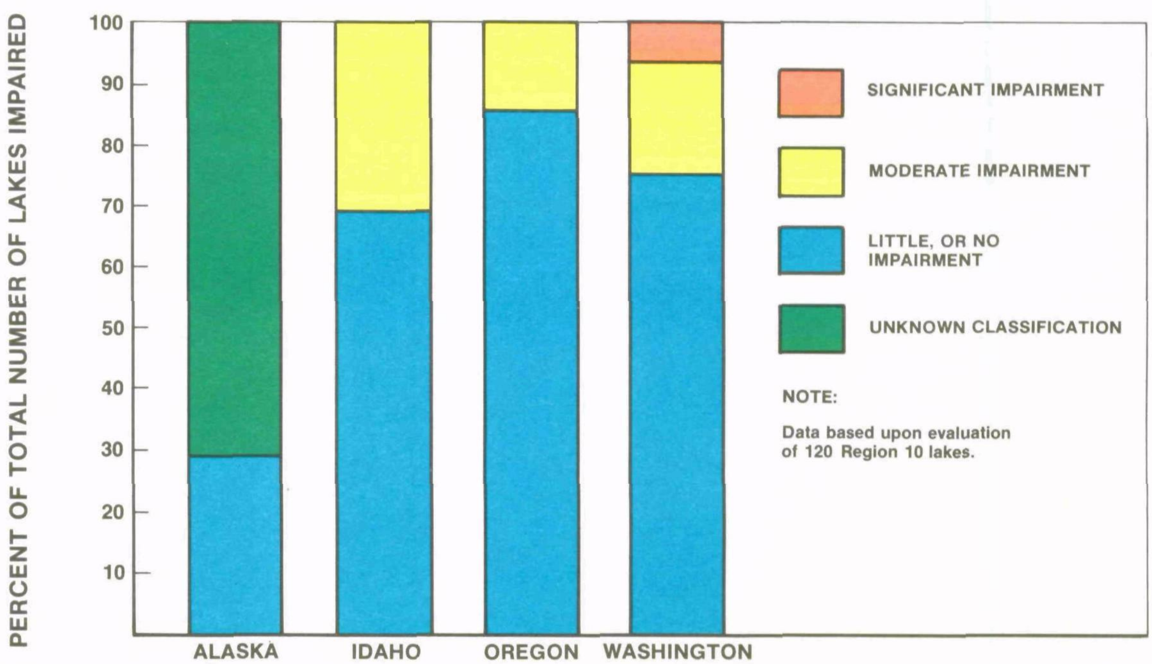


FIGURE 19

IMPAIRMENT STATUS OF RECREATIONAL LAKES



condition of some of these bodies of water may result from natural causes; intense recreational use, residential development, and agricultural use east of the Cascade Mountains, has accelerated the eutrophication process.

A review of the 120 lakes within Region 10 that have the highest recreational use in each state indicates that most have only limited recreational impairment. Figure 19 shows the impairment breakdown by state. The water quality of only two lakes in the State of Washington is considered to be significantly impaired with 75 percent showing little or no impairment.

In Idaho 30 percent, and in Oregon 12 percent of the lakes show moderate impairment of the highest beneficial uses. Most of the impaired Oregon lakes and reservoirs are in the semi-arid portion of the state. Those in Idaho are in the southern portion of the state.

In almost every case, moderate or significant impairment is the result of intense recreational use of lakes which are near populated areas. The more pristine lakes and reservoirs are situated away from these areas, many times in the higher elevations. The challenge for the future will be to maintain the existing good quality lakes while upgrading the poorer quality ones.

TABLE 7

PRINCIPAL OREGON LAKES AND RESERVOIRS IMPAIRMENT OF HIGHEST BENEFICIAL USES

Name	Surface Area (Acres)	Recreational Use Impaired[1] Swimming	Fishing	Boating	Aesthetics	Final Rating
Upper Klamath Lake	59,000	2	2	1	2	7
McKay Creek Res.	1,200	1	2	1	2	6
Owyhee Reservoir	14,000	1	1	2	2	6
Fern Ridge Res.	10,000	1	1	1	2	5
Waldo Lake	5,500	1	1[2]	1	1	4
Crescent Lake	3,500	1	1	1	1	4
Chinook Lake	2,500	1	1	1	1	4
Crater Lake	13,000	1	1[2]	1	1	4
Diamond Lake	3,000	1	1	1	1	4
Siltcoos Lake	3,000	1	1	1	1	4
Detroit Res.	3,000	1	1	1	1	4
Green Peter Res.	3,700	1	1	1	1	4
Prineville Res.	3,000	1	1	1	1	4
Timothy Lake	850	1	1	1	1	4
Lake Paulina	1,400	1	1	1	1	4
East Lake	1,200	1	1	1	1	4
Crane Prairie Res.	1,500	1	1	1	1	4
Lake Wallowa	1,800	1	1	1	1	4
Ochoco Res.	1,100	1	1	1	1	4
Davis Lake	1,600	1	1	1	1	4
Wickiup Res.	11,000	1	1	1	1	4
Cultus Res.	1,300	1	1	1	1	4
Blue River Res.	1,000	1	1	1	1	4
Cottage Grove Res.	1,000	1	1	1	1	4
Dorena Reservoir	1,800	1	1	1	1	4
Foster Reservoir	1,200	1	1	1	1	4
Olallie Lake	800	1	1	1	1	4
Cougar Reservoir	1,200	1	1	1	1	4
Hill Creek Res.	2,700	1	1	1	1	4
Odell Lake	3,300	1	1	1	1	4

