1-1980

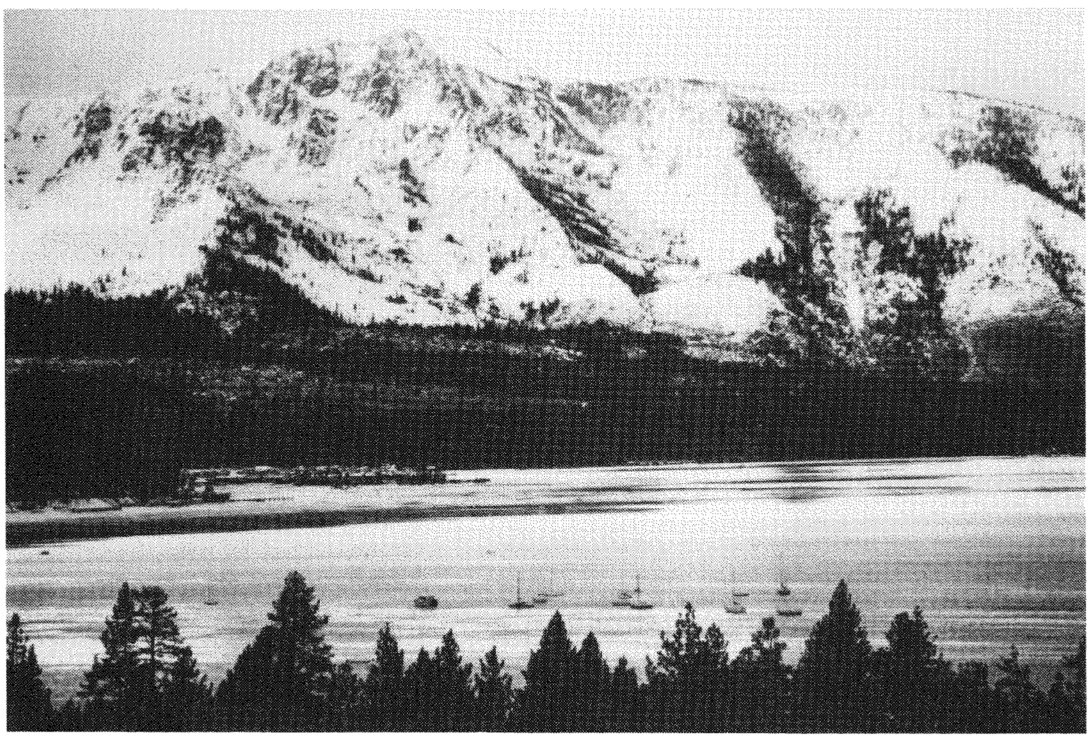
Draft Water Quality Control Plan: Lake Tahoe Basin

State Water Resources Control Board

DRAFT

WATER QUALITY PLAN:

LAKE TAHOE BASIN



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STATE Of CALIFORNIA

STATE WATER RESOURCES CONTROL BOARD

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CHAPTER I

INTRODUCTION

Lake Tahoe is extraordinarily clear and pure. It is possible to see down to depths of over 120 feet. Extremely low rates of algal growth in the Lake impart a deep blue color, unsurpassed by any lake in the world.

The federal Clean Water Act requires that the existing, high quality of the waters of Lake Tahoe be preserved. The purpose of this plan, prepared under Section 208 of the Act, is to adopt and provide for implementation of the control measures needed to prevent deterioration of Lake Tahoe water quality. After receiving public comments on the draft, the California State Water Resources Control Board will adopt a final Lake Tahoe Basin Water Quality Plan.

Before submitting the final plan to the Environmental Protection Agency, the State Board will seek to have a plan adopted for both the Nevada and California sides of the Lake. The State Board will inform the bi-state Tahoe Regional Planning Agency of the conditions required for the State Board to approve a plan submitted by the bi-state agency. If the Tahoe Regional Planning Agency fails to adopt an adequate plan, the plan adopted by the State Board will take effect.

Steep slopes, erosive soils, and a short season for disturbed vegetation to become reestablished make the Lake Tahoe Basin acutely sensitive to human activities. Development practices which may have little impact elsewhere can cause severe erosion in the Basin, increasing sediment and nutrient loads on the Lake. Relatively small nutrient loadings can seriously affect Lake Tahoe water quality. The level of algal growth in the Lake is limited by the availability of nutrients, and the concentration of nutrients in the Lake at present is extremely low. The primary source of additional nutrients is erosion resulting from land development and land management practices.

Rapid development in the Basin over the past two decades is causing a deterioration of the water quality of the Lake. The rate of algal growth in the open waters of the Lake has doubled, and there has been an increase in the growth of attached algae in nearshore waters. Further increases in algal growth could change the clear blue color of the Lake.

The changes in water quality which have been observed do not reflect the full impact of the increases in erosion rates caused by recent development. There is a long lag time between disturbances in the Basin and changes in the Lake. Increased nutrient loading rates exert their full effect through a gradual buildup of nutrient concentrations over many years. Thus, preventing future increases in erosion rates will not be enough to protect the water quality of Lake Tahoe. A major reduction in the quantities of nutrients reaching the Lake is required.

Reducing nutrient loads will require both remedial measures to correct existing erosion problems and strict controls on future development. The principal control measures are:

- Erosion and urban runoff control projects -- Projects to revegetate areas stripped of vegetation, stabilize roadway slopes, and install drainage control facilities are needed to correct severe erosion problems caused by poor development practices of the past.

- On-site surface runoff control measures -- Runoff from specific areas in the Basin, especially large parking lots and other areas intensively used by automobiles, is high in pollutants. Both maintenance practices and installation of proper drainage systems are needed to reduce the discharge of pollutants from these sites.

- Controls on Development -- Any development in the Basin will cause some erosion, but if strict controls are imposed some additional development can be allowed without impeding efforts to protect water quality. Development must be limited to existing subdivisions. In addition, construction must not be permitted on high erosion hazard lands or in streams, meadows, or other areas influenced by stream flows. The amount of impervious surface and surface disturbance must be limited to be consistent with land capability.

- Forest Practices -- Measures must be adopted to control erosion from forest lands, especially erosion from dirt roads.

Table I-1 summarizes the necessary control measures, and how this plan proposes to implement them. Many of the control measures can best be implemented by local government or through regional planning agencies, but the State Water Resources Control Board is ultimately responsible for implementation of the plan. To the extent that other agencies do not make implementation commitments, the State Board will carry out the plan.

The State Water Resources Control Board strongly supports creation of a land purchase program to help implement the restrictions on development set by the plan. The controls on development set under this plan will make a large number of vacant lots unsuitable for development. Roughly 12,000 of the 16,000 vacant lots on the California side of the Basin could not be used for residential or commercial construction. Establishment of a land purchase program, as through the creation of a National Scenic Area, could prevent development which threatens to damage water quality while eliminating the financial impact of regulation on landowners. After receiving public comments on this draft, and preparing its final water quality plan, the State Water Resources Control Board will propose and urge enactment of the legislation necessary to create a land purchase program for the Lake Tahoe Basin. Implementation of the water quality plan must not be delayed pending adoption of a land purchase program, however. State and federal law authorize the State Water Resources Control Board to implement the plan, and a water quality plan must provide for implementation.

TABLE I–1

SUMMARY OF LAKE TAHOE BASIN 208 PLAN

WATER QUALITY PROBLEM	SOLUTION	RESPONSIBILITY	PRIMARY AUTHORITY to ENFORCE CONTROLS	BACKUP AUTHORITY (If no commitment from agency with responsibility or primary authority)
EROSION and URBAN RUNOFF • bare areas • unstable roadway slopes • dirt roads • eroding roadside ditches and shoulders • concentrated runoff	EROSION and DRAINAGE PROJECTS • revegetate bare areas • stabilize and revegetate slopes • provide protective cover on dirt roads • build roadside drains • storm sewers	CITIES and COUNTIES (with assistance from state and federal grants, including $10 million in state bond funds) STATE TRANSPORTATION DEPARTMENTS (highways) FOREST SERVICE (National Forest Lands) PRIVATE LANDOWNERS	CITIES and COUNTIES REGIONAL PLANNING AGENCIES • Tahoe Regional Planning Agency • California Tahoe Regional Planning Agency FOREST SERVICE (Special Use Permits)	WATER QUALITY AGENCIES • State Water Resources Control Board • Lahontan Regional Water Quality Control Board • Nevada Division of Environmental Protection
ON-SITE RUNOFF PROBLEMS • areas of intensive vehicular use • unsurfaced private roads and driveways • snow disposal facilities • construction sites • golf courses	ON-SITE RUNOFF CONTROLS • drainage facilities • protective cover • best management practices	LANDOWNER	CITIES and COUNTIES REGIONAL PLANNING AGENCIES FOREST SERVICE (Special Use Permits)	WATER QUALITY AGENCIES
ADDITIONAL DEVELOPMENT CREATING EROSION and RUNOFF PROBLEMS	DEVELOPMENT RESTRICTIONS • no new subdivisions • construction prohibited – on high erosion hazard land – in stream environment zones – in excess of land capability • best management practices required for permitted construction	LANDOWNER	CITIES and COUNTIES REGIONAL PLANNING AGENCIES	WATER QUALITY AGENCIES
EROSION on FOREST LANDS • dirt roads • off-road vehicle use • campgrounds • ski resorts • tree removal • livestock grazing and confinement	FOREST PRACTICES • close and revegetate unneeded dirt roads • restrict off-road vehicles to designated areas and trails • best management practices for campgrounds, ski areas, tree removal and livestock grazing and confinement • restrictions on campground and ski area expansion	PRIVATE LANDOWNERS FOREST SERVICE (National Forest Lands)	CITIES and COUNTIES REGIONAL PLANNING AGENCIES FOREST SERVICE (Special Use Permits)	WATER QUALITY AGENCIES

The State Water Resources Control Board cannot assure that control measures are implemented in Nevada, but the State Board still must implement the plan in California. If the plan is implemented in California, the total level of sediment and nutrient generation can be reduced, even if Nevada does not adopt equally strict controls.

If this plan is implemented on both sides of the Lake, it will achieve a major reduction in sediment and nutrient loadings. The control measures to be adopted are strict, but only by achieving a major reduction in erosion problems can Lake Tahoe be protected against further deterioration. Full implementation of this plan is essential to assuring that Lake Tahoe's extraordinary water quality is preserved for future generations.

CHAPTER II

THE LAKE TAHOE ENVIRONMENT

A. WATER QUALITY

1. General Features of the Lake Tahoe Basin

"... at last the Lake burst upon us -- a noble sheet of blue water lifted six thousand three hundred feet above the level of the sea, and walled in by a rim of snow-clad mountain peaks that towered aloft full three thousand feet higher still! It was a vast oval... As it lay there with the shadows of the great mountains brilliantly photographed upon its surface, I thought that it must surely be the fairest picture the whole earth affords."
Mark Twain, Roughing It, 163 (University of California Press 1972).

The outstanding clarity and deep blue color of Lake Tahoe stem from low nutrient levels, which limit algal growth. Geology, soils, vegetation, and the activities of man profoundly influence the rate of nutrient input to the waters of the Lake Tahoe Basin and thus determine the quality of the Lake and its tributaries.

Lake Tahoe occupies a deep depression between the Sierra Nevada and Carson ranges. At 6,225 feet, it is one of the largest high-altitude lakes in the world, surrounded by a relatively small watershed of steeply sloping terrain. The Lake Tahoe Basin formed approximately three million years ago as a block of the earth's crust dropped between two adjacent fracture zones. Three waves of glaciation, the most recent only 10,000 years ago, helped form the rugged topography of the Basin.

Precipitation is more intense on the western slopes of the Basin. Average annual precipitation is approximately 40 inches (measured as rain) on the western shore of the Lake, compared to 20 inches along the eastern shore. Summers are dry, except for sporadic thunderstorms. Most of precipitation occurs as snowfall between late fall and early spring. Sixty-three watersheds convey water to the Lake via stream and groundwater flows. Stream flow is seasonal. Runoff peaks during the spring snowmelt.

The summers are generally cool. Mean maximum temperature at Tahoe City is 78°F. Winters are cold but seldom severe. The growing season is limited by the number of frost-free days, which ranges from 70 to 120 days per year at various points near the Lake.

Vegetation includes herbaceous plants, mountain meadows, riparian growth, montane chaparral, and extensive coniferous forests. The protective cover provided by this vegetation prevents soil erosion. Vegetation also collects sediment and absorbs dissolved nutrients in surface runoff which would otherwise be carried to the Lake.

Riparian vegetation and lowland meadow and marsh plants are particularly effective nutrient and sediment traps.

Relatively little erosion occurs under natural conditions. Poor development practices vastly increase the amount of erosion. The natural balance is easily upset and difficult to restore. Basin soils are generally shallow and highly erodible. Steep slopes and peak seasonal surface water runoff add to the erosion hazard. Once soils are stripped of protective vegetative cover, rapid erosion occurs. The short growing season limits the rate of revegetation.

Erosion threatens water quality. Increased soil erosion greatly increases the quantity of nutrients carried by surface runoff, increasing algal growth throughout the Lake. Erosion causes turbidity of nearshore waters where streams enter the Lake. Intense erosion clogs stream beds with accumulated sediment, degrading fish spawning and feeding habitats. Increases in bank erosion and sedimentation alter both the natural stream bed and bordering vegetation.

The Basin environment was little changed by its earliest inhabitants, the Washoe Indians. The first recorded white visitors were John Fremont's exploration party of 1844.

Pine and fir forests in accessible areas were heavily logged between 1860 and 1890 when demand for lumber and props for Nevada silver mines was high. This logging almost certainly affected water quality in the Lake Tahoe Basin, but the episode of intense erosion was relatively brief. Natural regeneration restored the forests, which again serve as protective soil cover and trap sediment and nutrients in surface runoff. Even so, the rate of erosion at some sites in the Basin may still be in excess of natural conditions as a result of logging in the nineteenth century.

During the first half of the twentieth century, human activities caused little disturbance of the Lake Tahoe Basin, but rapid changes have occurred over the past twenty-five years. Before World War II, the area served as the summer vacation residence of a small number of Californians. Steadily increasing numbers of vacationers began to visit the area in succeeding years. Promotion of year-round gaming at Stateline, Nevada casinos beginning in 1955 and the growth of winter sports following the 1960 winter olympics vastly increased the influx of visitors and residents. Peak summer population, including day users, estimated at 36,400 in 1956, now exceeds 220,000.

The environmental impacts accompanying such phenomenal growth did not go entirely unnoticed or uncontrolled. In recognition of the effect of nutrients from sewage on algal growth, projects to export domestic wastewater out of the Tahoe Basin were begun in the late 1960's and are now completed.

Erosion problems are at least as great a threat to water quality -- more nutrients reach the Lake from surface runoff than were reaching the Lake as a result of sewage disposal in the Basin. In contrast to earlier logging practices, where a return to natural conditions was permitted, commercial, residential, and highway construction cause intense erosion which continues over very long periods. Paved areas and structures replace the native vegetation which would normally serve to remove nutrients from surface and groundwater flows. Increased and concentrated surface runoff presents an erosion problem as long as impervious surfaces remain in place. Continuous disturbance by human activities often retard or prevent the stabilization of disturbed areas. Effective action to control erosion caused by development of the Basin is imperative if future generations are to have the opportunity to enjoy the outstanding water quality of Lake Tahoe.

2. Water Quality Status and Trends

a. The Open Lake

"So singularly clear was the water, that where it was only twenty or thirty feet deep, the bottom was so perfectly distinct that the boat seemed floating in the air! Yes, where it was even eighty feet deep. Every little pebble was distinct, every speckled trout, every hand's-breadth of sand . . . the water was not merely transparent, but dazzlingly, brilliantly so. Every object seen through it had a bright, strong vividness, not only of outline, but of every minute detail, which they would not have had when seen simply through the same depth of atmosphere. So empty and airy did all spaces seem below us, and so strong was the sense of floating high aloft in mid-nothingness, that we called these boat-excursions 'balloon voyages'."

Mark Twain, Roughing It, 168-169.

Lake Tahoe is a water body of exceptional natural purity, one of the clearest lakes in the world (Smith, et al, 1973). Only Crater Lake in Oregon rivals Lake Tahoe for its extraordinary clarity, extremely low rates of algal growth, and cobalt-blue color.

While lakes generally contain more algae and become less transparent with age, this natural eutrophication had not proceeded to any significant extent before recent human disturbances in the Basin. The condition of the Lake may well have been at equilibrium, or was changing at an extremely low rate. The natural balance has been upset, however, and Lake Tahoe is deteriorating. Over the past 20 years, the rate of algal growth in the Lake has doubled, and the algal growth rate is increasing at an accelerating rate. If the trend continues, the the Lake's translucent blue color will be altered. Understanding the factors which control algal growth is the key to maintaining water quality. Algal growth in Lake Tahoe is limited by the availability of nutrients. Human activities in the Basin are adding nutrients to the Lake, increasing algal growth.

Table II-1 summarizes the physical and chemical conditions in the open waters of Lake Tahoe as they existed in the late 1960's and early 1970's when comprehensive studies of water quality were conducted (Dugan & McGauhey, 1974; Goldman, 1974 California-Nevada-Federal Investigation, 1975). Nutrient concentrations are very low, falling within a range where nutrient availability limits algal growth. Other water quality measures indicate excellent conditions for support of game fish and other desirable aquatic life. Dissolved oxygen levels approach and occasionally exceed saturating levels throughout the year at all depths. Hydrogen ion concentration measured by pH averages 7.6, ranging from 7.0 to 7.9. Chloride concentration is low.

A white six-inch diameter disk, a Secchi disk, is visible on an average day down to 28.5 meters, and on the clearest days to 38 meters. Table II-2 compares Secchi disk measurements for Lake Tahoe and other lakes in California. Secchi disk measurements for Lake Tahoe as well as suspended solids and turbidity readings indicate extraordinary clarity. The water is so clear that light penetration is sufficient to support algal growth within a deep euphotic zone extending to a depth of 100 meters or more.

Data reflecting the biological productivity of the open waters of Lake Tahoe from 1959 through 1978 are summarized in Table II-3. Productivity measurements reflect the growth rates of suspended microscopic algae (phytoplankton). Algal growth rates in Lake Tahoe are among the lowest of any lake in the world, as can be seen from the comparison of productivity in Lake Tahoe and other lakes shown in Figure II-1. Low rates of production result in a low density of algal cells, as is reflected in chlorophyll-a measurements.