1 Numbers in columns represent the degree of recreation impairment per category for each lake—minimum impairment per category is 1 and highest is 3; therefore, final rating ranges from 4 for little or no impairment to 12 for maximum impairment of all recreation categories.

2 Does not support fish population because water is too soft to produce sufficient food. This condition is not pollution-related.

MARINE WATER QUALITY

Oregon's coastal and estuarine waters are economically important. Major industrial development as well as medium-sized population centers are located in these areas, mainly in the Coos Bay, Tillamook Bay and Yaquina Bay areas of the Coast.

Marine waters of the state support international shipping, shellfish production, and recreational boating and fishing. It is important that the health of these waters be maintained.

Measuring Marine Water Quality

Marine water quality determinations are based upon specific microbiological, chemical and toxicological criteria established by the U. S. Food and Drug Administration for the National Shellfish Sanitation Program. Waters free of fecal contamination, industrial waste, radionuclides, and biotoxins are considered safe for edible shellfish production, and are classified as "Approved for Commercial Shellfish Harvesting." Waters which generally meet the criteria but are subject to occasional closure resulting from seasonal increases in population, freshwater runoff, or temporary malfunctioning of waste treatment facilities are classified as "Conditionally Approved." Waters found to be contaminated, or suspected of being contaminated, which would produce shellfish unsafe for human consumption are classified as "Closed to Commercial Shellfish Harvesting."

Assessing water quality in marine water is a difficult, time-consuming and expensive task due to the complexities of tidal variations, fluctuating currents and unpredictable mixing patterns. However, the condition of shellfish such as oysters, clams, and mussels can be used to assess marine water quality. Shellfish concentrate disease-causing bacteria and viruses as well as toxic chemicals, radionuclides, and biotoxins from the waters in which they live. Since shellfish reflect concentrations of domestic, industrial, and agricultural wastes, they can be used as practical long-term indicators of water quality and the effectiveness of pollution control efforts at specific locations.

OREGON'S MARINE WATERS

Approximately 28,100 acres of commercial shellfish growing waters in the State of Oregon have been classified by the Oregon State Health Division (Figure 20) as growing areas which meet specific microbiological, chemical, and toxicological criteria.

Only those areas where sanitary surveys have been conducted and classifications have been made are included in this report. Twenty-five percent (7,080 acres) of the areas surveyed are currently classified as "Approved for Commercial Harvesting," 28 percent (7,960 acres) are "Conditionally Approved," and shellfish in 47 percent (13,300 acres) are considered to be unsafe for human consumption.

Coos Bay, Tillamook Bay, and Yaquina Bay are the most important shellfish growing waters in the State. Most of these waters are either closed or conditionally approved for the commercial harvest of shellfish. Only a small portion of Coos Bay (South Slough) is classified as approved. Restrictions on shellfish harvesting result primarily from high bacterial levels due to municipal sewage treatment plant discharges or seasonal increases in freshwater runoff from agricultural and logging areas.

A REGIONAL OVERVIEW

A total of 349,300 acres of commercial shellfish growing area (Figure 21) has been classified by agencies in Oregon, Washington, and Alaska. This represents approximately two percent of the classified growing waters in the nation. Seventy-three percent of the regional growing area (254,100 acres) is classified as approved; nine percent (32,900 acres) conditionally approved; and 18 percent (62,300 acres) closed.

Most of the closed growing areas are due to fecal contamination or the great potential for such contamination resulting from nearness to municipal sewage treatment facilities serving populated areas. The conditionally approved areas are primarily characterized by excessive fecal contamination occurring as a result of seasonal increases in freshwater runoff from agricultural and logging activities, as well as the occasional malfunctioning or bypassing of sewage treatment plants.

Population growth and associated sewage wastes appear to pose the greatest threat to approved shellfish growing areas in Region 10. Because of the small size of Oregon's shellfish industry and the generally undeveloped nature of Alaska's clam resources, changes in Washington State's shellfish growing area classification would probably have the greatest regional economic impact. The effect of reductions in the size of Washington's approved growing area may be mitigated by the industry's ability to maintain current production levels on somewhat less acreage. Nevertheless, the closure of key growing areas in southern Puget Sound or Willapa Bay would have an immediate adverse impact.

FIGURE 20

MARINE WATERS OF OREGON
STATUS OF CLASSIFIED SHELLFISH GROWING AREAS

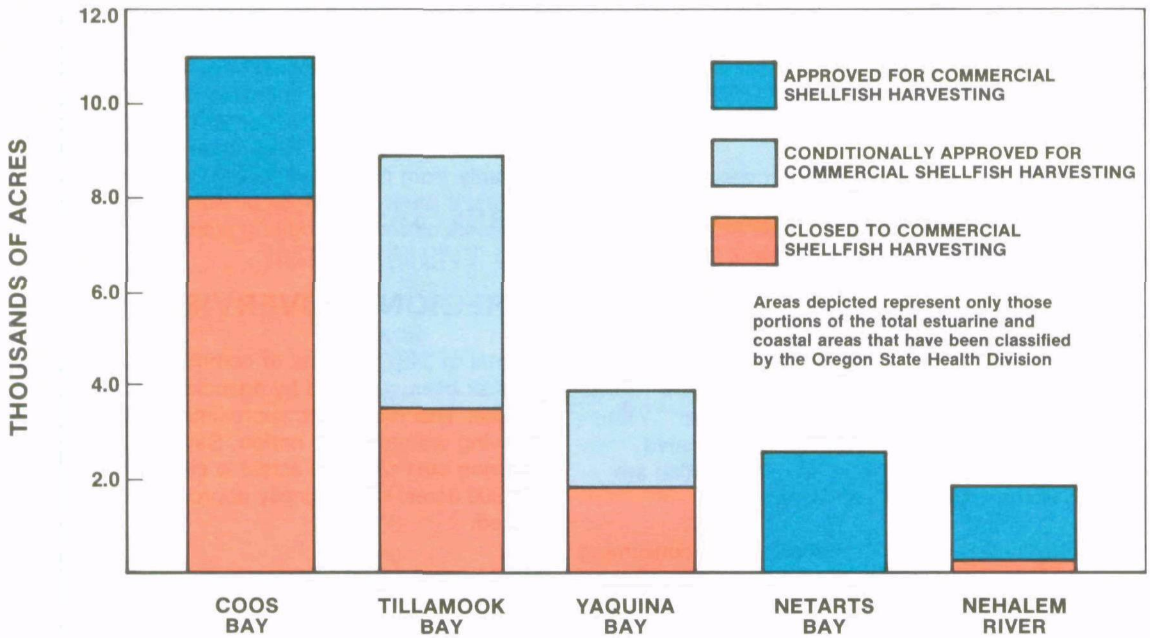
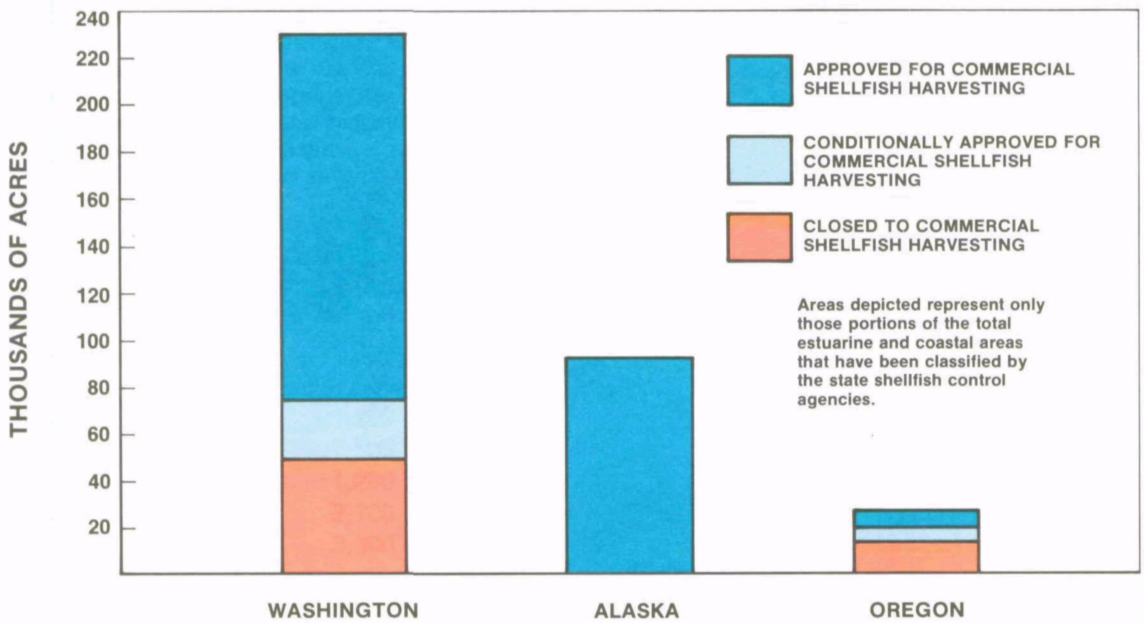


FIGURE 21

MARINE WATERS OF REGION 10
STATUS OF CLASSIFIED SHELLFISH GROWING AREAS



OREGON DRINKING WATER

The drinking water coming into most homes in the Northwest today is generally considered safe, mainly because of the high standards set by public water supply systems. However, potential contamination of drinking water supplies by the careless use of chemical compounds and the unsafe disposal of toxic wastes requires vigilance.