The processes which control algal growth can be illustrated by considering the seasonal cycle of productivity in Lake Tahoe. Nutrient availability controls algal growth in late spring and summer, while light and temperature control at other times of the year. A seasonal variation in water clarity, shown by the summary of Secchi disk measurements in Figure II-2, is related to the annual cycle of phytoplankton growth and accumulation of algal cells. Algal growth can be limited by light, temperature and the availability of nutrients. Figure II-3 presents seasonal data on incident solar radiation, surface temperature nitrate nitrogen (one of the more important nutrients), within the euphotic zone, and algal primary production. During the winter low light intensity and low temperatures limit algal growth. With the approach of spring, increasing sunlight, warmer temperatures, and available nutrient supplies produce conditions which favor increased productivity. Peak seasonal productivity falls off in late spring as nutrients are depleted in the euphotic zone, well before the onset of optimum light and temperature conditions which peak in summer. In fall and winter algal growth rates are

TABLE II-1

PHYSICAL AND CHEMICAL CHARACTERISTICS OF LAKE TAHOE*

PARAMETER	APPROXIMATE VALUE
Dissolved Oxygen	8.8 mg/l 1/
Dissolved Oxygen	104 % saturation 1/
pH	7.6 1/
Suspended Solids	2.6 mg/l 2/
Turbidity	0.2 JTU 1/
Nitrate-N	13 μg/l 3/
Total Nitrogen	133 μg/l 4/
Total Phosphorus	9.3μ g/l 5/
Total Iron	20 μ g/l 6/
Chlorides	1.7 μ g/l 1/

* Abstracted from Tahoe Regional Planning Agency Draft 208 plan (July 1977). Primary Sources: 1. Dugan and McGauhey (1974); 2. McGauhey (1971); 3. Paerl, et al (1975); 4. Dugan and McGauhey (1974); McGauhey (1971). (mean value); 5. Goldman (1974); Dugan and McGauhey (1974); McGauhey (1971). (mean value); 6. Elder, pers. comm. in 1975.

TABLE II–2

COMPARATIVE WATER CLARITY
OF CALIFORNIA LAKES AND RESERVOIRS *

HIGH ALTITUDE MOUNTAIN LAKES	MEAN SECCHI DISK Depth (Meters)
Lake Tahoe	28.5
Donner Lake	11.9
June Lake	8.8
Independence Lake	7.2
Silver Lake	5.7
Gull Lake	5.6
Lake Almanor	3.4
FOOTHILL AND LOW ALTITUDE LAKES	
Lake Berryessa	4.9
Lake Shasta	4.5
Folsom Lake	4.2
Lake Don Pedro	3.1
Lake Isabella	1.5
Clear Lake	0.3

* Abstracted from the files of the California Department of Water Resources, Central District.

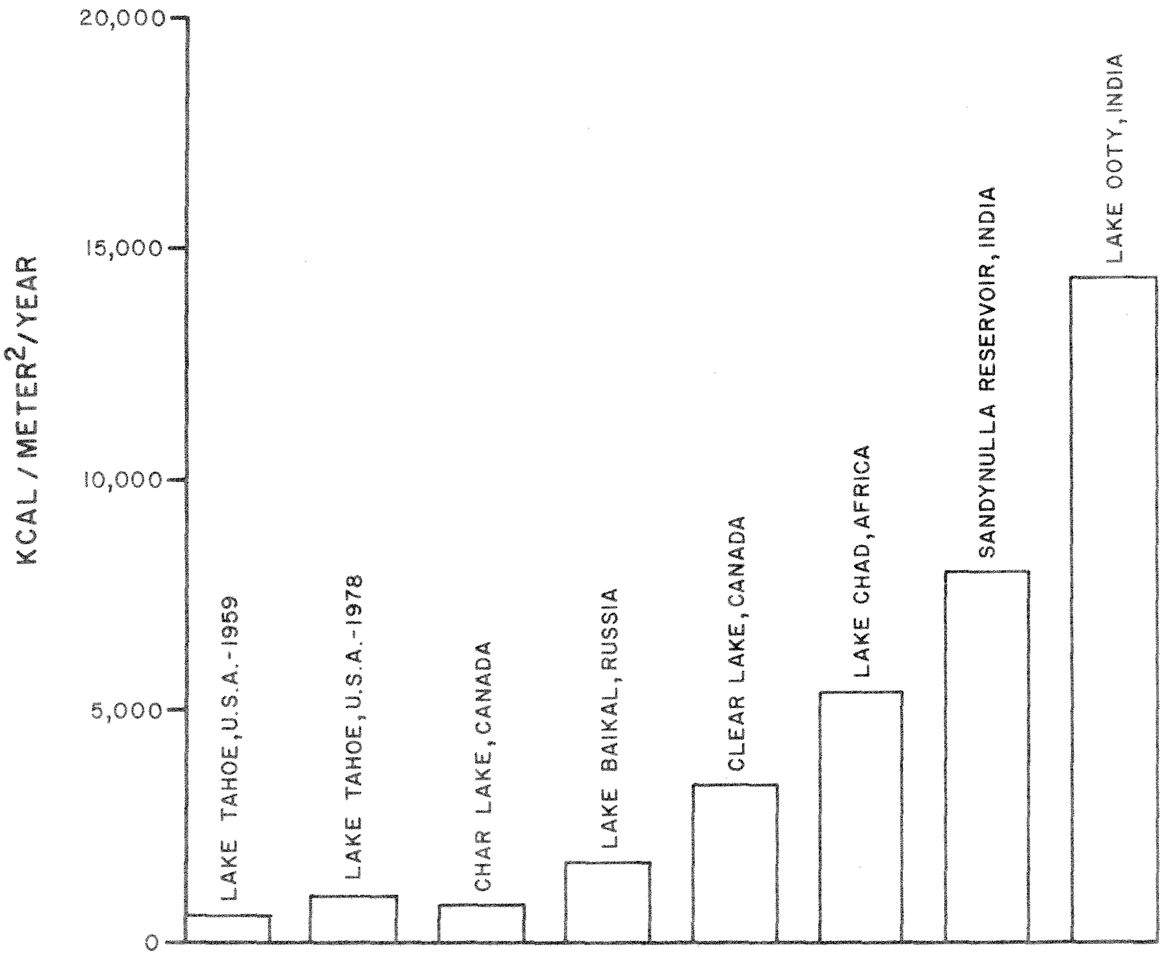
TABLE II-3

BIOLOGICAL CHARACTERISTICS OF LAKE TAHOE *

Average Photosynthetic Rate	0.18 mgC/m^3 hr
Maximum Photosynthetic Rate	0.35 mgC/m^3 hr
Average Concentration of Chlorophyll a in Upper 100 meters	0.4 mg/m^3
Depth of Maximum Photosynthetic Rate	23 meters
Maximum Extent of Photosynthesis	100 meters
Secchi Depth	26 meters
Light Extinction Coefficient	0.07 ln/meter
Algal Growth Potential	0.20 mg/m^3
Chlorophyll a	0.13 mg/m^3
Maximum Algal Growth Rate	20 %/day

* Abstracted from Tahoe Regional Planning Agency Draft 208 plan (July 1977). Primary Sources: Tilzer, J. pers. comm. in 1975; California Nevada Federal Investigation (1975).

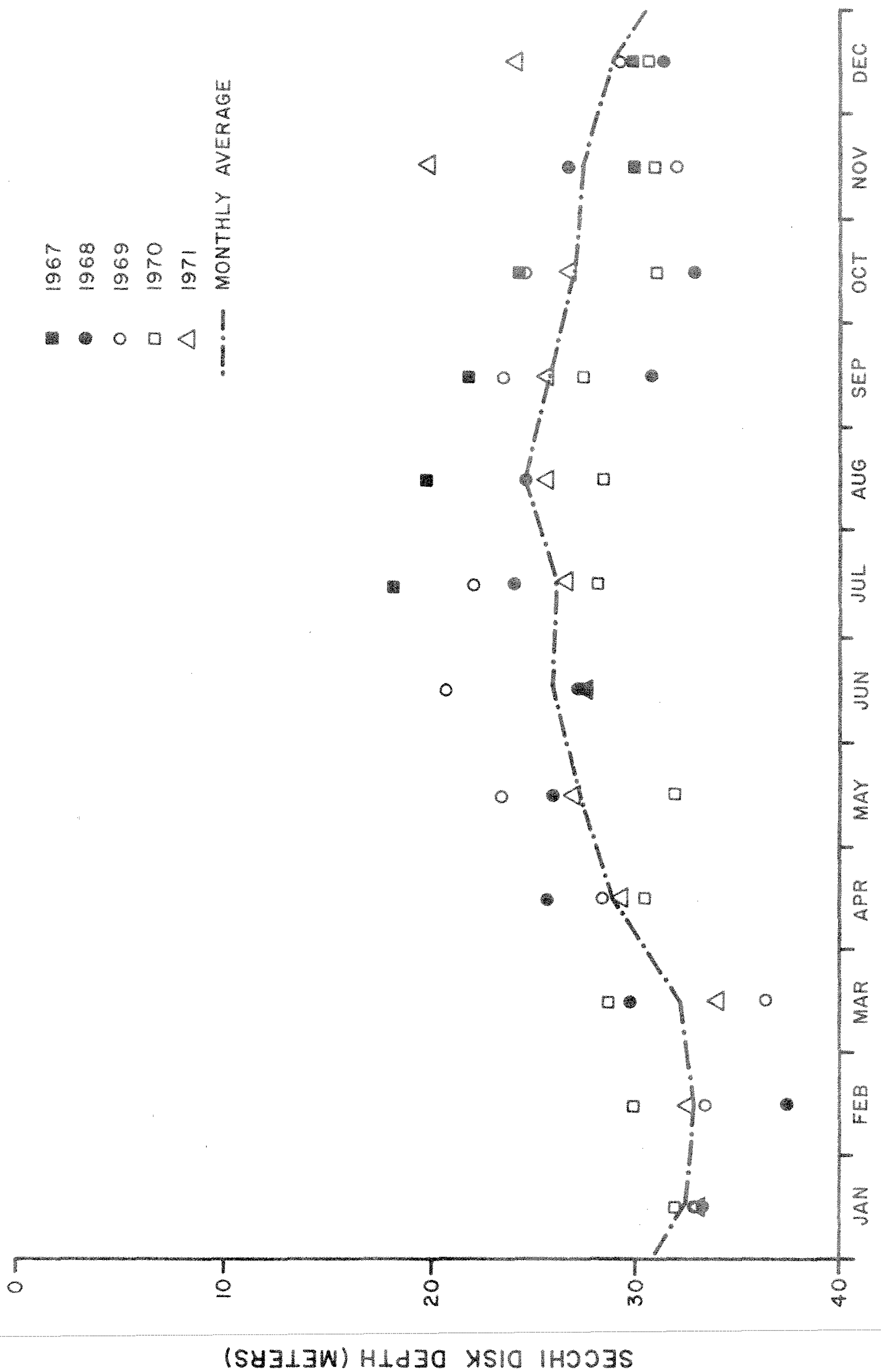
FIGURE II-I



***Lake Tahoe 1959 data (Goldman, 1974), 1978 data (Goldman, unpublished) converted to kilocalories per square meter per year by method described in Brylinsky and Mann (1973). All other data from Brylinsky and Mann (1973).**

The Primary Productivity of Lake Tahoe
Compared with other Water Bodies *

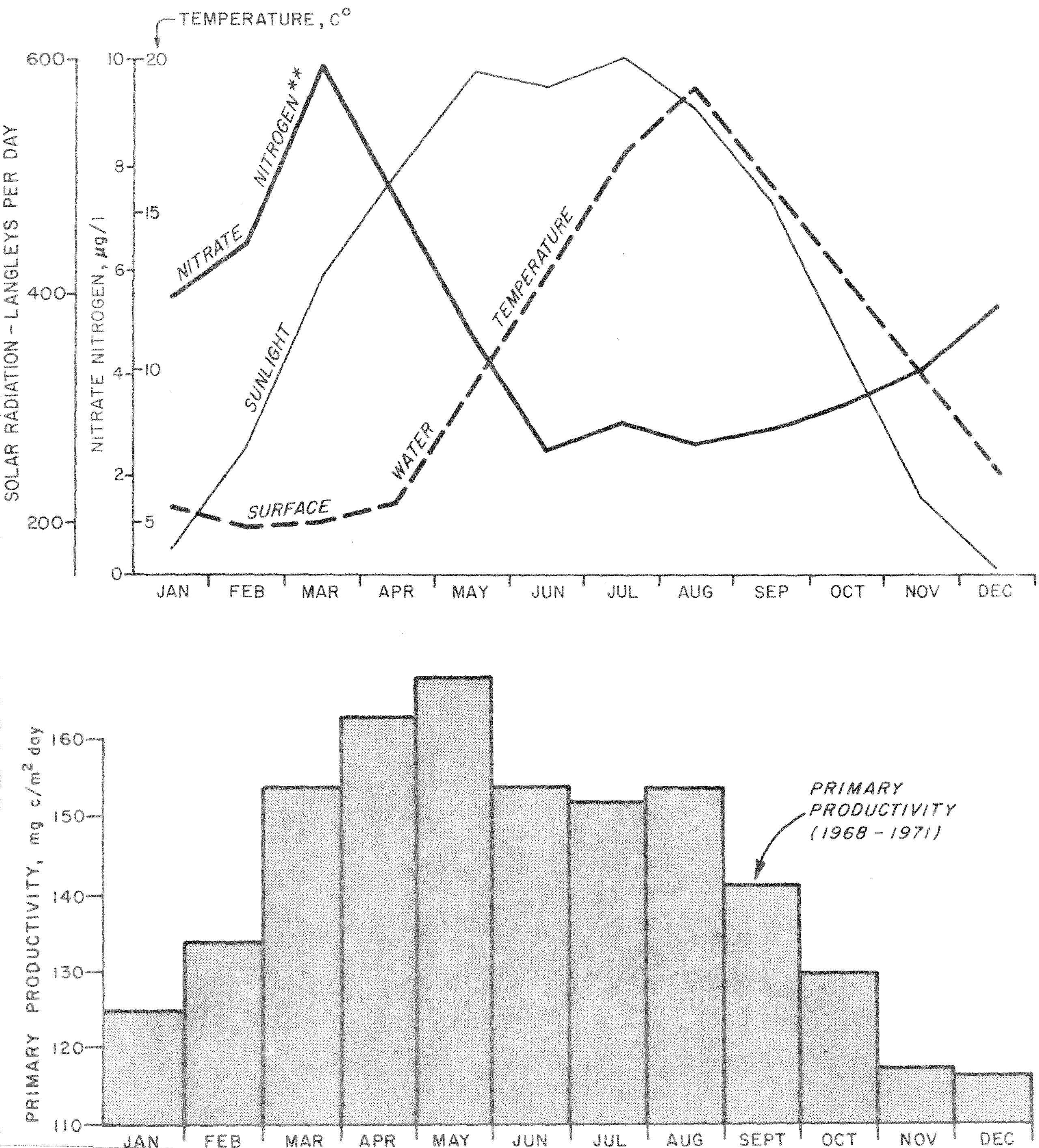
Figure II–2



SEASONAL SECCHI DISK TRANSPARENCY
IN THE OPEN WATERS OF LAKE TAHOE*

*From Goldman (1974)

Figure II-3



* DATA SOURCE: TAHOE RESEARCH GROUP (GOLDMAN, 1974)
** IN UPPER 100 METERS (EUPHOTIC ZONE)

ANNUAL CYCLES IN PHYSICAL CONDITIONS, NUTRIENTS, AND ALGAE PRODUCTIVITY IN THE OPEN WATERS OF LAKE TAHOE* further reduced by decreased sunlight and lower water temperatures. Winter mixing of relatively nutrient rich, deep waters into the surface euphotic zone restores nutrients which support the next cycle of algal growth the following spring. (Paerl et al, 1975). The seasonal addition of nutrients associated with spring runoff further accentuates the nutrient cycle.

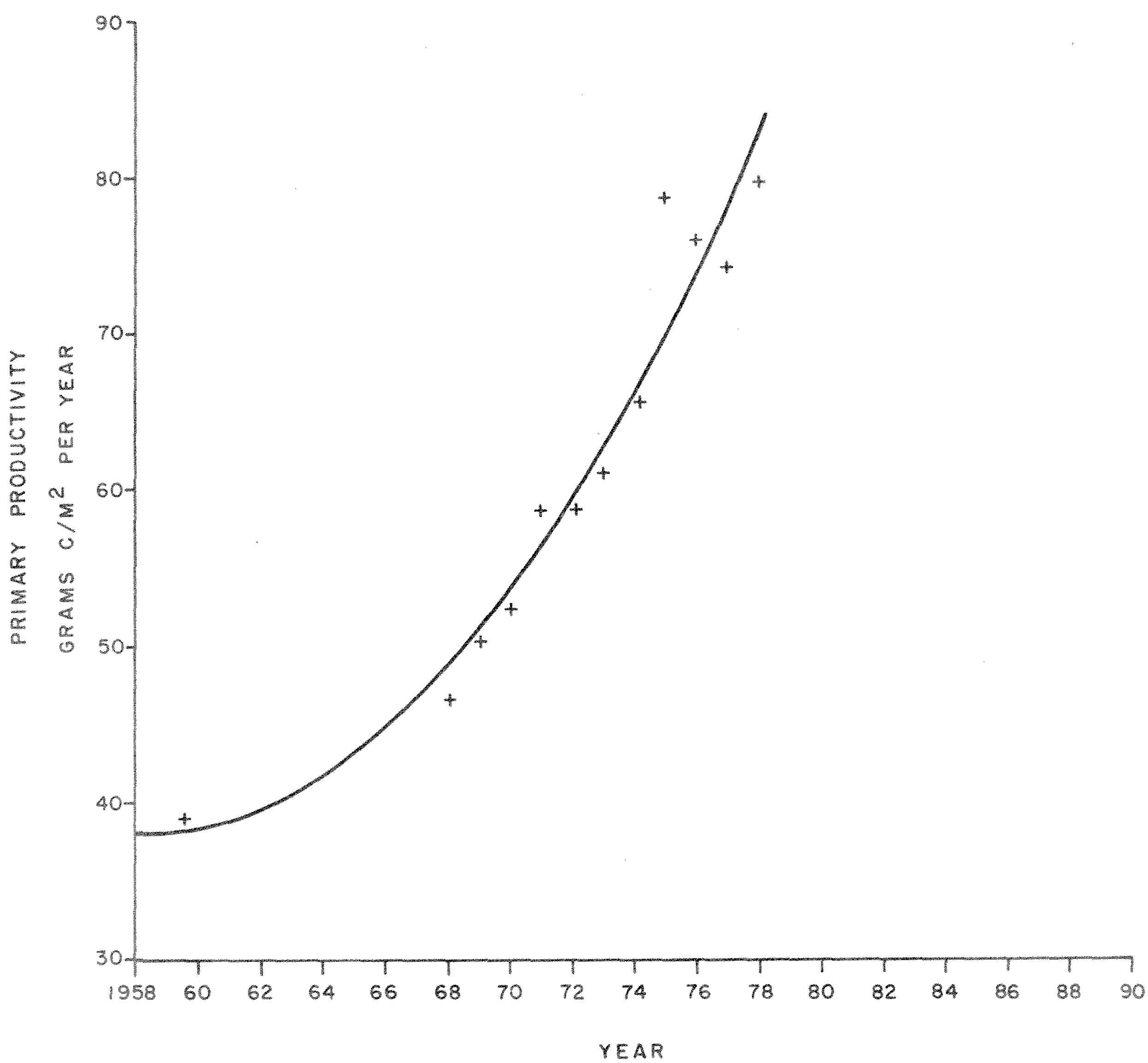
There is considerable additional evidence that algal growth is severely nutrient limited. Bioassay experiments have found that sewage and stream runoff added to Lake Tahoe water markedly increases algal growth rates (LTAC, 1968; Goldman 1974). Finally, the measured concentrations of nutrients in Lake Tahoe (nitrogen, phosphorus and iron) are well below the levels where experiments and field studies of other aquatic environments have found phytoplankton growth to be limited by nutrient availability (Holm-Hansen et al, 1976).