In 1974, the United States Congress enacted the Safe Drinking Water Act. The Safe Drinking Water Act requires EPA to establish national drinking water quality standards. EPA has the primary responsibility for establishing the standards, and the states are responsible for implementing programs to ensure the standards are being met. The State of Oregon does not currently have a drinking water supervision program, so this leaves EPA also with the responsibility for implementing the national standards in the State.

The national drinking water standards contain maximum allowable levels for various contaminants and require water systems to monitor (sample and analyze) their water on a periodic basis for determining compliance with these contaminants.

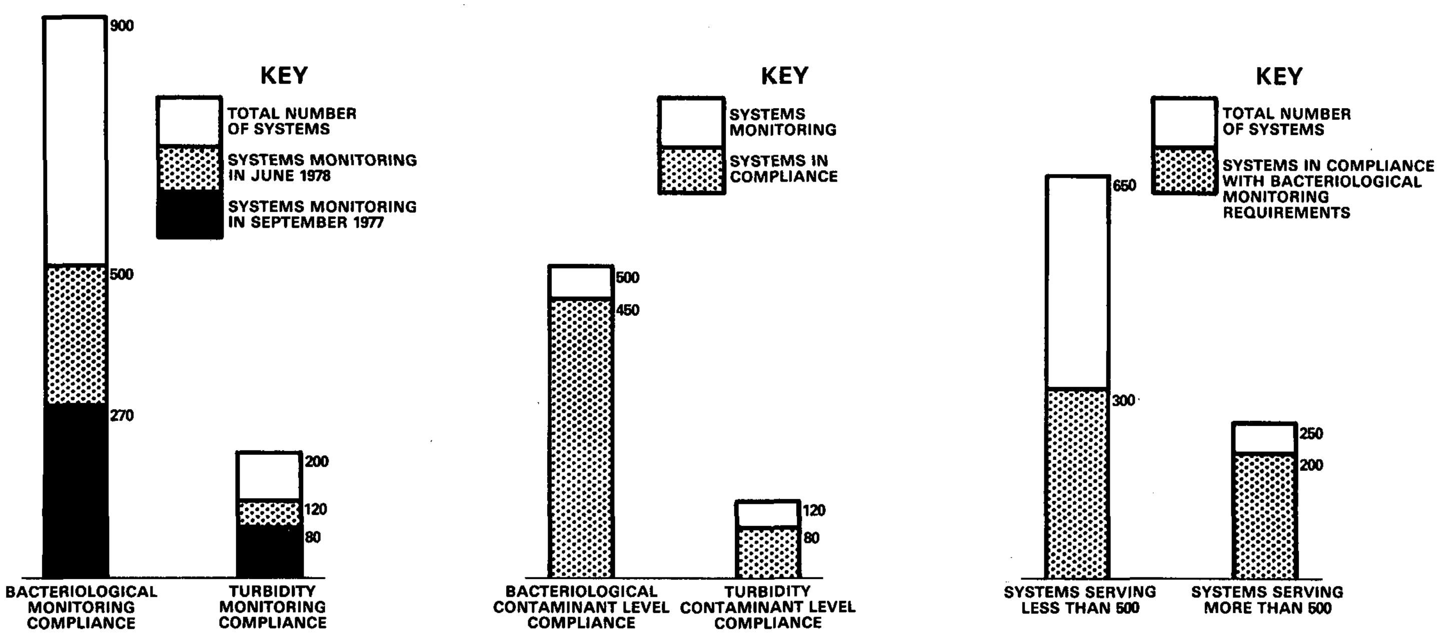
The national standards went into effect in June 1977 and bacteriological and turbidity monitoring was required to commence at that time. All of the State's 900 community water systems are required to monitor for bacteriological contamination. Compliance with this requirement is increasing as shown by data presented in Figure 22-A. The State's 200 community water systems which utilize surface water sources are also required to monitor for turbidity. As with bacteriological monitoring, compliance with this requirement is increasing, as shown in Figure 22-A.

A complete evaluation to determine Oregon water systems' ability to meet the contaminant levels cannot be made until all drinking water systems perform their required monitoring. The water systems which are presently monitoring for bacteriological and turbidity contaminants are largely in compliance with the contaminant levels. This information is presented in Figure 22-B.

As is the case in most states, smaller drinking water systems experience more obstacles in achieving compliance with drinking water regulations. This is attributable to many factors, including limited financial capabilities and difficulties in obtaining qualified operators. Since the majority of the State's larger public water systems are now in compliance with the regulations, additional regulatory follow-up is being initiated with the smaller systems. A breakdown by water system size for compliance with bacteriological monitoring is shown in Figure 22-C.