Although algal productivity is limited by the availability of nutrients, the monitoring data on nutrient concentrations in Lake Tahoe do not provide a basis for determining water quality trends. Nutrient concentrations in the Lake are very near the limit of analytical detection, where measurement errors are greatest. Nutrient measurements also fluctuate widely from place to place and time to time, without apparent pattern. While human activities have increased the amount of nutrients reaching the Lake, increases in nutrient concentrations are obscured by these variations. Similarly, it is not possible to determine trends from color conditions. The human ability to perceive changes in color over time is exceedingly poor, and physical measurements are hard to translate into subjective perception. The physical color spectrum of Lake Tahoe's water was measured only once, in 1970 (Smith et al, 1973).

Measurements of algal growth rates, on the other hand, clearly indicate trends in water quality, and show that man is altering the quality of Lake Tahoe. Studies of phytoplankton growth in recent years indicate accelerated rates of production. The season of maximum phytoplankton productivity has lengthened, extending well into the summer months which formerly were periods of decreasing production attributable to nutrient depletion (Goldman, 1974).

The most convincing evidence comes from a 19-year record of phytoplankton productivity measurements at a single (index) station in the open waters of the Lake (Goldman and de Amezaga, 1975, and Goldman unpublished data). The record is reproduced in Figure II-4. The rate of algal production has increased in every consecutive year since the beginning of the record with the exception of 1976 and 1977, two years of extreme drought. The diminished algal production rates during the drought may reflect the importance of nutrients derived from land runoff. More extensive data collected at several stations throughout the

Figure II-4



*DATA SOURCES: 1959-1971 (Goldman, 1974); 1972-1978 (Goldman, unpublished)

ANNUAL PRODUCTIVITY OF PHYTOPLANKTON
ALGAE IN THE OPEN WATERS OF LAKE TAHOE, 1959-1978*

Lake from 1968 through 1971 (Goldman, 1974) show similar trends to that of the single index station, indicating a Lake-wide increase in algal growth rates.

The extent of the increase is roughly a doubling in algal growth rates over the 19 years of record. The rate of production does not appear to be stabilizing. Rather, the record, if anything, suggests an acceleration of the rate of eutrophication extending up through the most recent measurements.

b. Nearshore Waters

Nearshore waters provide the main visual evidence of water quality to persons visiting the Lake. Changes in nearshore water quality may also indicate trends occurring more slowly in open waters. Reported changes in nearshore water are a cause for serious concern because they indicate that Lake Tahoe is visibly deteriorating. Scientists studying the Lake, Basin residents, and regular visitors to the Lake report an increase in attached algal growth in nearshore waters (Loeb, 1980). Sediment plumes also provide visible evidence of water quality degradation.

Although nearshore waters and open waters of the Lake eventually mix, there is often a distinct separation, especially during early summer (Leigh-Abbot, et al, 1978). Increases in erosion have a more immediate impact on nearshore waters than on the rest of the Lake because nearshore waters are partially self-contained and are the first to receive sediment and nutrients generated in the surrounding Basin. There are also differences in biological productivity. Nearshore and offshore waters both support the growth of suspended microscopic algae (phytoplankton). Only in the nearshore waters does enough sunlight reach the bottom to support attached algae (periphyton). Attached algae are readily visible on hard surfaces, rocky bottoms, pier pilings, and boats (see Figure II-5).

Heavy accumulations of attached algal growth can be a nuisance and detract from visual quality. Periphyton growth in Lake Tahoe reaches its peak in spring and early summer, closely following the seasonal light pattern and inflow of nutrients from adjacent watersheds. While the heaviest growths are usually to be found in the vicinity of stream mouths, most of the nearshore areas are visibly green during the season of rapid growth (Goldman and de Amezaga, 1975). Occasionally large mats of decaying periphyton break off and float to the surface or are carried in by streams. The decay of these mats may provide additional nutrients, triggering phytoplankton blooms such as those observed near the mouth of the Upper Truckee River (Goldman and de Amezaga, 1975).

Attached algal growth is hard to quantify. There are no periphyton productivity data comparable to the extensive productivity measurements for offshore phytoplankton (Figure II-4). There is evidence

Figure 5. Attached Algal Growth

that periphyton growth, like phytoplankton growth, is severely limited by nutrient availability. Heaviest growths are clearly associated with localized sources of nutrients (Fraga, 1965). Loeb (1980) has found that the distribution of attached algae directly correlates with the extent of land development around Lake Tahoe. Algal production rates adjacent to heavily developed areas are two to eight times those of control sites adjacent to relatively undisturbed watersheds. The accumulated mass of attached algae at sites adjacent to heavily developed areas is five to eleven times that at the control sites. Other factors such as light, water temperature, and substrate type were similar for all sites, suggesting a causal relationship between nutrients derived from land disturbance and increased periphyton productivity.

Sediment plumes which cloud nearshore waters are a highly visible indication of nearshore water quality. These plumes of turbid water frequently are observed issuing from the mouths of streams which drain disturbed watersheds (see Figure II-6). The occurrence and size of sediment plumes corresponds to rainfall events and to the spring peak in snowmelt and stream discharge. Because of the variability of these events and the spatial complexity of the plumes, the limited physical measurements which have been taken of nearshore water transparency are not adequate to assess trends. Considering the effect of development on erosion rates, there is good reason to believe that nearshore water quality has markedly diminished. The current extent of the problem and the degree to which it could deteriorate further can be assessed on basis of estimates of increasing sediment loads with increasing development in the Basin, as shown in Figure II-7 (the basis of the sediment load estimates in Figure II-7 is explained on page 27). Present rates of sediment generation are several times natural background levels, and further development would significantly increase sediment generation.

c. Tributary Streams

Tributaries draining subdivided or otherwise developed areas contain higher concentrations of nutrients than streams which drain relatively less disturbed watersheds. Streams in disturbed watersheds have an algal growth stimulating potential which is ten times that of streams in relatively undisturbed watersheds.

The data shown in Table II-4 compare the average quality of streams draining relatively natural areas and those draining obviously disturbed watersheds. The differences between disturbed and undisturbed watersheds probably are even greater than suggested by estimates in the table. There are no truly undisturbed watersheds in the Tahoe Basin. Many were logged within the last century, and all now have highways or roads which are important sources of stream sediment loads. In disturbed watersheds, most sediments and nutrients are discharged during short episodes of peak stream flow (Leonard et al, in press; White, 1978).

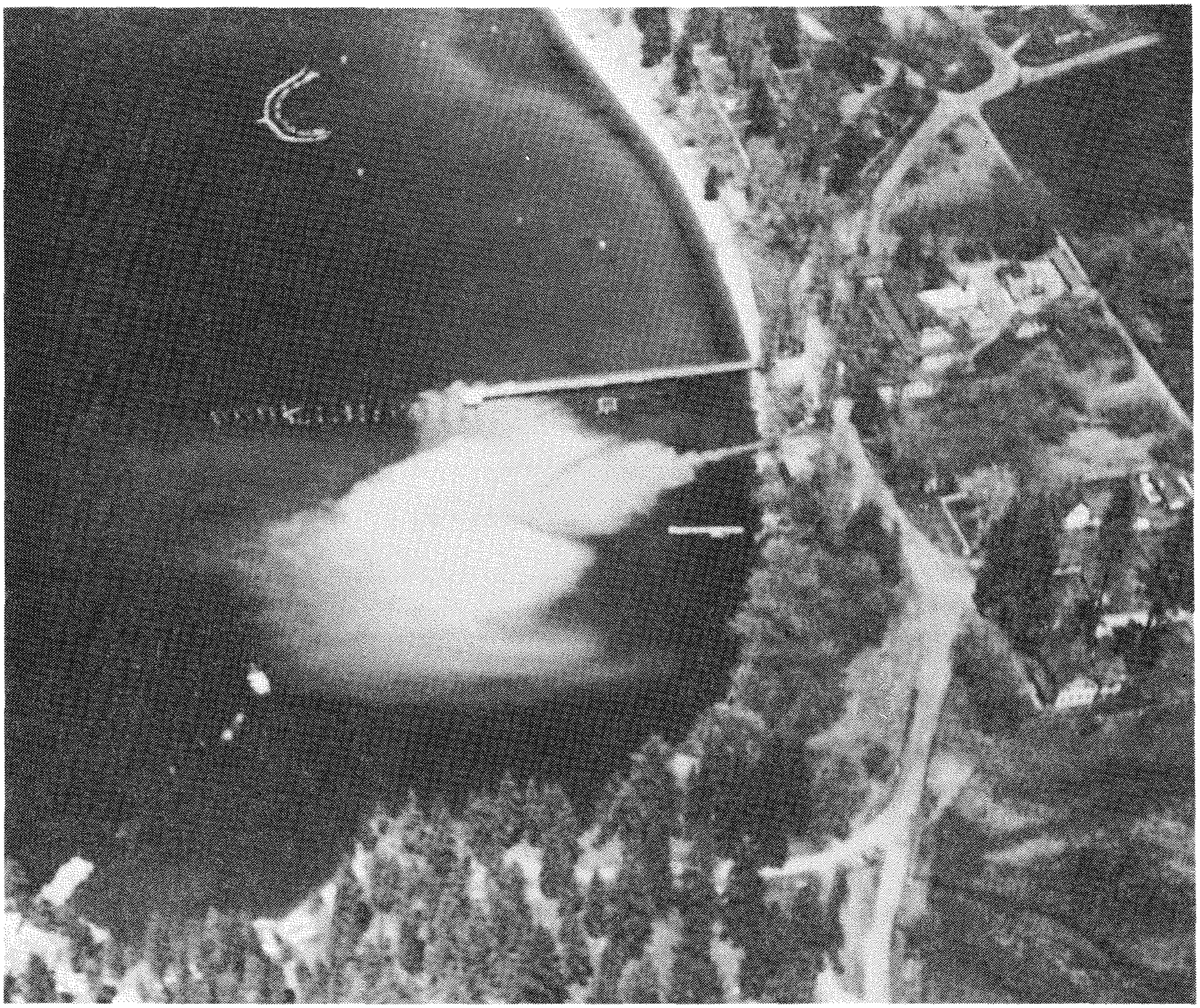
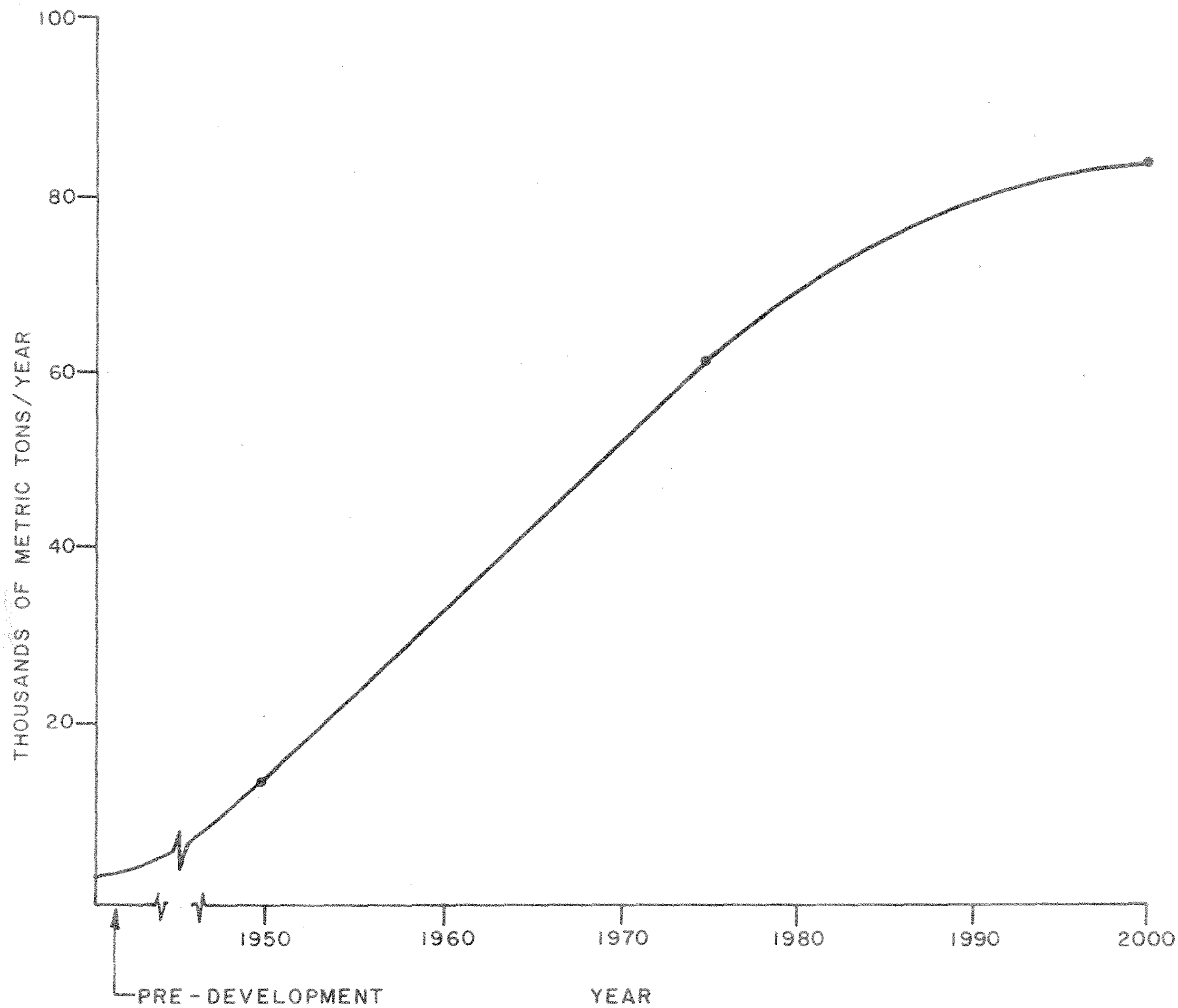


Figure 6. Sediment Plume

Figure II-7



ANNUAL LOADING RATES OF SEDIMENT TO
LAKE TAHOE FROM SURFACE RUNOFF

TABLE II–4

MEAN QUALITY OF TRIBUTARY STREAMS *

PARAMETERS	DISTURBED	UNDISTURBED
Dissolved Oxygen (mg/l)	9.7	9.6
Dissolved Oxygen (% saturation)	98	100
pH	7.3	7.1
Suspended Solids (mg/l)	8	4
Turbidity (JTU)	5	0.5
Nitrate–N (μg/l)	47	30
Total Nitrogen (μg/l)	300	252
Total Phosphorus (μg/l)	29	15
Total Iron (μg/l)	97	45
Chloride (mg/l)	1.2	0.5
Algae Growth Potential (μg/l)	0.5	0.05

* Comparison of physical, chemical, and biological data from 21 tributaries draining disturbed watersheds and 15 tributaries draining areas which have not been developed. Abstracted from Tahoe Regional Planning Agency Draft 208 plan (July 1977). Primary Sources: California Nevada Federal Investigation (1975); Goldman (1974); McGauhey (1971).

Sampling programs which form the basis of average water quality estimates in Table II-4 were not designed to accurately assess sediment and nutrient loads occurring during short duration peaks in stream flow.

Impacts of erosion range from subtle to obviously detrimental changes in stream quality. A study by the Lahontan Regional Water Quality Control Board (Baker and Davis, 1976) found significant reductions in abundance and diversity of aquatic organisms downstream of disturbed areas, with several types of organisms eliminated. In the worst cases, siltation smothered organisms which provide food for fish, obliterated spawning and nursery habitats of sport fish, limited recreation potential and impaired the appearance of streams. In cases where increased erosion has not visibly affected streams, the additional nutrients released by erosion still contribute to the eutrophication of the Lake.

d. <u>Nutrient and Sediment Loads and Sources</u>

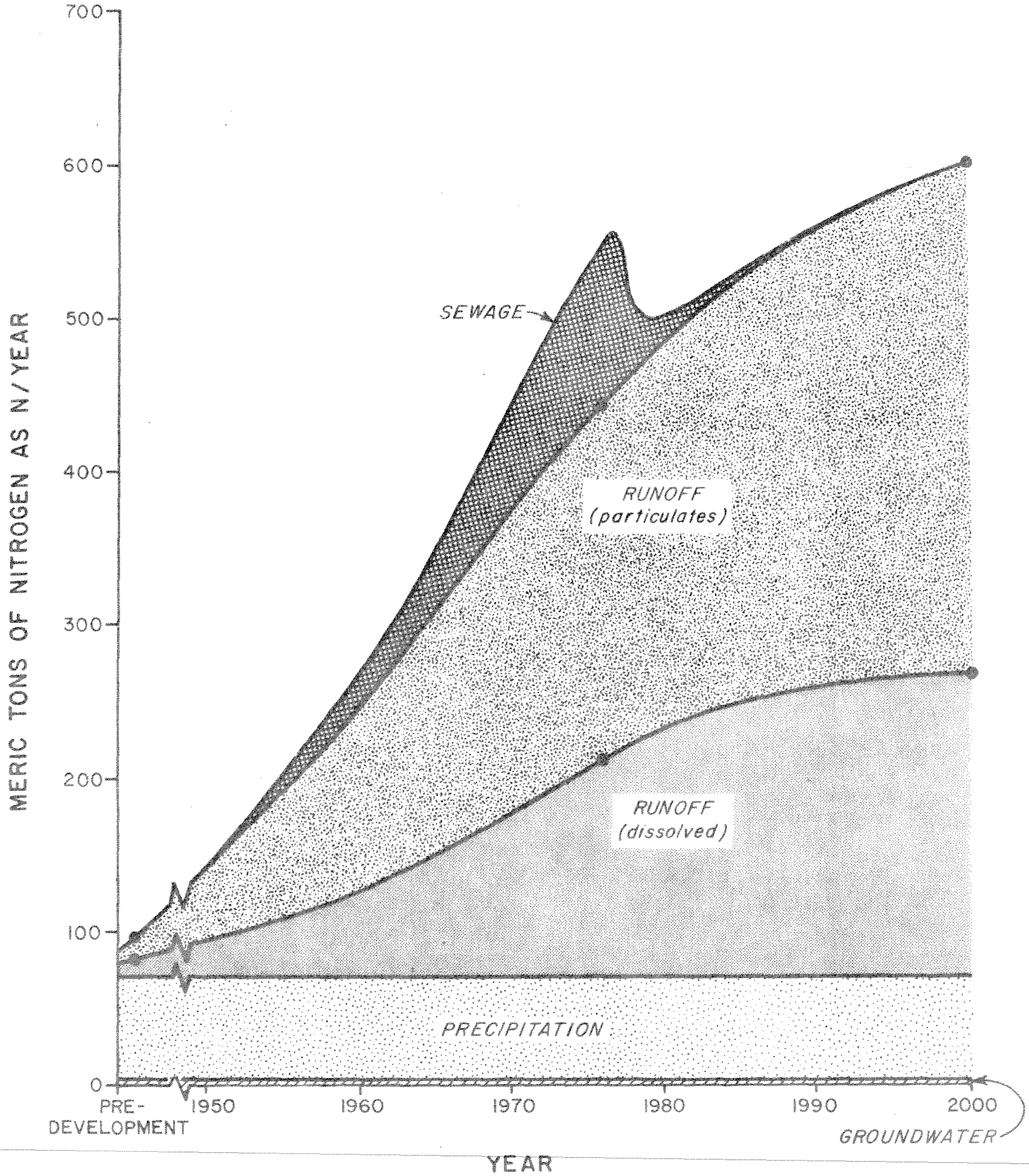
Current water quality problems and trends are tied to increasing nutrient and sediment loads entering Lake Tahoe.

Nutrients enter Lake Tahoe through erosion and surface runoff, groundwater flows, washout of air-borne materials in rain and snow, and leaching of sewage previously disposed on land. Figures II-7 through II-10 summarize the loading rates, the quantities annually reaching the Lake, for suspended sediments and the algal growth stimulating nutrients -- total fixed nitrogen, phosphorus and iron. It should be emphasized that because the nutrients which enter the Lake each year remain for much longer periods, nutrient concentrations and algal growth rates in the Lake reflect the nutrient loadings sustained over many years. Short term fluctuations in annual nutrient loadings are not likely to have any major effect.

Loading rates shown for surface runoff and sewage include both soluble nutrients and nutrients bound to particulate matter, while the figures for other sources are based on dissolved nutrient content. The particulate content of groundwater, rain and snow is relatively low. If data for particulates in these sources were available, they would not significantly change the total nutrient loads.

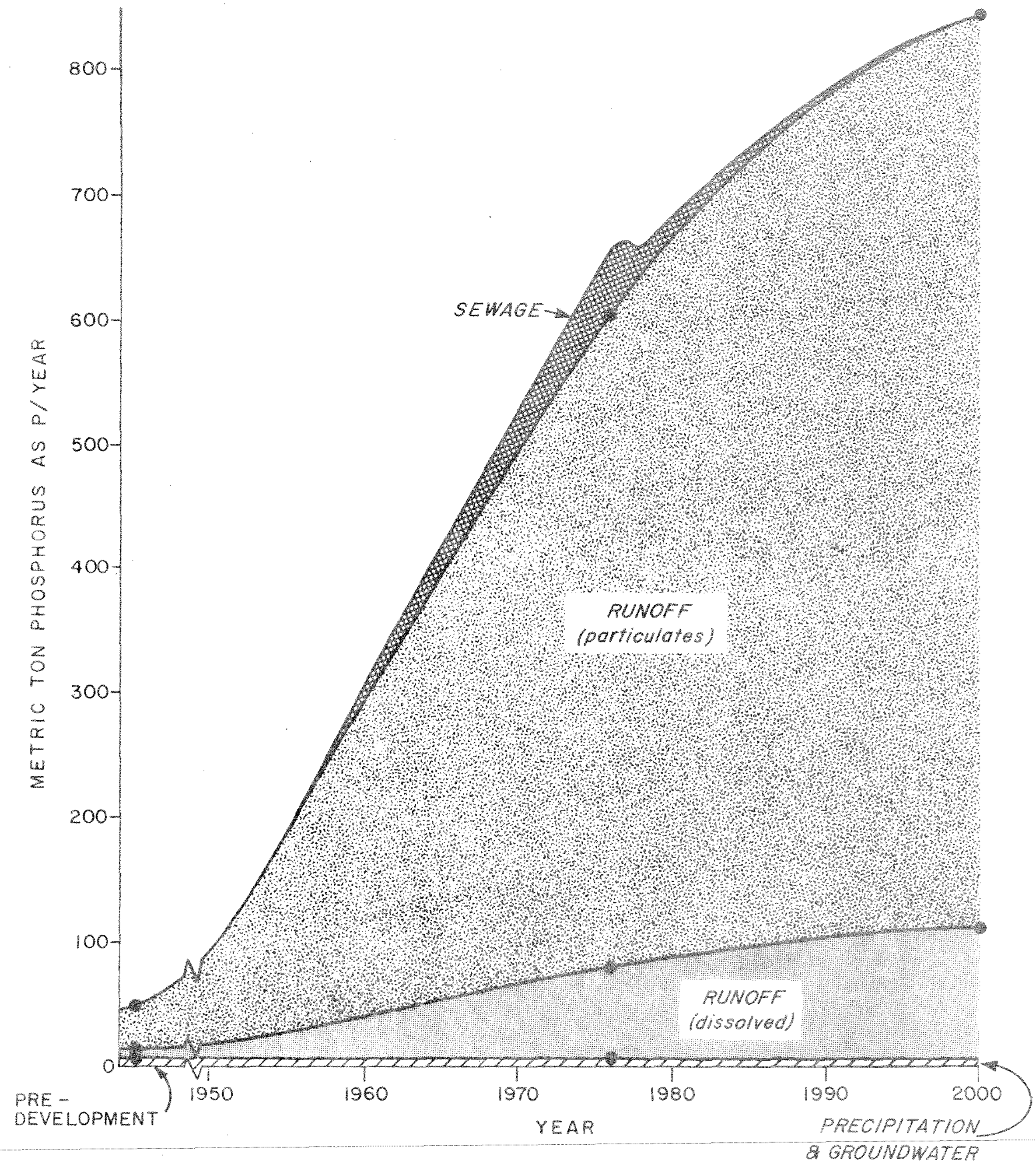
The particulate nutrient content of surface runoff is considerably more than the dissolved nutrient content (Glancy, 1977; Leonard, et al, in press). To explain impacts on Lake Tahoe water quality, these particulate bound nutrients should be considered as part of the total nutrient loading. Quantitative nutrient budgets for Lake Tahoe have been developed on the basis of dissolved nutrients in precipitation and surface runoff (Dugan and McGauhey, 1974, Tahoe Regional Planning Agency, 1977), but these nutrient budgets

FIGURE II-8



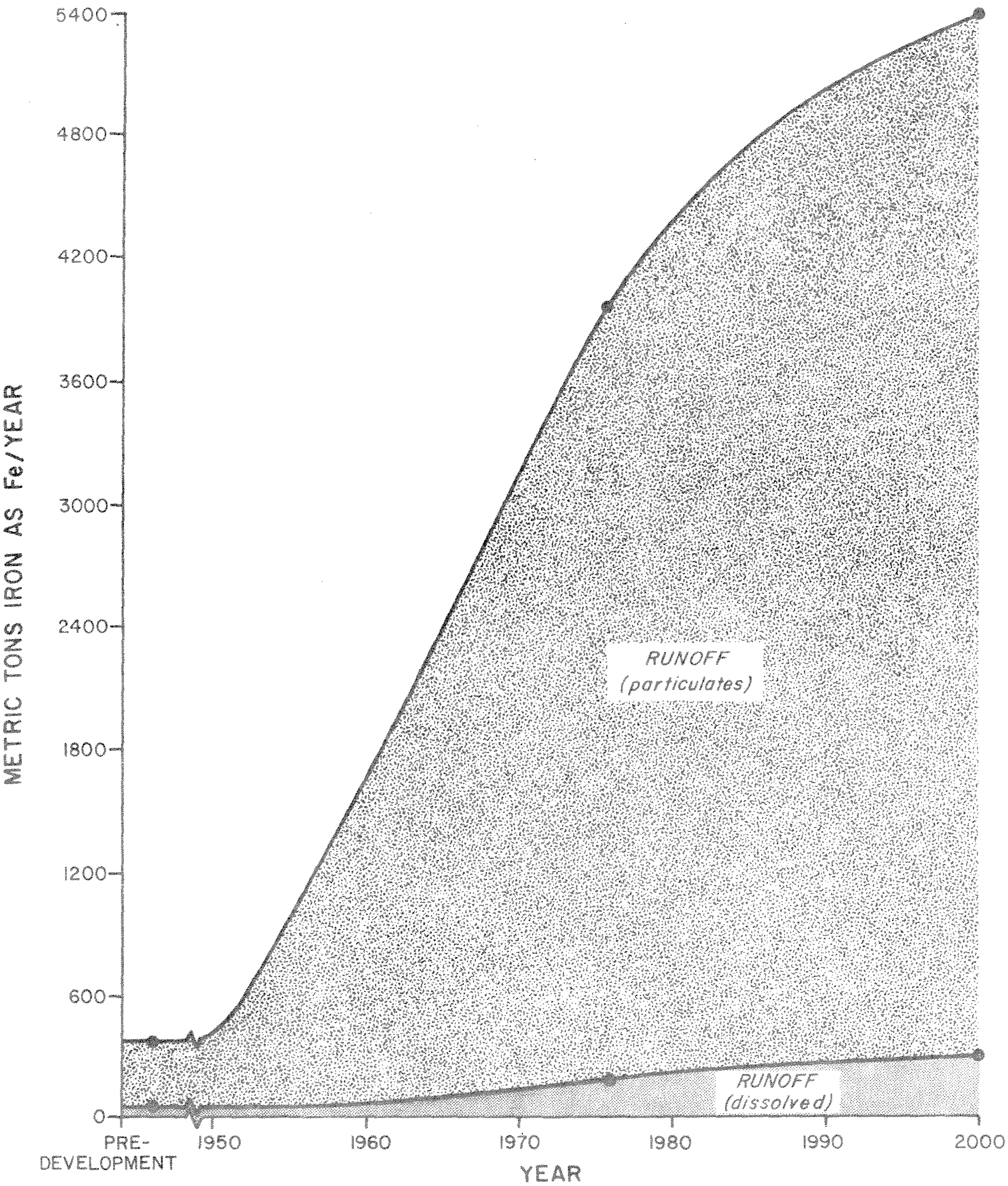
LOADING RATES OF NITROGEN TO LAKE TAHOE

FIGURE II-9



LOADING RATES OF PHOSPHORUS TO LAKE TAHOE

FIGURE II-10



*Runoff is the dominant source of iron to Lake Tahoe. All other sources combined (i.e., precipitation, sewage, and groundwater flow) contribute less than 6 metric tons per year.

LOADING RATES OF IRON TO LAKE TAHOE*

do not account for recent increases in algal productivity. Algal growth rates, which have been increasing by over five percent per year, would not be expected to increase faster than the concentration of nutrients. Even if all the dissolved nitrogen entering from precipitation and surface runoff remained in the Lake, however, the nitrogen concentration would increase by less than two percent per year. Adding the nutrients in groundwater and the nutrients from sewage to the nutrient budget still cannot account for the increase in algal growth rates. The most important nutrient source overlooked in previous nutrient budgets is the particulate bound nutrient load in surface runoff. Algae normally use dissolved inorganic nutrients, but particulate bound nutrients can be separated from the particles or converted to dissolved inorganic nutrients by bacteria. Particulate bound nutrients remain in the Lake long enough for these conversions to take place, although some of the nitrogen and most of the phosphorus and iron probably are lost to bottom sediments before they are made available for algal uptake.

Figures II-7 through II-10 indicate:

- Sediment and nutrient loads have increased greatly above natural conditions; and
- Surface runoff is the dominant source of nutrients to Lake Tahoe, and will become even more important in the future.

Surface runoff is the most important source of nutrients whether the combined particulate and soluable nutrients or just the soluble nutrients are considered.

The basis for the sediment and nutrient load estimates is set forth below.

i. Surface Runoff

Surface runoff from eroding land carries soil particles (sediment) and plant nutrients that otherwise would remain in the soil. The nutrient levels in surface runoff increase when sediment levels increase.

Estimates of the natural sediment load, the sediment load in 1976, and the load which would generate the ultimate level of development allowed by Tahoe Regional Planning Agency zoning are presented in Chapter III, Table III-4. The corresponding nutrient loads are shown in Table III-5 (the derivation of Tables III-4 and III-5 is explained on pages 65 through 71). Figures II-7 through II-10 assume that the ultimate level of development allowed by current zoning will be reached by the year 2000. Surface runoff would then contribute over 88 percent of the nitrogen and over 99 percent of the phosphorus and iron reaching Lake Tahoe.

Although some erosion and accompanying nutrient loading occurs under natural conditions, the process has been tremendously accelerated by development. Nutrient loads to Lake Tahoe are estimated to be 11 to 16 times natural conditions. They will increase to 16 to 22 times natural conditions if development is allowed according to Tahoe Regional Planning Agency ordinances.

ii. Groundwater

No direct information is available for the nutrient content of unpolluted groundwater in the Tahoe Basin. Quantitative estimates of the rate of groundwater infiltration to the Lake are also incomplete. Except for groundwater contaminated by sewage disposal in the Basin, groundwater flows probably are a minor source of nutrients compared with surface water flows. Overlying soils and vegetation remove nutrients very effectively. Coates et al, (1976) estimate that 70 to 90 percent of the nitrate and ammonia in precipitation which falls on land is removed by the soil-vegetation system before the rainfall reaches the Lake in stream discharges. Data provided by Dugan and McGauhey (1974) indicate that approximately 60 percent of the total fixed nitrogen and 40 percent of the phosphate in precipitation are removed before entering the Lake through surface runoff. Considering the prolonged contact of groundwaters with the soil-vegetation system, even greater nutrient removals would be expected in groundwater than in surface water. Studies of the Ward Valley watershed (Leonard, et al, 1979, in press) indicate that groundwater flow is only 10 to 16 percent of surface water stream flow. Considering the expected lower nutrient content and lower flow, uncontaminated groundwater probably contributes less than 10 percent as many nutrients to Lake Tahoe as enters through surface runoff.

The estimates of the nutrients in groundwater presented here do not include any nutrients present as a result of contamination by sewage. Sewage disposal on land, before sewage was exported from the Lake Tahoe Basin, has added to the nutrients reaching Lake Tahoe in groundwater flows. The loading rates for sewage shown in Figures II-7 through II-10 include the nutrients reaching the Lake in groundwater flows as a result of previous sewage disposal in the Basin. Some nutrients may also be found in groundwater as a result of leakage from sewerlines, a potential source of nutrients which should be investigated further.

iii. Atmospheric Sources

The mean annual precipitation (rain and snowfall) directly on the surface of Lake Tahoe is about 236,700 acre-feet. Data on the average concentration of nutrients in precipitation are available for 1970 through 1974 (Table II-5). These measured

TABLE II–5

ESTIMATED MEAN ANNUAL POLLUTANT LOADINGS FROM PRECIPITATION

PARAMETER	Reported Concentrations (μg/l) LTAC[1]	TRG[2]	TRG[3]	Values Used To Estimate Annual Loading (μg/l)	Estimated Annual Loading (tons/year)
Suspended Solids	—	—	—	0	0
Nitrate Nitrogen	56	63	57	60	17.56
Total Nitrogen as N	357	122	—	240	70.0
Total Phosphate as P	14.8	—	—	15	4.38
Total Iron	1	—	—	1	0.30

1. Lake Tahoe Area Council (McGauhey, 1971, pg. 152)
2. Tahoe Research Group (Leonard & Coats, 1974)
3. Tahoe Research Group (Coats, Leonard & Loeb, 1975)

concentrations when multiplied by precipitation yield nutrient loads to the Lake from atmospheric sources during the early 1970's.

The degree to which human activities have increased the level of nutrients in precipitation is not known. Nitrate and ammonia concentrations in Basin precipitation are comparable to or lower than those measured at various sites in North America (Shutt and Hedley, 1925; Williams and Beddow, 1932; Herman and Gorman 1956; Feth, et al, 1964). Atmospheric sources of nutrients are considered constant in Figures II-8 through II-10. However, human activities both outside and within the Basin could add to the nutrients reaching the Lake through precipitation.

Approximately 18 tons of nitrogen per year, 25 percent of the total nitrogen in precipitation, is in the form of nitrates. All or part of these nitrates may be the result of emissions of oxides of nitrogen, especially from automobiles. Upon contact with water, oxides of nitrogen form the nutrients nitrate and nitrite. In 1977, the nitrogen in emissions of oxides of nitrogen in the Tahoe Basin totalled approximately 470 tons (California Air Resources Board, 1979). Most of these emissions, roughly 70 percent of the winter emissions and 90 percent of the summer emissions, were from automobiles. Emissions of oxides of nitrogen in the Basin are expected to increase by 10 to 30 percent between 1977 and 1995.

iv. Previous Sewage Disposal on Land

Export of sewage out of the Basin began in the late 1960's. By 1974, virtually all sewage produced in the Basin was exported. Before this time, effluents from community wastewater treatment plants were spread or sprayed on land. Sewage from outlying homes and commercial establishments too distant to be served by community sewers were discharged through subsurface leachfields.