FIGURE 22

OREGON DRINKING WATER STATUS



A

COMPLIANCE WITH BACTERIOLOGICAL AND TURBIDITY MONITORING REQUIREMENTS

B

COMPLIANCE WITH BACTERIOLOGICAL AND TURBIDITY CONTAMINANT LIMITS THROUGHOUT THE PERIOD JULY 1977 - JUNE 1978

C

COMPLIANCE WITH BACTERIOLOGICAL MONITORING REQUIREMENTS BY WATER SYSTEM SIZE - JUNE 1978

NOISE

Sound, so vital a part of our existence, is growing to such disagreeable proportions within our environment today that it is a very real threat to health. The problem is not limited to occupational noise and hearing loss, but also includes community noise, which affects us physiologically and psychologically by causing nervousness and tension.

In view of these facts, Congress passed the Noise Control Act of 1972 which gives EPA authority to set standards on new products that are major sources of noise (cars, trucks, etc.) and existing noise sources which need national uniformity of treatment (interstate railroads, trucks and aircraft).

However, the primary responsibility for control of noise rests with State and local governments.

Technical assistance is available from EPA in areas such as: developing model legislation; reviewing proposed legislation and regulations; and training of State and local officials in writing laws and ordinances and in noise enforcement measurement techniques. EPA has thus far provided assistance to Oregon and Washington in developing noise regulations, assistance to the cities of Anchorage, Seattle and Portland in developing noise control ordinances, and in the monitoring of noise levels from railroad locomotives, ferries and auto and motorcycle racetracks.

Oregon has adopted statewide noise control regulations designed to limit levels of exposure from environmental noise sources such as commercial or industrial facilities, and to limit the noise emission levels of motor vehicles. Trucks, motorcycles, recreational vehicles, racing vehicles, and warning devices are some of the other noise sources controlled by these regulations.

Portland has a noise ordinance intended to regulate maximum environmental noise levels and levels of noise emission from other vehicles. The ordinance establishes a specific program with authority delegated to a Noise Control Officer and a Noise Review Board. Other noise sources addressed by the ordinance include home equipment and power tools, watercraft, motor vehicle racing, noisy animals and construction activities.

Figure 23 indicates the percent of Oregon's population covered by noise ordinances, while Figure 24 shows the same information for the Region as a whole. Neither of these charts reflect the effectiveness with which the ordinances are implemented or enforced.

FIGURE 23

PERCENT OF OREGON POPULATION COVERED BY NOISE ORDINANCES

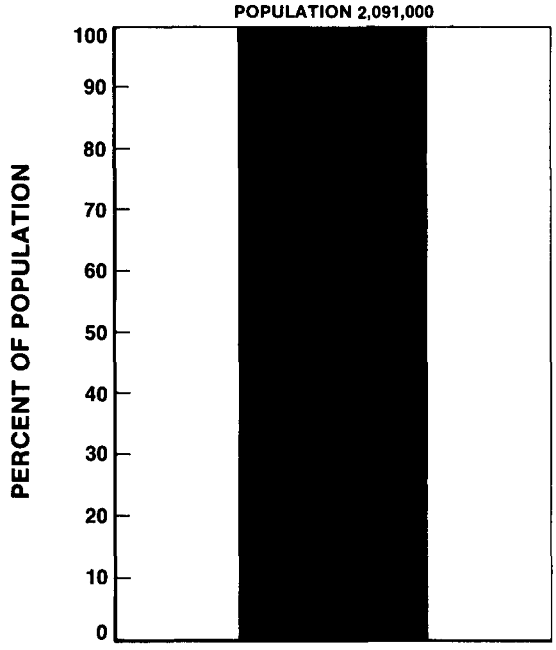
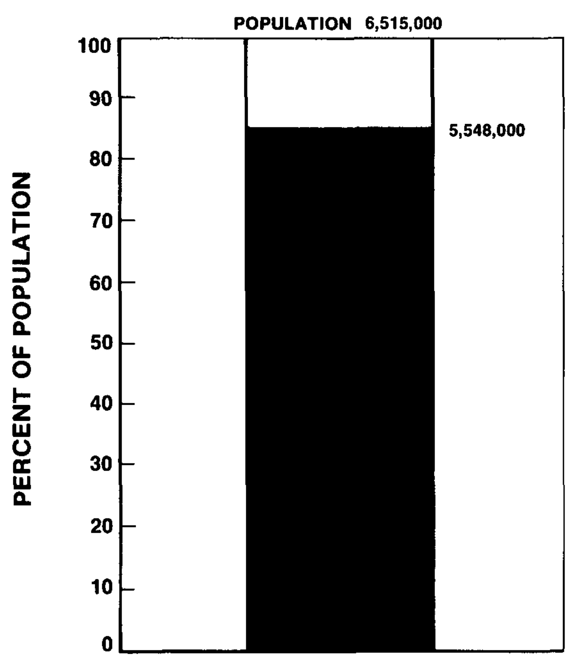


FIGURE 24

REGION 10 POPULATION COVERED BY NOISE ORDINANCES



SOLID WASTE

Waste management deals with problems ranging from health and environmental hazards to the efficiency of collection operations. The diverse nature of wastes (dead animals, mercury-rich industrial sludges, dredge spoils, abandoned cars, septic tank pumpings, residential solid waste, infectious hospital wastes, demolition, debris, feedlot wastes, etc.) makes the challenge of waste management as complex as its sources.