Once deposited on land, sewage nutrients are carried down the watersheds by surface runoff and groundwater flows. The time between sewage deposition on land and entrance of sewage nutrients in the Lake is estimated to be 10 years or less. Virtually all sewage disposal sites were within five kilometers of the Lake. Loeb and Goldman (in press) estimate that the rate of groundwater flow down Ward Valley is 0.7 meters per day. Assuming this is a representative value, sewage from the more remote sites would reach the Lake in approximately 17 years through groundwater transport. Direct transport in surface runoff or interception of groundwater by surface streams would cause the nutrients to travel much faster. Considering these influences, a reasonable estimate of the average transport time would be about half the maximum transport time, or somewhat less than ten years. This estimate, though not conclusively confirmed by the few existing studies, is consistent with available data (Loeb and Goldman, in press; Perkins, et al, 1975). Transport time would be shorter for disposal sites closer to the Lake.

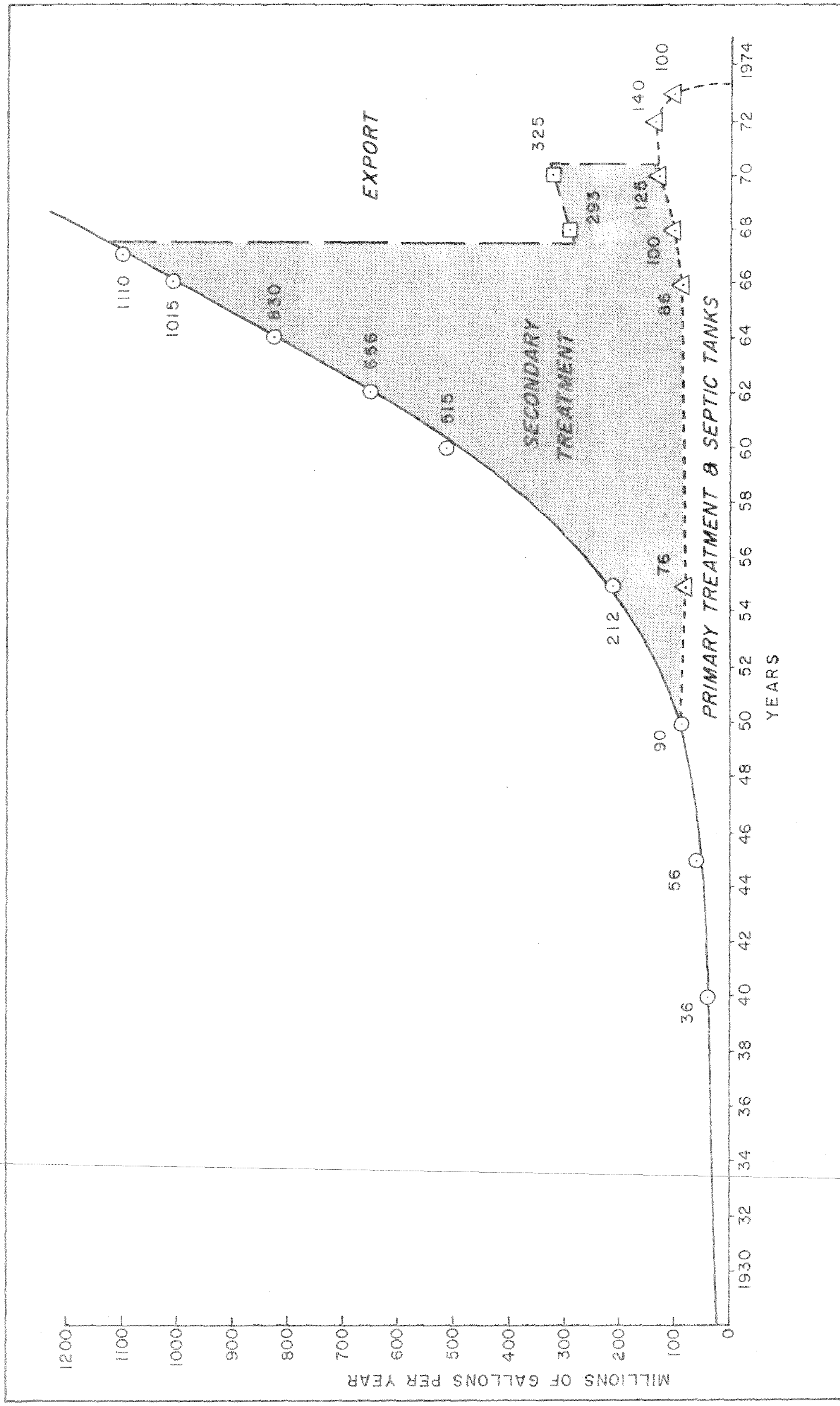
The quantity of nutrients entering Lake Tahoe from past sewage disposal in the Basin can be estimated on the basis of waste water flows, wastewater nutrient content, and removal of nutrients by soil bacteria. Figure II-11 shows the volume of wastewater from California which was disposed of in the Basin. To account for flows from Nevada, total flows are estimated at 25 percent more than those shown in the figure. The quantity of nutrients in the effluent is estimated by multiplying estimated flows by the concentrations typically contained in sewage. With primary treatment, typical concentrations are 25 mg/l total nitrogen, 13 mg/l phosphorus, and 1.5 mg/l iron. With secondary treatment, typical concentrations are 19 mg/l total nitrogen, 5 mg/l phosphorus, and 0.75 mg/l iron (Environmental Protection Agency, 1978). To account for denitrification by soil bacteria after the sewage is spread on land, the total nitrogen reaching the lake is estimated at 15% less than the quantity in sewage flows (State Water Resources Control Board, 1977). These estimates do not account for any nutrient uptake by vegetation, which could further reduce the total nutrient loads below those shown in Figures II-8 through II-10.

e. Response of Lake Tahoe to Nutrient Loads

There is a long lag time between activities in the Basin and changes in the Lake. The large volume of the Lake acts as a sink. Nutrient concentrations accumulate slowly over many years after nutrient loadings increase over natural levels. If nutrient loadings continue at present levels, the Lake will continue to deteriorate. Preserving the quality of the Lake will require a major reduction in nutrient loads.

The purity of the Lake in its natural state and its response to the introduction of nutrients can be traced to its physical setting, dimensions, and hydrology. Lake Tahoe is a large deep lake contained within a very small drainage basin. The surface area of the Lake, 192 square miles (497 square kilometers) constitutes almost 40 percent of the drainage basin, 506 square miles (1,311 square kilometers). The Lake is exceptionally deep, depths averaging 990 feet (303 meters), and holds a phenomenal 123 million acre-feet of water in storage. With such a small land drainage area and great water depth, natural inputs of contaminants are low and subject to enormous dilution in the Lake's great volume.

FIGURE II-11



SEWAGE GENERATED IN CALIFORNIA AND DISPOSED OF IN THE LAKE TAHOE BASIN

The hydrologic budget of the Lake Tahoe Basin is shown in Table II-6.

The hydraulic residence time, the volume of the Lake divided by annual outflow, is approximately 650 years, a very long residence time for a freshwater lake. The hydraulic residence time shows how long it would take for nutrients entering the Lake to be removed if Lake outflow were the only means by which nutrients could leave the system. While losses to the atmosphere and bottom sediments are probably more important in determining the residence time of nutrients in Lake Tahoe, the long hydraulic residence time indicates that nutrients may accumulate over an extended period before they are removed. At the same time, the great volume of the Lake relative to annual inputs means that the quality of the Lake waters will change very slowly following an increase in the annual loading of nutrients entering the Lake. These two features are of particular importance for interpreting water quality trends resulting from human activities in the Lake Tahoe Basin. Because the Lake responds slowly to increased nutrient loading rates, deterioration of water quality is hard to detect over short periods. It may take decades or even centuries for the effect of increased loading rates to be fully realized. Once deterioration has begun, it will take a long time to reverse. In these circumstances,any deterioration in water quality must be taken seriously and prompt action should be taken to correct the problem. Increased algal growth rates measured after an increase in nutrient loading rates indicate trends which will continue for many years if nutrient loading rates continue at their higher level.

If the manner in which Lake Tahoe responded to nutrients were understood in a complete and quantitative way, it would be possible to identify the precise level of control which would be needed to maintain water quality. This understanding is not available. Past efforts to predict the response of Lake Tahoe to nutrients through the use of complex models have failed. For example, the 1977 Draft 208 Plan prepared for the Tahoe Regional Planning Agency predicted that nutrient loads associated with full development of the Basin would increase algal growth rates in Lake Tahoe by 6 to 7 percent above levels measured in the early 1970's. This relatively modest increase in fertility was expected to occur slowly over 80 to 100 years. These predictions have since proven to be gross underestimates of the increase in algal growth rates. In fact, in the two years since the predictions were made, algal growth rates have increased by at least 30 percent and are accelerating (see Figure II-4).

Although models cannot be relied upon as the only basis for a water quality control program, they can be of some use. They can be used to forecast general trends and provide a rough measure of the level of nutrient control that would be necessary to maintain water quality.

TABLE II–6

LAKE TAHOE BASIN HYDROLOGIC BUDGET *

Storage	123,000,000 acre-ft/yr.
Inputs	
Precipitation directly on Lake Tahoe	236,700 acre-ft./yr.
Tributary runoff	411,600 acre-ft./yr.
Outputs	
Lower Truckee River and Export from Basin	187,700 acre-ft./yr.
Evaporation from Lake Tahoe	434,500 acre-ft./yr.
Change in Storage	–26,100 acre-ft./yr.

* Based on measurements from 1960 through 1974 (Tahoe Regional Planning Agency, 1977).

Increased nutrient loads slowly increase the concentration of nutrients in the lake, resulting in accelerated algal growth rates, which in turn results in higher algal cell densities, diminishing water clarity. To model the effects of nutrients on water clarity, it would be necessary to understand all of these intervening processes in detail. Higher nutrient concentrations will increase algal growth rates, but the quantitative response under field conditions cannot yet be predicted. Hence, the predictive chain is broken at the second link. However, it is possible and useful to consider how nutrient loads effect the concentration of nutrients in the Lake.

The relation between pollutant loads entering Lake Tahoe and pollutant concentrations in the Lake can be determined through a mass balance model of the sort developed in Appendix A. The relationship is described by the following equation:

$$Cq = \frac{WR}{V}$$

Where: Cq is the ultimate equilibrium concentration of a pollutant in the Lake; W is the rate at which the pollutant enters the Lake (loading rate); R is residence time, the average time the pollutant remains in the Lake; and V is the volume of the Lake.

Both R (the residence time for a given pollutant) and V (the Lake's volume) are constants. Hence, the equilibrium concentration of a pollutant in the Lake will be proportional to its loading rate.

The natural concentrations of suspended sediments and nutrients in Lake Tahoe are not known. However, natural loadings during the period prior to development can be estimated. These estimates (see Figures II-7 through II-10) combined with the knowledge that the increase in equilibrium concentration will be proportional to the increase in loading rates, provide a basis for estimating the percentage increases in pollutant concentrations above natural concentrations. Estimated increases in the ultimate concentrations of pollutants in Lake Tahoe associated with present land development and full buildout of the Basin are provided in Table II-7.

As indicated in Table II-7, continuation of loadings associated with either the present level of development or full buildout of the Basin could ultimately increase the concentration of nutrients in Lake Tahoe by a few hundred to over two-thousand percent above natural levels.

When the loading rate of a nutrient is increased, the approach to a new equilibrium concentration in the Lake is not immediate. Due to the large volume of the Lake, nutrient concentrations

TABLE II–7

ESTIMATED EQUILIBRIUM CONCENTRATION

OF NUTRIENTS IN LAKE TAHOE

AS A PERCENTAGE OF NATURAL CONCENTRATION

	NATURAL		PRESENT DEVELOPMENT		FULL BUILDOUT OF THE BASIN	
	Load to Lake (tons/year)	Concentration in Lake a/	Load to Lake (tons/year) b/	Equilibrium Concentration in Lake a/	Load to Lake (tons/year) b/	Equilibrium Concentration in Lake a/
Total Nitrogen	97	100%	450	460%	600	620%
Phosphate Phosphorus	42	100%	610	1,500%	840	2,000%
Total Iron	360	100%	3,900	1,100%	5,200	1,440%

a/ Expressed as a percentage of natural concentrations in the Lake. The natural predevelopment concentrations of the listed substances in Lake Tahoe are not known. However, it can be shown (see text) that the increase of the ultimate equilibrium concentration of any nutrient in the Lake will be proportional to the increase in loading rate. Hence, the equilibrium concentration at loading rates under developed conditions, as a percentage of the equilibrium concentration under natural loading rates, can be determined by the following term:

$$\frac{\text{Load under developed conditions}}{\text{Natural load}} \times 100$$

b/ Includes atmospheric, runoff and groundwater sources, but not sewage loads. Sewage was excluded because this source has been terminated and did not persist for a long enough period of time to achieve equilibrium with concentrations of pollutants in Lake Tahoe.

build up slowly after nutrient loading rates are increased. Generally, three to four residence times are required to reach the new equilibrium concentration. Thus, increases in nutrient concentrations can be expected to lag considerably behind the nutrient loading curves in Figures II-8, II-9 and II-10. Residence times for nutrients are on the order of a few decades to perhaps as much as a century.

Thus, the full effects of increased loading rates on algal growth in Lake Tahoe are not likely to occur for several decades or even centuries. Nutrient loads must be reduced below present levels if increasing algal productivity is to be stabilized or reversed. The proper level probably is closer to natural nutrient loading rates than to current loading rates.

3. Water Quality Standards

The Federal Clean Water Act requires that no degradation be allowed in any high quality waters which, because of its exceptional recreational or ecological significance, constitutes an outstanding national resource. Lake Tahoe unquestionably is an outstanding national resource, both for its recreational and its ecological value. This plan designates Lake Tahoe as an outstanding national resource.

California and Nevada have also established non-degradation policies under state law for existing high quality waters, including Lake Tahoe.

Viewed from the standpoint of protecting beneficial uses, preventing deterioration of Lake Tahoe requires that there be no significant increase in algal growth rates. Lake Tahoe's exceptional recreational value depends on enjoyment of the scenic beauty imparted by its clear, blue waters. Increased growth of attached algae in nearshore waters already is impairing Lake Tahoe's recreational value by altering its aesthetic appearance. Likewise, preserving Lake Tahoe's ecological value depends on maintaining the extraordinarily low rates of algal growth which make Lake Tahoe an outstanding ecological resource.

Several other state and federal laws recognize the importance of protecting Lake Tahoe water quality from degradation. The Tahoe Regional Planning Compact, approved by the California and Nevada Legislatures and by Congress, declares that "the waters of Lake Tahoe . . . are threatened with deterioration or degeneration, which may endanger the natural beauty and economic productivity of the region." Legislation enacted in both California and Nevada recognizes the importance of protecting Lake Tahoe. In requiring export of sewage from the Lake Tahoe Basin, the California Legislature declared its action was necessary "to meet the unique problems of water quality control presented by population growth and development" in the Lake Tahoe Basin. Section 114 of the Federal Clean Water Act also indicates the need "to preserve the fragile ecology of Lake Tahoe."

a. Proposed Objectives

In addition to the basic non-degradation standard set by the Clean Water Act, this plan sets the water quality objectives set forth in Table II-8 for Lake Tahoe and its tributary streams. When the Environmental Protection Agency approves the plan, the objectives will have the force of binding standards under state and federal law. As is explained in Table II-7, the objectives are based on those set by the Water Quality Control Plan for the North Lahontan Region (State Water Resources Control Board and Lahontan Regional Water Quality Control Board, 1975), with some modifications clarifying the standards for Lake Tahoe and revising the standards for tributary streams. Based on data obtained in the late 1960's and early 1970's, the standards are set to stabilize the quality of the Lake at that recorded in those years. The specific objectives set for Lake Tahoe and its tributaries shall apply in addition to the general objectives currently set by the Water Quality Control Plan for the North Lahontan Region.

The nutrient objectives proposed for tributary streams reflect the quality to be expected from relatively undisturbed watersheds. Achieving water quality objectives for tributary streams will also help protect the Lake. Tributary standards are in addition to, not a substitute for, the standards set for Lake Tahoe, however. Despite attainment of the standards set for a stream, further reductions in the nutrient concentrations in the stream may be required so that the total nutrient load from all streams is reduced enough to prevent deterioration of the Lake.

The Clean Water Act requires each state to identify waters where enforcement of the minimum, nationwide controls set by the Act, applicable chiefly to municipal and industrial discharges, will not achieve water quality standards. Such waters are classified as "water quality segments," each segment having waters with common physical, chemical, and biological characteristics. The Lake Tahoe Basin must be classified as a water quality segment. Violations of the water quality standards set in this plan can be found in Lake Tahoe, where algal productivity is rapidly increasing, and in tributary streams draining disturbed watersheds. Uncontrolled surface runoff, which is not subject to the minimum, nationwide controls set by the Clean Water Act, threatens to cause further increases in algal growth in the Lake.

A set of guidelines establishing limits on the quality of runoff from land development sites is set forth in Table II-9. The guidelines for surface discharges contain limits on nutrients, turbidity (sediments), and oil and grease which are considerably lower than existing runoff quality. Compliance can be expected to reduce the discharge of pollutants from land development by approximately 80 to 90 percent. Limits on runoff infiltrated into the ground are less stringent than surface discharge limits, reflecting the ability of soil and vegetation to remove significant quantities of pollutants.

TABLE II-8

WATER QUALITY OBJECTIVES for SURFACE WATERS
of the NORTH LAHONTAN BASIN

Surface Water	TFR[2]	Cl	SO_4	B	Total N	Total P	Total Iron
				Constituent[1] (mg/l except as noted)			
Lake Tahoe [3/ 4/] Hydrologic Unit							
Lake Tahoe[5]	60/65		1.0/2.0	0.01/-	0.15/-	0.008/-	
Fallen Leaf Lake	50/-	0.30/0.50	1.3/1.4	0.01/0.02	0.20/-	0.005/0.010	
Griff Creek	80/-	0.40/-	-/-	-/-	0.19/-	0.010/-	0.03/-
Carnelian Bay Creek	80/-	0.40/-	-/-	-/-	0.19/-	0.015/-	0.03/-
Watson Creek	80/-	0.35/-	-/-	-/-	0.22/-	0.015/-	0.04/-
Dollar Creek	80/-	0.30/-	-/-	-/-	0.16/-	0.030/-	0.03/-
Burton Creek	90/-	0.30/-	-/-	-/-	0.16/-	0.015/-	0.03/-
Ward Creek	70/85	0.30/0.50	1.4/2.8	-/-	0.15/-	0.015/-	0.03/-
Blackwood Creek	70/90	0.30/-	-/-	-/-	0.19/-	0.015/-	0.03/-
Madden Creek	60/-	0.10/0.20	-/-	-/-	0.18/-	0.015/-	0.015/-
McKinney Creek	55/-	0.40/0.50	-/-	-/-	0.19/-	0.015/-	0.03/-
General Creek	50/90	1.0 /1.5	0.4/0.5	-/-	0.15/-	0.015/-	0.03/-
Meeks Creek	45/-	0.40/-	-/-	-/-	0.23/-	0.010/-	0.07/-
Lonely Gulch Creek	45/-	0.30/-	-/-	-/-	0.19/-	0.015/-	0.03/-
Eagle Creek	35/-	0.30/-	-/-	-/-	0.20/-	0.010/-	0.03/-
Cascade Creek	30/-	0.40/-	-/-	-/-	0.21/-	0.005/-	0.01/-
Tallac Creek	60/-	0.40/-	-/-	-/-	0.19/-	0.015/-	0.03/-
Taylor Creek	35/-	0.40/0.50	-/-	-/-	0.17/-	0.010/-	0.02/-
Upper Truckee River	55/75	4.0 /5.5	1.0/2.0	-/-	0.19/-	0.015/-	0.03/-
Trout Creek	50/60	0.15/0.20	-/-	-/-	0.19/-	0.015/-	0.03/-

1. Annual average Value/90th percentile value.
2. Total filtrable residue (total dissolved solids).
3. The water quality objectives presented here are derived from those contained in the Water Quality Control Plan for the North Lahontan Basin, (State Water Resources Control Board and Lahontan Regional Water Quality Control Board, 1975) with the following modifications. Several of the narrative objectives applying to waters of Lake Tahoe proper, are clarified. In addition, water quality objectives limiting the nutrient content of tributary streams have been reviewed, and, in some cases, revised. Revised stream standards are based on data contained in Table B-1 of the Tahoe Regional Planning Agency draft 208 plan (1977), which classifies tributary streams as draining disturbed or undisturbed watersheds and provides a summary of measured water quality characteristics derived from a number of different monitoring programs. Data for total nitrogen, total phosphorus and iron have been examined for the purpose of updating water quality objectives. A weighted mean concentration (weighted on the basis of the number of samples reported for the different monitoring programs) was first determined for each of the three nutrient constituents, for each tributary stream. For a stream draining an undisturbed watershed, the revised water quality objectives represent the weighted mean concentrations determined for that specific stream. For streams draining disturbed watersheds, revised water quality objectives are based on the overall mean nutrient concentration for all streams draining undisturbed watersheds.
4. In addition, the following standard for fecal coliform shall apply to Lake Tahoe and its tributaries; the fecal coliform concentration, based on a minimum of not less than five samples for any 30-day period, shall not exceed a log mean of 20/100 ml, nor shall more than 10% of the total samples during any 30-day period exceed 40/100 ml.
5. In addition, the following water quality objectives apply specifically to Lake Tahoe:
   - Algal Growth Potential: Mean annual algal growth potential at any point in the Lake shall not be greater than twice the mean annual algal growth potential at the limnetic reference station.
   - Plankton Count: Mean seasonal concentration of plankton organisms shall not be greater than 100 per ml and the maximum concentration shall not be greater than 500 per ml at any point in the Lake.
   - Clarity: The vertical extinction coefficient shall be less than 0.08 per meter when measured below the first meter. The turbidity shall not exceed 3 JTU at any location in the Lake too shallow to determine a reliable extinction coefficient. Secchi disk transparency shall not be decreased below levels recorded in 1967–71.
   - Electrical Conductivity: The mean annual electrical conductivity shall not exceed 95 umhos/cm at 50°C and the 90 percentile value shall not exceed 100 umhos/cm at 25°C at any location in the Lake.
   - Additional Biological Indicators: Algal productivity and the biomass of phytoplankton, zooplankton, and periphyton shall not be increased beyond levels recorded in 1967–71.

TABLE II-9

UNIFORM REGIONAL RUNOFF QUALITY GUIDELINES *

SURFACE DISCHARGES

Surface water runoff which directly enters Lake Tahoe or a tributary thereto should meet the following constituent levels:

CONSTITUENT	MAXIMUM CONCENTRATION
Total Nitrogen as N	0.5 mg/l
Total Phosphate as P	0.1 mg/l
Total Iron	0.5 mg/l
Turbidity	20 JTU
Grease and Oil	2.0 mg/l

If the constituent levels of water entering a site from upstream areas are of a superior or equal quality to the above, those waters should meet the quality level listed above prior to discharge from the site.

If the constituent levels of waters entering a site do not meet the above, there should be no statistically significant increase (at a 90 percent confidence level) in the water discharged from the site.

RUNOFF DISCHARGED TO GROUNDWATERS

Waters infiltrated into soils should not contain excessive concentrations of nutrients which may not be effectively filtered out by soil vegetation.

CONSTITUENT	MAXIMUM CONCENTRATION
Total Nitrogen as N	5 mg/l
Total Phosphate	1 mg/l
Iron	4 mg/l
Turbidity	200 JTU
Grease and Oil	40 mg/l

* These guidelines shall apply in addition to any more stringent effluent limitations necessary to achieve the water quality objectives set forth in Table II-8.

b. Monitoring

The State of Nevada and the U.S. Forest Service, operate ongoing water quality monitoring programs in the Lake Tahoe Basin. The California State Water Resources Control Board, in conjunction with other state and federal agencies, has developed a comprehensive monitoring program based, in part, on an existing monitoring program conducted by the University of California at Davis (Tahoe Research Group). The State Water Resources Control Board approved the monitoring program on October 18, 1979. The locations of sampling sites and types of measurements for existing and proposed monitoring programs are shown in Table II-10 and Figure II-12.

4. Water Quality Summary

a. The quality of offshore waters of Lake Tahoe is excellent. However, studies conducted over the last two decades indicate an alarming increase in the growth of algae throughout the Lake, with direct visual deterioration of nearshore waters resulting from growth of attached algae.

b. Algal growth depends on nutrients. Additional nutrients increase algal growth.

c. Surface runoff is the most important source of both algal growth stimulating nutrients and sediment to Lake Tahoe.

d. Land development practices have significantly increased the concentration of nutrients and sediment entering Lake Tahoe in surface runoff.

e. Future development will increase nutrient loadings still further. Currently, nutrient loads are as high as 1500 percent of natural levels. Nutrient loads would be up to 2000 percent of natural levels with the development allowed by the Tahoe Regional Planning Agency General Plan.

f. The full impact of increased nutrient loading rate may take decades, even centuries to be fully realized. Nutrient concentrations and algal growth rates in Lake Tahoe will increase if current loading rates are maintained. They will increase at an even more rapid rate if additional development is permitted.

g. The major effects of erosion and surface runoff from development are:

i. Siltation of stream beds;

ii. Reductions in the clarity of nearshore waters and increases in attached algal growth; and

iii. Accelerating eutrophication of the open waters of the Lake.

TABLE II–10

WATER QUALITY MONITORING IN THE LAKE TAHOE BASIN

NEVADA DIVISION OF ENVIRONMENTAL PROTECTION

Tributary Stream Monitoring

SAMPLING SITES:

1. First Creek at Dale and Knotty Pine
2. First Creek at Lakeshore Blvd.
3. Second Creek at Second Creek Drive
4. Second Creek at Lakeshore Blvd.
5. Wood Creek at Lakeshore Blvd.
6. East Fork of Third Creek at Hwy 27
7. Third Creek at Lakeshore Blvd.
8. West Fork Incline Creek at Hwy 27
9. East Fork Incline Creek at Tyrolian Village
10. Incline Creek at Lakeshore Blvd.
11. Mill Creek at Lakeshore Blvd.

MEASUREMENTS:

pH, BOD_5 or COD, chloride, total phosphate, ortho phosphate, ammonia, nitrate, nitrite, total dissolved solids, conductivity, alkalinity,bicarbonate, carbonate, kjeldahl-nitrogen, fecal coliform, fecal streptococci, dissolved oxygen, temperature, and stream flow

FREQUENCY:

Four times a year at each site.

Lake Monitoring

SAMPLING SITE:

Offshore of Sand Harbor, Lat. 39°11'50" – Long. 119°56'00"

MEASUREMENTS AND FREQUENCIES:

The same measurements as previously described for tributary streams are taken at the Lake station on a quarterly schedule. In addition, fish tissue and sediments are analyzed for the following toxic materials annually:

PCBs	Methoxychlor
Aldrin	Hexachlorobenzene
Dieldrin	Pentachlorophenol
Total DDT	Alpha BHC
O, P, DDE	Gamma BHC
P, P, DDE	Arsenic
O, P, DDD	Cadmium
P, P, DDT	Chromium
Chlordane	Copper
Endrin	Monochlor

STATE OF CALIFORNIA

Tributary Stream Monitoring

SAMPLING SITES:

1. Upper Truckee River
2. Trout Creek
3. Blackwood Creek
4. Ward Creek
5. General Creek
6. Burton Creek
7. Incline Creek
8. Third Creek
9. Edgewood Creek

MEASUREMENTS:

Flow, suspended solids, nitrate, orthophosphorus, total phosphorus, iron, temperature, turbidity, conductivity, ammonia, and total organic nitrogen

FREQUENCY:

52 times a year at each site

Lake Monitoring

SAMPLING SITES:

1. Index Station off Tahoe Pines – presently being monitored by the Tahoe Research Group
2. Center Station, South – Lat. 39° 00.0'N, Long. 120° 00.0'W
3. Center Station, North – Lat. 39° 08.7'N, Long. 120° 00.8'W
4. * Off the Incline – Third Creek area
5. * Off Tahoe City
6. * Off Upper Truckee River
7. * Off East Shore between Deadman's Point and Skunk Harbor
8. * Off Rubican Point

* – Exact location to be selected

MEASUREMENTS:

Temperature, dissolved oxygen, chlorophyll, light transmittance, phytoplankton and zooplankton (identification, enumeration and biomass), primary productivity, nitrate, orthophosphate, total phosphorus, and total iron. A sufficient number of measurements will be made to characterize these properties through the euphotic zone (to a depth of 100 meters or more below the surface).

FREQUENCY:

36 times a year at Index Station; Four times a year at other stations

TABLE II–10 (continued)

WATER QUALITY MONITORING IN THE LAKE TAHOE BASIN

Meteorlogical Monitoring

(Proposed Pilot Study, if Funds become Available)

SAMPLING SITES:

Two stations; one near North Shore, one near South Shore

MEASUREMENTS:

Lead, nitrate, ammonia, pH, and conductivity in rain and snow samples

FREQUENCY:

To coincide with major rain and snowfall events

Storm Drain Monitoring

(Proposed, if Funds become Available)

SAMPLING SITES:

Up to 12 major storm drains

MEASUREMENTS:

Sediments, nutrients, lead and organic analyses

FREQUENCY:

To coincide with runoff events

Remote Sensing

(Proposed Aerial Photography, if Funds become Available)

This program element has not yet been developed.

U.S. FOREST SERVICE

SAMPLING SITES:

1. Blackwood Creek
2. Heavenly Valley Creek
3. Meyers Landfill
4. Marlette Creek
5. Meeks Creek
6. Meiss Series (Upper Truckee River, Big Meadow, Grass Lake)

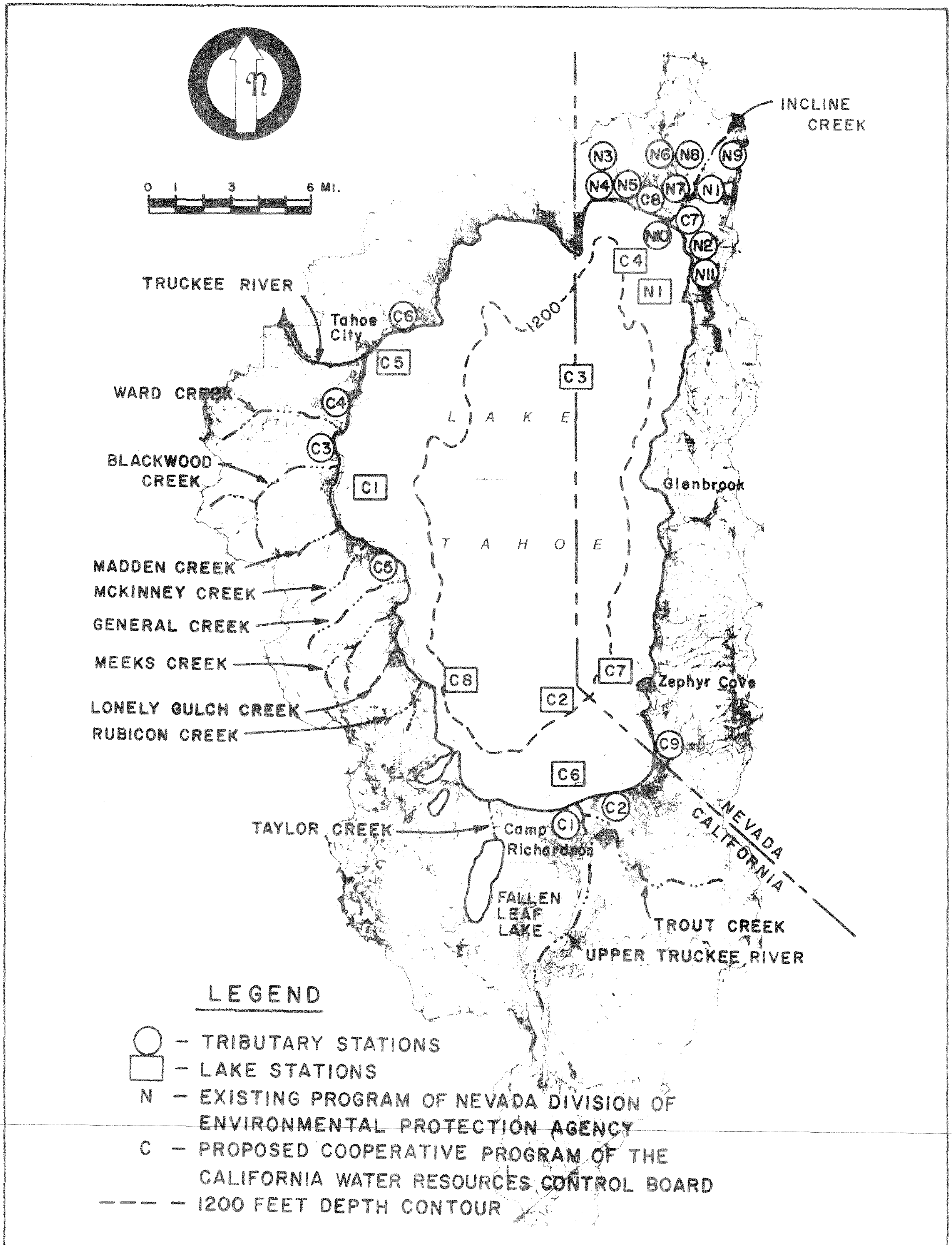
MEASUREMENTS:

Temperature, pH, conductivity, suspended sediment, discharge, turbidity, fecal coliform, hardness, alkalinity, total phosphorus, nitrate nitrogen, and organic nitrogen.

The above are measured at all stations. In addition, chloride, sulfate, and dissolved iron are measured at Meyers Landfill and phenols and color are measured at Meeks Creek.

FREQUENCY:

Weekly or twice weekly to coincide with snowmelt runoff except at Meeks and Meiss sites which are sampled four-six times per year.



LAKE TAHOE MONITORING
(See also Table II - 10)

h. Prevention of further deterioration of the quality of Lake Tahoe will require that nutrient and sediment loads be reduced to well below current levels.

B. PLANNING BACKGROUND

1. Water Quality Planning

The need for water quality standards and water quality planning to protect Lake Tahoe has long been recognized. In 1966, the Federal Water Pollution Control Administration (now the Environmental Protection Agency) convened the Conference of the Matter of Pollution of the Interstate Waters of Lake Tahoe and its Tributaries. The conference found that sewage disposal and erosion caused by development within the Basin threatened the water quality of the Lake. The conference recommended adoption of more stringent water quality standards, export of all wastewater and solid waste from the Basin, and enforcement of tighter controls over development. Shortly after the conference the California Regional Water Quality Control Board, Lahontan Region, adopted a water quality control policy. Nevada adopted standards in 1967.

The primary objective of the policy adopted by the Lahontan Regional Board was "to maintain the waters of Lake Tahoe in their present natural state of crystal clarity and pristine purity." The policy prohibited the discharge of sewage or solid waste to surface waters in the Lake Tahoe Basin. It also called for control of erosion and urban runoff.

In 1969, California enacted a statute requiring export of municipal sewage from the Lake Tahoe Basin. Nevada Governor O'Callaghan issued an executive order in 1971 prohibiting the use of septic tanks in the Basin. Nearly $100 million has been spent to build systems to collect, treat, and export sewage from the Basin. By 1974 these systems served virtually all developed areas of the Basin. During the same period local governments in the Basin issued franchises to private companies to collect and export solid waste. By 1972 all dumps in the Basin were closed.

The principal remaining threat to Lake Tahoe is erosion. In 1970 the Lahontan Regional Board adopted the Addendum to the Lake Tahoe Water Quality Control Policy Regarding Control of Siltation. The Addendum prohibits the discharge of earthen materials to surface waters. Any activity causing erosion which adds silt to Lake Tahoe or its tributaries violates the prohibition. The Addendum also prohibits the deposit of any earthen material below the high water mark of the Lake or within the 100-year flood plain of any stream. Nevada adopted similar standards in 1973. The prohibitions have not been strictly enforced, however. Because enforcement actions have been brought in only a few isolated cases, the prohibitions have done little to prevent erosion problems.

Congress recognized that erosion and surface runoff threaten Lake Tahoe water quality when it enacted section 114 of the Clean Water Act in 1972. Congress directed the Environmental Protection Agency to study the adequacy of federal control to protect Lake Tahoe. The study, completed in 1975, concluded that water quality standards for the Basin should be held inviolate. The study noted a decline in water quality, as shown by growth of attached algae in nearshore waters and by subtle color changes and decreased clarity in the Lake. Land development and land disturbance were increasing nutrients and sediments entering the Lake. The study concluded that: "Continued transport of sediment and nutrients to Lake Tahoe portends that the clarity of Lake Tahoe will not be maintained." The study found adequate control over federal lands. But "Federal (and State) oversight and control in the regulation of activities on private lands is presently inadequate to 'preserve the fragile ecology of Lake Tahoe.'"