Improper disposal methods can pollute the land, air or water. For example, burning dumps contribute to air pollution and some disposal sites, especially west of the Cascade Mountains, are so situated that leachate and drainage waters aggravate the pollution of rivers and streams.

The long-term solution to solid waste management problems lies in the development of systems that will wisely control the quantity and characteristics of wastes. This can be done by efficient collection, creative recycling, recovering energy and other resources, and properly disposing of wastes that have no further use. In the near term, the development of environmentally acceptable methods of disposal on land is stipulated by Federal law as a national goal.

One method of measuring progress in this area is to determine the number of people served by adequate disposal sites. Figure 25 presents this information for the years 1971 through 1976. In 1976, some 1,631,000 people or 78 percent of Oregon's population were being served by State-approved solid waste disposal sites. This is an increase of 460 percent in five years.

Resource recovery is also beginning to be implemented within the State with facilities being planned or under construction in Coos County, Lane County, the Portland area, Tillamook County and Union County for the development of solid waste recycling facilities. Figure 26 shows the status and location of resource recovery projects in Region 10.

Disposal of hazardous wastes in Region 10 is becoming a significant problem. Currently there are two State-licensed disposal facilities within the region, one in Idaho and the other in Oregon.

Under new Federal legislation (The Resource Conservation and Recovery Act) only sites which meet EPA or equivalent standards will be able to receive hazardous wastes for disposal.