2. Regional Land Use Planning

The state and national interest in preventing deterioration of Lake Tahoe threatened by uncontrolled development led to creation of regional planning agencies.

In 1967, the Lake Tahoe Joint Study Committee, established by the California and Nevada legislatures, proposed the creation of the Tahoe Regional Planning Agency. California and Nevada approved the Tahoe Regional Planning Compact to form the bi-state agency. Congress ratified the Compact in 1969.

In 1971 the Tahoe Regional Planning Agency adopted a General Plan, which includes a land use plan. The plan makes use of a land capability system, developed by the United States Forest Service in cooperation with the bi-state agency. Land is classified according to its ability to support development without causing excessive erosion or water pollution. The system sets coverage limits, specifying the amount of impervious surface which should be allowed on different land types. Three-fourths of the land in the Basin is classified as high erosion hazard land, which should be left in its natural condition. The agency adopted a Land Use Ordinance to carry out the land use plan. The Land Use Ordinance does not require strict adherence to the land capability system, but allows excess coverage in certain situations. The ordinance also allows construction of one home on each lot in any existing subdivision, regardless of land capability.

The Tahoe Regional Planning Agency has not set strict enough controls to protect Lake Tahoe. Only five percent of the development proposals presented to the agency have been disapproved. The Environmental Protection Agency's Lake Tahoe Study identified deficiencies in the bi-state agency, and recommended amendments to the Compact. The Tahoe Regional Planning Agency's own water quality management plan stated:

> "While TRPA [the Tahoe Regional Planning Agency] has broad authority to provide environmental controls and manage land uses, differences regarding the philosophy of growth, inadequate funding to the Agency, and a voting rule that allows approval by inaction rather than action reduces the Agency's effectiveness."

In September 1978, Governor Brown of California and Governor O'Callahan of Nevada agreed to compact amendments. The changes would include new voting procedures and a ban against new casino construction. The Nevada Legislature did not accept the changes proposed by the two governors, however, and alternative compact revisions proposed by the Nevada Legislature proved unacceptable to California legislators. Months of negotiations between legislators from the two states failed to produce agreement on a new compact before the Nevada Legislature adjourned. Before adjourning, the Nevada Legislature passed a bill allowing the governor to withdraw from the Compact. Upon dissolution of the bi-state agency, the Nevada Tahoe Regional Planning Agency would assume powers comparable to those of the California Tahoe Regional Planning Agency.

When it approved the Tahoe Regional Planning Compact, each State also created its own regional planning agency with authority over its side of the Basin. The Nevada Tahoe Regional Planning Agency expired when the bi-state agency covened in 1970. In 1973, Nevada reestablished the Nevada Tahoe Regional Planning Agency with authority over proposals for casino development. After formation of the bi-state agency the California Tahoe Regional Planning Agency limited its review to public works projects on the California side. Dissatisfied with the bi-state agency, the California Legislature strengthened statewide representation on the California Tahoe Regional Planning Agency in 1973 and provided funding to staff the California agency. The California Tahoe Regional Planning Agency adopted a Regional Plan in 1975 which sets stricter controls than those set by the bi-state agency. Although the California Tahoe Regional Planning Agency has set stricter coverage limits, and allows fewer overrides, than the bi-state Tahoe Regional Planning Agency, it does not require strict adherence to the land capability system. Like the bi-state agency, the California Tahoe Regional Planning Agency allows construction of one home on each lot, regardless of land capability.

The League to Save Lake Tahoe, a private nonprofit organization, and Huey Johnson, Secretary of California's Resources Agency, among others, have proposed creation of a Lake Tahoe National Scenic Area. Pursuant to legislation creating the National Scenic Area the federal government would adopt a plan, including a property acquisition program, to protect the environmental resources of the Lake Tahoe Basin.

Representative Vic Fazio (Sacramento) is preparing National Scenic Area legislation for introduction in Congress. A related proposal, supported by Representatives Phillip Burton (San Francisco) and Jim

Santini (Nevada's sole representative), would provide for sale of federal land near Las Vegas to raise funds which could be used to buy land in the Lake Tahoe Basin.

3. <u>208 Planning</u>

Section 208 of the Clean Water Act requires preparation of regional water pollution control plans. These "208 plans" must identify existing and potential water quality problems and control measures. The plans must include programs to carry out the necessary control measures, and the programs adopted in the plans must be implemented.

Each State designates planning areas and agencies capable of developing the 208 plans. For areas where no areawide planning agency is designated, the State prepares the 208 plans. Plans must be reviewed and adopted by the State before they are submitted to the Environmental Protection Agency. In California, the State's planning responsibilities are assigned to the State Water Resources Control Board. The Nevada Department of Conservation and Natural Resources has similar duties.

In 1974, California and Nevada jointly designated the Tahoe Regional Planning Agency as the agency responsible for preparing the 208 plan for the Lake Tahoe Basin. The Lake Tahoe Basin 208 planning area is shown in Figure II-13. The Environmental Protection Agency approved the designation.

In 1977 the Tahoe Regional Planning Agency issued a Draft 208 Plan, prepared by agency staff and J. B. Gilbert and Associates. The draft identified five major water pollution problems:

- Erosion and drainage problems caused by past development, especially road building, including unstable slopes and areas stripped of vegetation. The draft identified the work needed to correct these problems, at a cost of $78 million;

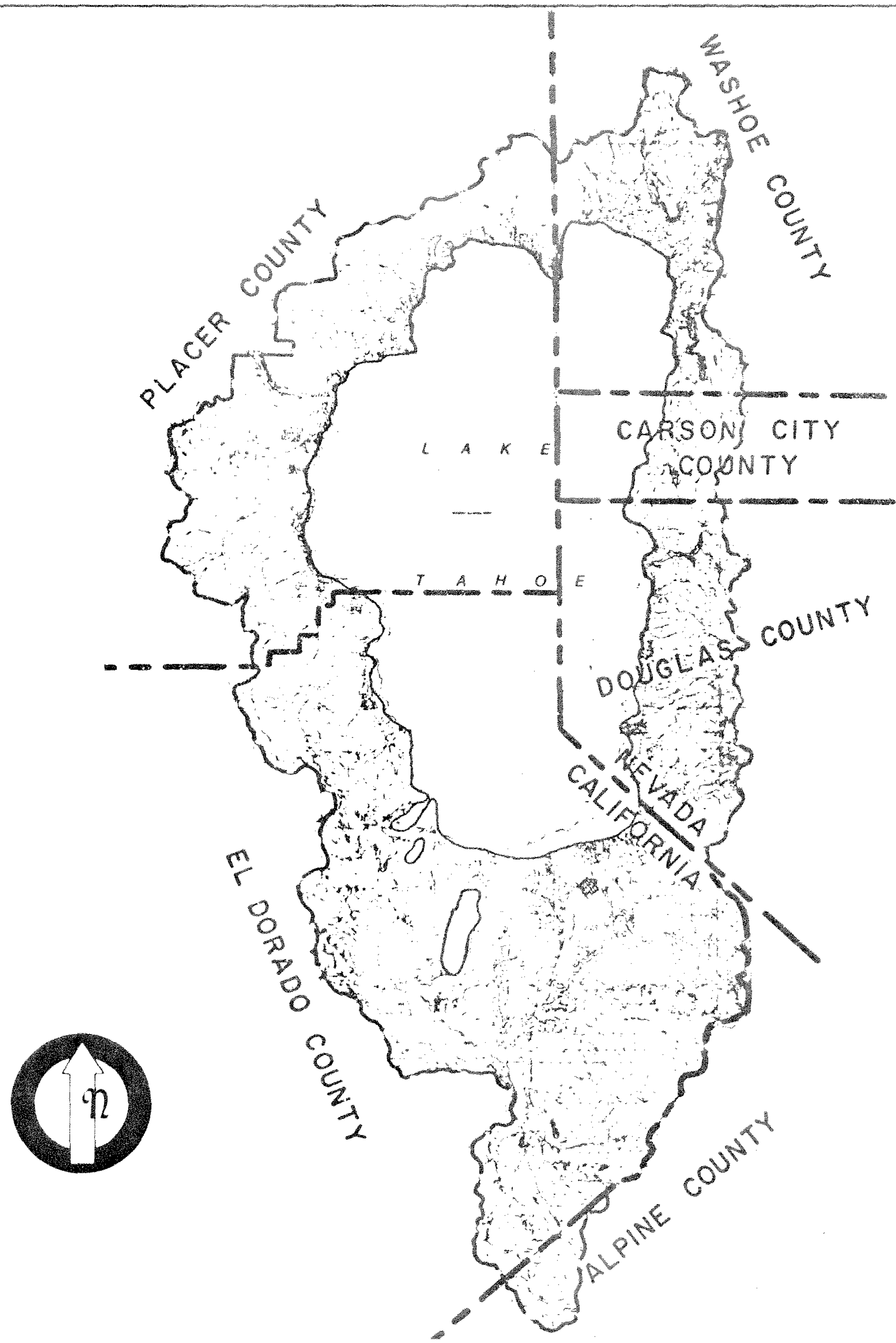
- Development in stream environment zones, such as meadows and drainageways, destroying their natural capacity to remove pollutants;

- Runoff from specific areas such as parking lots, construction sites, and ski slopes;

- Erosion from development on high erosion hazard lands; and

- Erosion from forest lands, primarily from old logging roads and skid trails or areas used by off-road vehicles.

The agency's draft 208 plan included proposals to fund the plan. Most of the money would be raised by a basin user fee. The draft also proposed zoning changes. Unsubdivided areas in stream environment zones or high erosion hazard lands zoned for commercial or residential



The 208 planning area includes: (1) Lake Tahoe; (2) Adjacent parts of Washoe, Carson City and Douglas Counties in Nevada which are in the Lake Tahoe watershed; (3) Adjacent parts of Placer and El Dorado Counties in California which are in the Lake Tahoe watershed; and (4) An additional area in Placer County, near the Lake Tahoe outlet to the Truckee River, consisting of the area adjacent to the Lake Tahoe watershed which lies southward and eastward of a line starting at the intersection of the watershed crestline and the north boundary of Section 1, thence west to the northwest corner of Section 3, thence south to the intersection of the watershed crestline and the west boundary of Section 10 (all sections referring to Township 15 North, Range 16 East, M.D. B. & M.).

LAKE TAHOE BASIN 208 PLANNING AREA

use would be rezoned to prevent development. A moratorium on development in existing subdivisions in stream environment zones would also be imposed while detailed plans to protect stream environment zones were prepared. The draft also sets forth best management practices to control surface runoff.

In January 1978, the Tahoe Regional Planning Agency approved a final 208 plan. The agency accepted the draft's assessment of pollution problems, but eliminated major control measures proposed in the draft. The final 208 plan lacked commitment to enforce the remaining controls. The agency rejected the basin user fee and all other sources of funds above the levels already being spent on erosion control. The agency also deleted the proposed zoning changes.

Nevada conditionally approved the Tahoe Regional Planning Agency's final 208 plan in March 1978. Seven of the conditions set by Nevada required plan amendments or implementing ordinances to be made by July 1978. The Tahoe Regional Planning Agency has not complied with these conditions.

In July 1978 the California State Water Resources Control Board rejected the plan for failure to include the control actions and enforcement commitments needed to protect Lake Tahoe. The State Board also found that the Tahoe Regional Planning Agency had not exercised the controls needed to protect the Lake, and that there was no regional agency capable of achieving the objectives of 208 planning. The State Board therefore decided to revoke designation of the Tahoe Regional Planning Agency as the agency responsible for 208 Planning at Lake Tahoe. The State Board decided that the revocation of planning responsibility should not take effect until November 1978, and could be reconsidered at any time until then. The State Board resolved that when the revocation of the designation of the Tahoe Regional Planning Agency became effective, the State Board would assume responsibility for preparing the 208 plan. The State Board reaffirmed its decision in November 1978.

This document is a draft of the 208 plan the State Water Resources Control Board assumed responsibility for preparing when it rejected the Tahoe Regional Planning Agency's plan. To provide an opportunity for further public comment, this draft is being circulated before a final Lake Tahoe 208 Plan is prepared and adopted by the State Water Resources Control Board. The Tahoe Regional Planning Agency will then be given another chance to adopt an acceptable plan, after which the State board plan -- or the Tahoe Regional Planning Agency plan if the agency adopts an acceptable plan -- will be submitted for approval by the Environmental Protection Agency.

4. Authority to Regulate Land Use and Water Quality

Several public agencies have authority to adopt and enforce the control measures needed to protect water quality at Lake Tahoe. Many others can provide support. This discussion summarizes the authority of public agencies with major responsibilities for land use and water quality.

a. Local Government

Placer County	Washoe County
El Dorado County	City & County of Carson City
City of South Lake Tahoe	Douglas County

The Lake Tahoe Basin includes parts of Placer and El Dorado Counties in California, and parts of Washoe, Carson City, and Douglas Counties in Nevada. The City of South Lake Tahoe, the only incorporated city in the Basin, is in El Dorado County. Figure II-14 shows the boundaries of these local governments.

Cities and counties have broad powers to adopt and enforce regulations so long as they do not conflict with state or federal law. These powers include authority to set land use controls and regulations to protect water quality.

Cities and counties also have authority to provide public services. These public services may include erosion control projects. Public services now being provided include roads and storm sewers. A number of special service districts have been formed within the counties to help provide these services.

b. Resource Conservation Districts

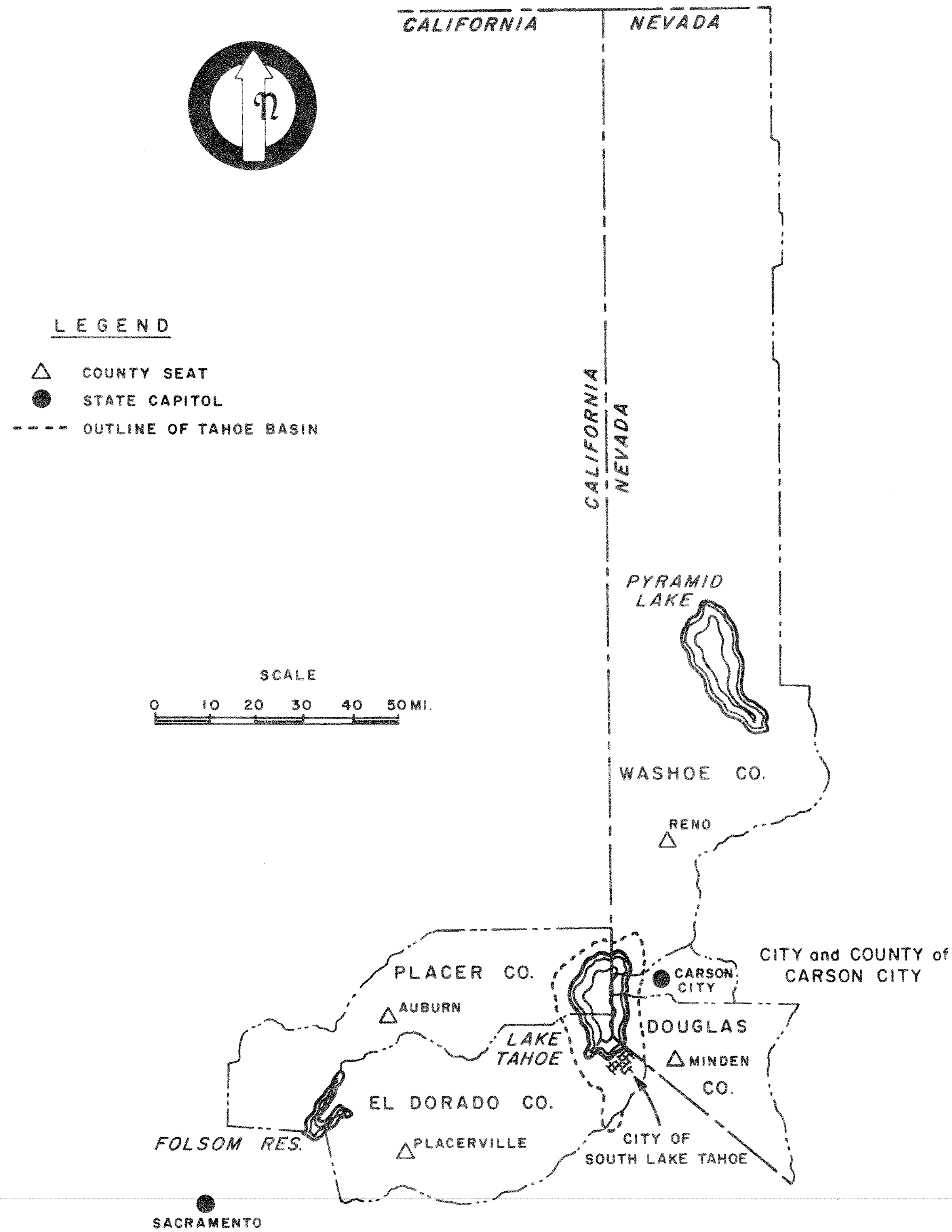
Tahoe Resource Conservation District (California)
Nevada Tahoe Conservation District

Resource Conservation Districts are special districts formed under state law.

Each State has a resource conservation district for the Lake Tahoe Basin. These districts provide financial and technical assistance to both private individuals and public agencies for erosion control.

The Nevada Tahoe Conservation District is a member of the Carson-Walker Resource Conservation and Development Council. The council recently obtained an 80 percent federal grant for a $150,000 erosion control project in the Kingsbury Grade area of Douglas County. The project involved mechanical stabilization and revegetation of oversteepened slopes.

Figure II-14



LOCAL GOVERNMENT BOUNDARIES

c. Sewerage Agencies

Tahoe-Truckee Sanitation Agency (North Tahoe Public Utility District and Tahoe City Public Utility District)

Incline Village General Improvement District

South Tahoe Public Utility District

Douglas County Sewer Improvement District No. 1

Four sewage treatment and export systems serve the ten sewerage districts in the Lake Tahoe Basin. Figure II-15 shows the sewerage districts and export systems.