FIGURE 25

PERCENT OF POPULATION SERVED BY STATE-APPROVED SOLID WASTE DISPOSAL FACILITIES

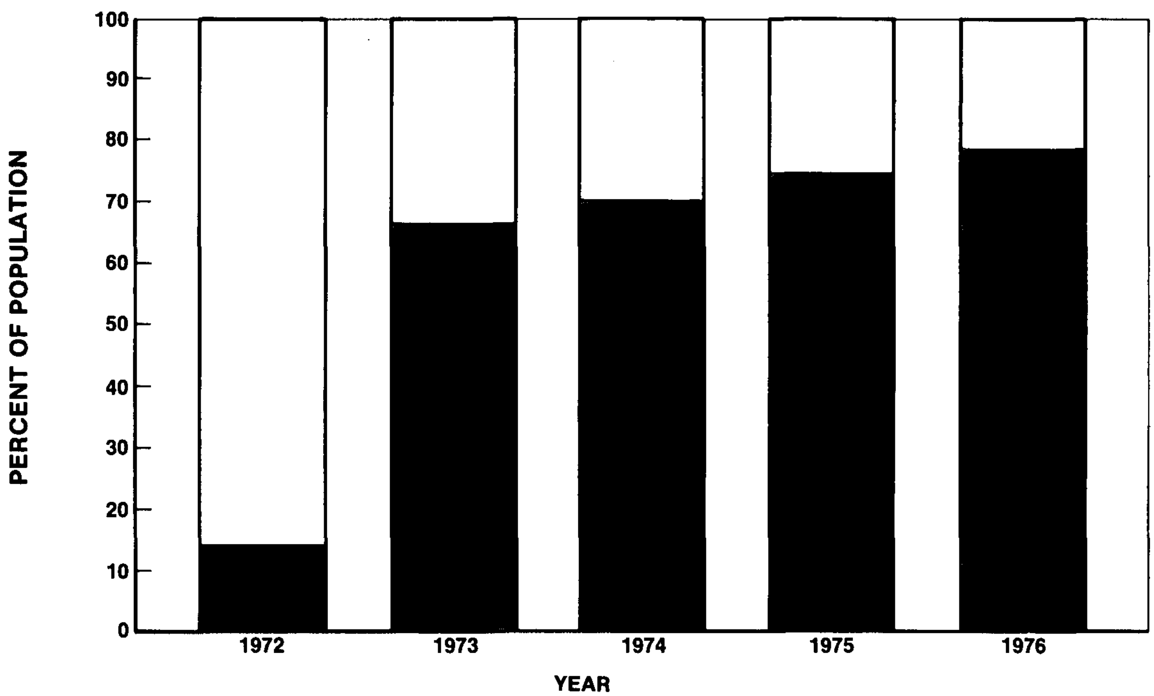
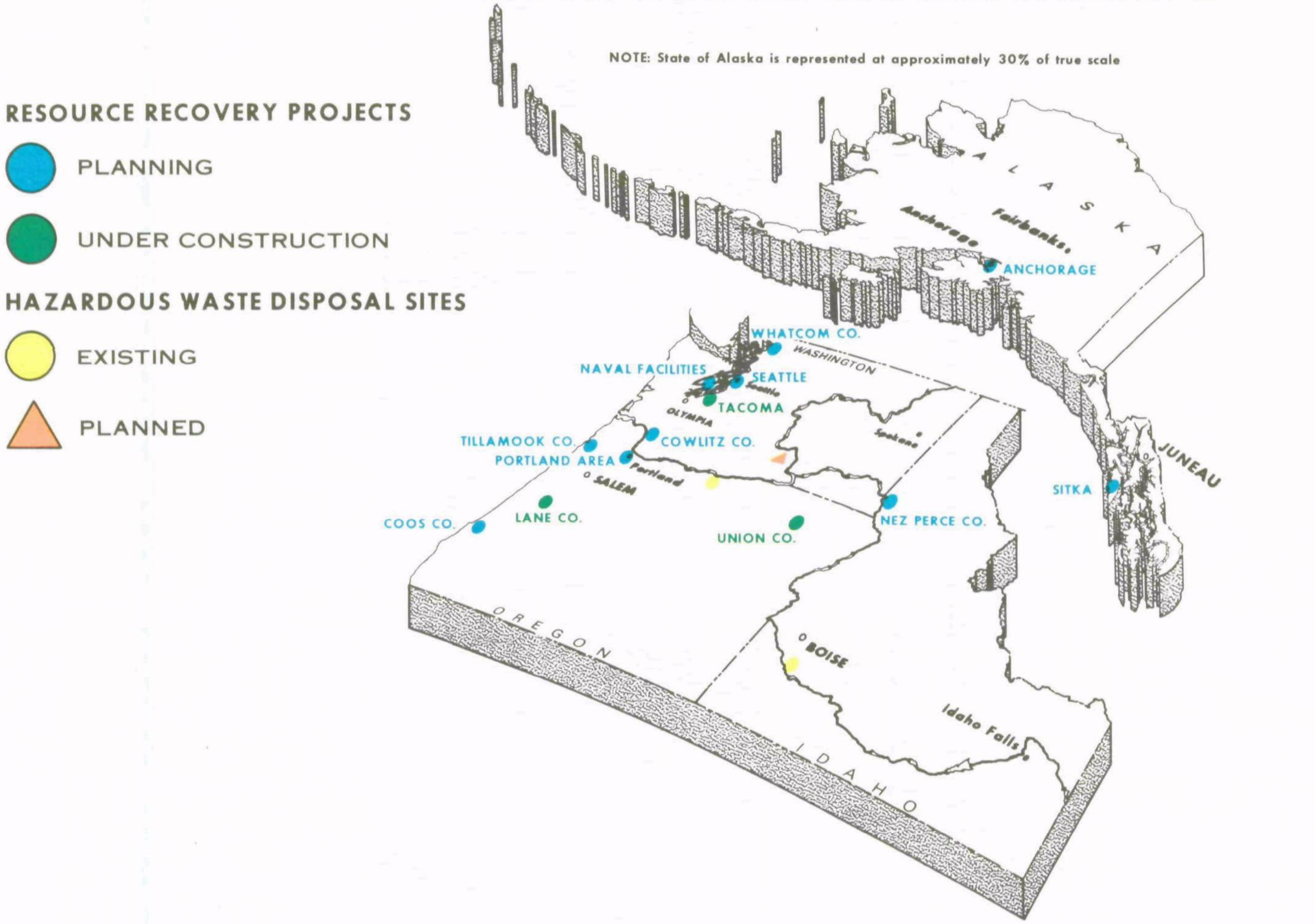


FIGURE 26
STATUS OF RESOURCE RECOVERY PROJECTS AND HAZARDOUS WASTE DISPOSAL SITES IN REGION 10



HAZARDOUS SUBSTANCES

Chemicals are pervasive in our environment. They are in our food, water and air. While chemicals are beneficial, some may produce long term, adverse effects if allowed to enter the environment improperly.

The need for vigilance in the Pacific Northwest is highlighted by the following:

- Lead levels in a school yard in Kellogg, Idaho were so high, that soil had to be removed.
- Arsenic from a copper smelter near Tacoma, Washington is suspected to be responsible for increased lung cancer in smelter workers.
- A spill of copper concentrate into the Nisqually River resulted in severe damage to fishery on this major Washington river.
- A ruptured transformer spilled over 250 gallons of the dangerous chemical Polychlorinated Biphenyl (PCB) into the Duwamish River in Seattle, and approximately 800 establishments in Region 10 currently use PCB containing transformers or capacitators.

Of increasing concern is the possible relationship between some chemicals and cancer. The American Cancer Society reports that at least 75% of the cancers in people are induced by factors in the environment.

Recent Federal legislation has addressed the hazardous substances problem. The Toxic Substances Control Act (TSCA) provides for controlling the manufacture, processing, distribution, use and disposal of chemicals. The Resources Conservation and Recovery Act provides for proper disposal of hazardous waste. These laws, combined with other EPA legislative responsibilities, should reduce the potential for future adverse impacts.

EPA is developing a strategic plan which will focus the Region's attention on high priority chemicals. Following the identification of chemicals manufactured and used in the Region, impacts and methods of control will be assessed. The strategy will utilize Federal, state and local control measures.

This report has addressed environmental quality along media lines—air, water, noise and solid waste. Increasingly, actions taken in each of these areas must consider the impacts of hazardous materials. For example, higher levels of treatment of air and water waste discharges generate increased volumes of sludges and other solid wastes for disposal on land. These sludges contain toxic and hazardous materials as a result of new discharge restrictions and pretreatment requirements for industries discharging to municipal wastewater treatment systems.

Data to define the nature and extent of environmental problems in the Northwest resulting from toxic and hazardous chemicals are lacking; however, EPA is currently gathering data to depict the extent of the problem.

SUMMARY

Air Quality: Violations of air quality health standards in Oregon involve carbon monoxide, photo-oxidants, and particulate matter.

For **carbon monoxide**, the private automobile is responsible for more than 90 percent of the emissions in counties where the standards are not being met. The Portland Inspection and Maintenance Program has been successful in reducing emissions but additional efforts are needed. Carbon monoxide emissions will be reduced through improved vehicle maintenance, by reducing peaks in traffic and congestion in high density traffic corridors, by reducing the total miles driven, and through the increasing prevalence of emission control equipment on vehicles in use. While further improvements in **particulate matter** pollution from industrial sources can be obtained from relatively reliable and inexpensive control equipment, fugitive dust is responsible for a large share of Oregon's problem in this area. **Photo-oxidants** result in part from emission of hydrocarbons. Improvements lie in reducing hydrocarbon emissions from vehicles and in reducing the amount of evaporation in the handling of gasoline and solvents.

Overall, Oregon's air quality appears to be improving. The majority of the counties of the State have showed declining air quality standards violations in recent years.

River Water Quality: The most common water quality violations in Oregon deal with temperature, dissolved oxygen, bacteria, suspended and dissolved solids, and excessive nutrient concentrations. These problems occur mostly in eastern Oregon streams and near high population centers throughout the State. Toxic concentrations of heavy metals also occur in several rivers of the State.

With a few exceptions, the major water quality problems in Oregon do not stem from municipal and industrial waste discharges, which in the past were the primary focus of water pollution abatement programs. Water pollution in rivers and streams in the State results from intense land and water use, reservoir conditions, and natural runoff. Waste treatment is already well advanced in the State. Measures to reduce the water quality impacts from runoff, stream regulation, and improper land management largely remain to be defined, although initial efforts are underway.

The major task in Oregon at this time is to protect and preserve the excellent water quality that exists in most bodies of water in the State, while implementing long-term programs to improve water quality in the remaining waters.

Lake Water Quality: Lake eutrophication occurs naturally but is accelerated by man's activities. It is estimated that of the fifteen lakes and reservoirs in Oregon which have at least ten square miles of area, five are eutrophic and two are on the way toward being so. Of the thirty most used recreational lakes in the State, four have at least a moderate degree of impairment. Both eutrophic conditions and use impairment correlate closely with the degree of land use in the vicinity of the lake or the existence of intense recreational use. Implementation of improved land management practices is needed to ensure future good lake water quality.

Marine Water Quality: Coos Bay, Tillamook Bay and Yaquina Bay are the most important shellfish growing areas in the State. Most of these waters are either closed or conditionally approved for the commercial harvesting of shellfish. Overall, of the total waters classified for purposes of shellfish harvesting, 47 percent are currently considered to be unsafe for human consumption and another 28 percent are conditionally approved subject to varying conditions throughout the year. Population growth and associated sewage waste appear to pose the greatest threat to marine waters throughout the Northwest.

Drinking Water: The State of Oregon does not currently have a drinking water supervision program. Therefore, EPA is taking the responsibility for implementing national standards. As of June 1978, 55 percent of Oregon's community water systems were monitoring for bacteriological contamination, up from 30 percent the previous year. Of those monitoring, 90 percent were in compliance with bacteriological contaminant limits. Water systems utilizing surface water sources are also required to monitor for turbidity. Sixty percent are currently monitoring for turbidity, with 70 percent in compliance with contaminant limits.

Noise: The State of Oregon has adopted statewide noise control regulations for commercial and industrial sources and motor vehicles, based on objective standards of sound intensity. The City of Portland has similar standards in addition to regulations for residential noise sources.

Solid Waste: About 80 percent of the State's population is currently being served by solid waste disposal methods which are non-polluting. This represents a dramatic increase in the last few years. Resource recovery projects are in planning or construction stages in a number of areas in the State.

Hazardous Substances: Nearly every area of environmental quality just summarized is impacted by the use of chemicals. New laws and regulations have resulted from public concern over the adverse health and environmental effects of hazardous substances; however, it is an area in need of better data, research and integrated control efforts.

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