In California, the Public Utility District Act authorizes public utility districts to provide surface runoff management services, but the districts on the California side of the Basin do not provide this service. In Nevada, the Incline Village General Improvement District, Round Hill General Improvement District, and Kingsbury General Improvement District No. 1 provide some surface water management service. The other Nevada sewerage districts do not have authority to provide this service.

d. Regional Agencies

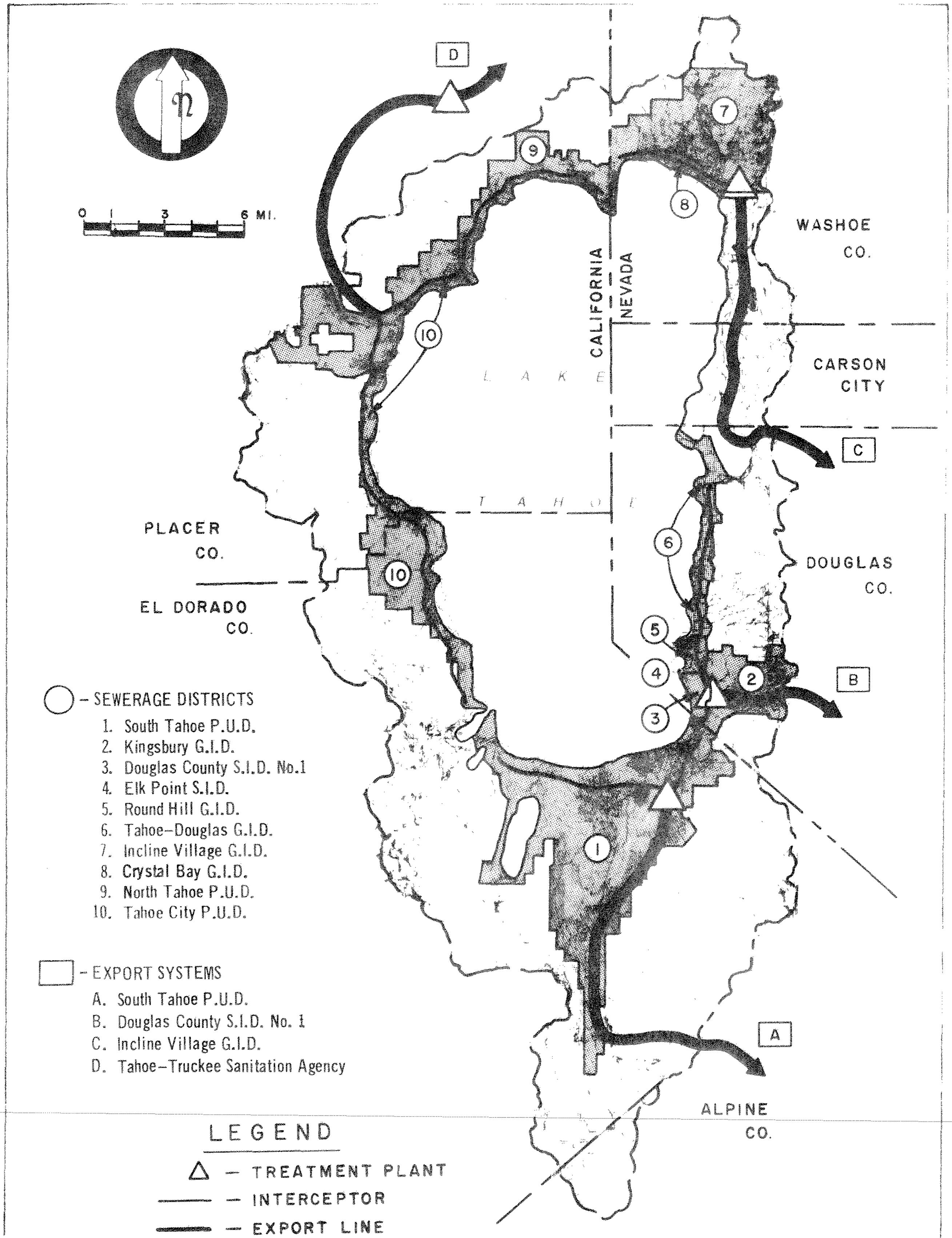
Tahoe Regional Planning Agency
California Tahoe Regional Planning Agency
Nevada Tahoe Regional Planning Agency
California Tahoe Conservancy Agency

The Tahoe Regional Planning Agency has broad authority to adopt ordinances and issue permits governing land use and water quality. These ordinances set minimum standards which must be enforced by local government. States and local governments may set stricter rules. The Tahoe Regional Planning Compact requires the Tahoe Regional Planning Agency to permit gaming on land zoned for gaming as of February 5, 1968.

The California Tahoe Regional Planning Agency has authority to adopt ordinances and issue permits for the California side of the Basin. These standards prevail where they are stricter than those set by the bi-state agency, and must be enforced by local government. Public works projects by the State of California require approval by the California Tahoe Regional Planning Agency.

The Nevada Tahoe Regional Planning Agency has authority to review casino development not subject to review by the bi-state agency. If either State pulls out of the compact, the Nevada agency will assume broader responsibilities comparable to those of the California Tahoe Regional Planning Agency.

Figure II 15



SEWERAGE DISTRICTS AND EXPORT LINES IN THE LAKE TAHOE BASIN

The regional planning agencies do not have authority to acquire and hold property to preserve scenic and recreational opportunities in the Basin. In California, the California Tahoe Conservancy Agency has been established for this purpose. The positions on the governing board have not been filled, however, and no money has been appropriated to the agency.

e. State Agencies

i. Water Quality Agencies

California State Water Resources Control Board
Lahontan Regional Water Quality Control Board
Nevada Environmental Commission
Nevada Division of Environmental Protection

State water quality agencies are responsible for water quality planning and enforcement under programs established under state law and under the federal Clean Water Act. California state law assigns the State Water Resources Control Board responsibility for water quality planning and standard setting required by the federal Clean Water Act. The State Board can also review any action of the Lahontan Regional Board setting standards, issuing permits, or taking enforcement action. Water quality standards may include discharge prohibitions. Discharges may also be regulated by permits issued by the Regional Board. The activities which may be regulated as discharges under state law are not limited to the pumping or pouring of effluent through a pipe, ditch, or other "point source." Deposits of fill material and activities contributing to erosion and surface runoff are also covered. Enforcement actions may include orders to clean up conditions causing or threatening pollution, injunctions, and actions for civil and criminal penalties. The State Board administers a sewage treatment plant construction grants program, which offers both state bond funds and federal funds provided through the Clean Water Act. The State Board is also responsible for the State's water rights program.

In Nevada, standards are set by the State Environmental Commission. The Nevada Division of Environmental Protection is responsible for water quality management and enforcement of regulations adopted by the Commission. The Division of Environmental Protection has enforcement authority similar to that of the California water quality agencies.

ii. State Lands Agencies

California State Lands Commission
Nevada Division of State Lands

Approval by state lands agencies is required before any structure may be placed below the high water level of Lake Tahoe. Approval is also required before any material may be taken from below the high water mark.

iii. Parks Departments

California Department of Parks and Recreation
Nevada Division of State Parks

State parks agencies purchase and manage state parks.

iv. Transportation Departments

California Department of Transportation
Nevada Department of Transportation

These agencies have authority for construction and maintenance of state highways. This authority includes responsibility for control of erosion and runoff from Basin highways.

f. Federal Agencies

Federal activities in the Lake Tahoe Basin include regulatory programs, land purchase and management, and administration of grants and loans. The Western Federal Regional Council, composed of federal agency regional administrators, coordinates federal policy and programs in the region. In 1978, the council adopted a Federal Policy for the Lake Tahoe Basin. The policy directs all federal agencies to ensure their activities are consistent with land, water, and air resources capabilities. The policy also directs federal regulatory agencies to assure that water quality is not degraded. The Environmental Protection Agency, Forest Service, and Soil Conservation Service are directed to provide financial and technical help in implementing the Lake Tahoe 208 plan. Environmental priorities shall govern the location, type and size of all proposals to the Department of Housing and Urban Development.

i. Environmental Protection Agency

Water quality standards and 208 plans must be approved by the Environmental Protection Agency.

The Clean Water Act requires a permit for any "point source" discharge of a pollutant to surface waters. Point sources do not include unchannelled runoff. Permits are issued by state water quality agencies, but the Environmental Protection Agency can veto a state issued permit. The Environmental Protection Agency may also bring enforcement actions for permit violations.

The Clean Water Act also establishes several grant programs, including grants for water quality planning and administration of the permit program. Grants are also available for sewage treatment works. After the 208 plan is approved, these construction grants may be awarded only for treatment works which conform to the plan. Another program under the Clean Water Act provides grants for projects, including erosion control projects, to protect the quality of freshwater lakes.

ii. Army Corps of Engineers

No structure or fill material may be placed in any lake, stream, or adjacent wetland without a federal permit. The Corps of Engineers has issued a blanket permit for areas other than Lake Tahoe and a few of the largest streams. The Corps has authority to revoke this general permit, and require individual permits for activities in all streams and wetlands in the Basin.

The Corps also provides flood hazard information for use in floodplain zoning.

iii. Forest Service

The United States Forest Service manages 63 percent of the land in the Lake Tahoe Basin. The administrative unit of the Forest Service responsible for these lands is the Lake Tahoe Basin Land Management Unit. Land ownership in the Basin is shown in Figure II-16 and Table II-11. The Forest Service has purchased over 30,000 acres since 1970, and has identified an additional 33,000 acres which should be placed in public ownership. Purchase of these lands would raise the portion of lands in the Basin managed by the Forest Service to 79 percent.

The Forest Service's Land Management Plan places the highest priority on protection of the water quality of Lake Tahoe and its tributary lakes and streams. The Forest Service has authority to carry out projects to control erosion on National Forest lands. Projects are being planned or carried out to control erosion from old roads, campgrounds, and landfills. Private activities on National Forest lands, which include timber removal, a ski area and organizational camps, require special use permits. These permits set erosion control requirements.

iv. Soil Conservation Service

The Soil Conservation Service provides technical and financial assistance to landowners and public agencies for erosion control. Priorities for assistance are set by the resource conservation districts.

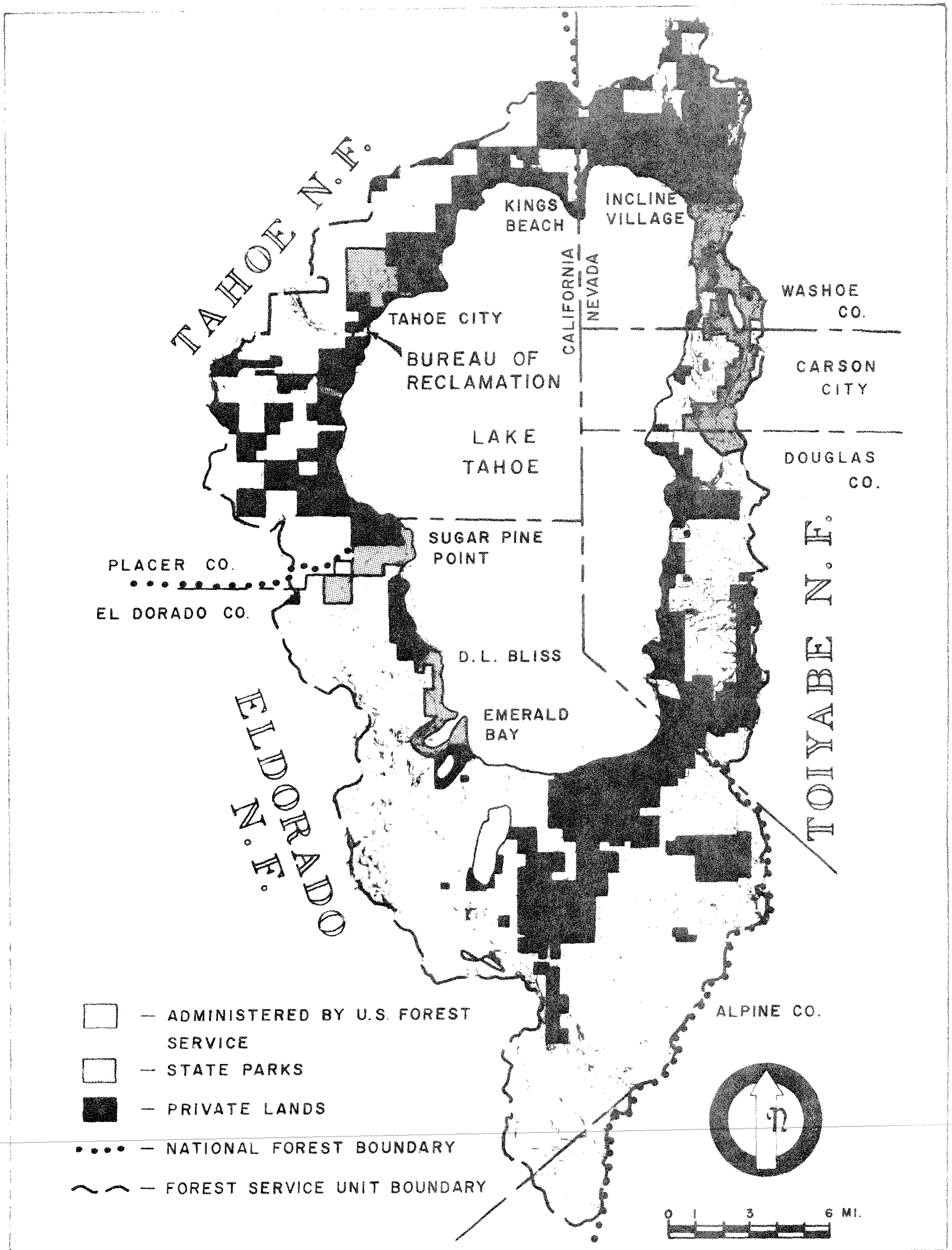
TABLE II–11

LAKE TAHOE BASIN LAND OWNERSHIP

LAKE TAHOE BASIN ACREAGE – 1/1/79 *

TOTAL LAND AREA		205,250 acres
	California –	155,170 acres (75.6%)
	Nevada –	50,080 acres (24.4%)
PUBLIC OWNERSHIP		144,604 acres (70%)
National Forests		132,583 acres (65%)
California		110,727 acres
Nevada		21,856 acres
OTHER PUBLIC		12,021 acres (6%)
Bureau of Reclamation		64 acres
State of California		5,567 acres
State of Nevada		6,047 acres
Cities/Counties – California		263 acres
Counties – Nevada		80 acres
PRIVATE OWNERSHIP		60,646 acres (30%)
California		38,677 acres
Nevada		21,969 acres

* Includes land in Alpine County, California, within the Lake Tahoe watershed.



LAND OWNERSHIP

v. Department of Housing and Urban Development

The Department of Housing and Urban Development provides funds for land use and housing plans. The Department also offers financial assistance for housing, including mortgage loan insurance.

CHAPTER III

WATER QUALITY PROBLEMS AND CONTROL NEEDS

A. SOURCES OF WATER POLLUTION

1. Surface Water Runoff

a. Conditions Affecting Surface Runoff

Surface runoff is the principal source of pollutants affecting Lake Tahoe. Runoff breaks down Basin soils and transports erosion products to the Lake. These erosion products include soil particles, which cause turbidity and sedimentation, and nutrients, which stimulate algal growth.

Soil particles are measured in terms of suspended sediment. Nutrients are measured as total nitrogen, phosphate, and iron. The same erosion processes which generate suspended sediment also release nutrients bound up in the soil. As levels of suspended sediment in surface runoff increase, so do levels of dissolved and particulate bound nutrients. Measurements of soil loss or sediment generation therefore provide an indication of the relative quantity of nutrients released by erosion and soil disturbances. Throughout this report estimates of suspended sediment are used as a measure of erosion problems, both to provide an estimate of soil loss and to indicate where erosion problems are increasing nutrient loadings on the Lake.

Vegetation and ground litter intercept precipitation and allow it to infiltrate through the soil where nutrients are stripped out for plant growth. Snow melt and rainfall in excess of soil infiltration capacity runs off the surface and is conveyed through drainage courses to the Lake. Steeply sloping upland slopes with sparse vegetation and shallow soils generate more sediment and nutrients than more densely covered areas with good soils because there is more surface runoff to erode the soil.

At the downstream end of many channels sediments have been deposited and areas slowly transformed into marshes, meadows, and riparian areas. Here surface runoff velocity is retarded by flat slopes and riparian vegetation. Water moves both below and above ground as a thin sheet. Sediment and nutrients are physically and biologically stripped out of the runoff.

Under natural conditions, surface runoff entering Lake Tahoe contains extremely low concentrations of suspended sediment and nutrients, but the natural balance is easily upset.

i. Runoff Quality - Natural Conditions

Basin soils are derived primarily from granitic rock and are coarse textured, low in water holding capacity, and have a high potential for erosion. Numerous factors affect the rate at which these soils are naturally eroded. Four variables that are most significant in determining the rate of erosion are:

- Watershed slope and elevation
- Distribution of soils within the watershed
- Amount of highly erodible soil with low infiltration capability
- Extent and density of vegetative cover

(a) Erosion Processes

The principal types of erosion caused by surface runoff include:

- Sheet Wash -- a continuous, uniform removal of thin soil layers not readily visible but occurring on all exposed soil surfaces. Infiltration capacity of the soil is reduced, less water is percolated into the soil, and surface runoff rates greatly increase. Areas that are bare or have sparse vegetation are the major sources of sheet erosion.
- Rill Erosion -- concentration of surface runoff creates shear forces which erode and transport large quantities of soil materials. This process occurs during heavy rainfall or snowmelt runoff.
- Sloughing -- movement of loose soil on slopes steeper than the natural angle of repose, about two horizontal units to one vertical unit for most Basin soils. Sloughing is readily visible on areas of decomposed granite in the Basin. Material from sloughing slopes is deposited at the slope toe and transported by surface runoff into streams and the Lake.

(b) Natural Pollutant Loadings

Although Basin soils are highly erosive, natural erosion rates and delivery of sediment materials to the Lake are low. A State Water Resources Control Board study revealed that a highly erodible portion of a watershed on the west shore which has been naturally stabilized over time generated only about 0.035 metric tons/hectare/year of sediment. Appendix B summarizes other studies in the Basin with similar findings. A study of an undisturbed watershed in the heavily forested granitic batholith of Idaho revealed natural erosion rates of about 0.088 metric tons/hectare/year (Megahan, 1972).

Based on an analysis of water quality data for undisturbed watersheds in the Lake Tahoe Basin, set forth in Appendix B, the suspended sediment yield for the Basin under natural conditions is estimated at 3,100 metric tons/year, an average of 0.038 metric tons/hectare. The associated nutrient loading, obtained using the relationship between sediment and nutrient production described in Appendix B, is as shown in Table III-1.

ii. Runoff Quality - With Basin Development

Development in the Basin has greatly upset this natural balance and accelerated the generation of sediment and nutrients. The major impacts of development are to:

- Remove the vegetative cover, decreasing infiltration of precipitation and increasing runoff. Erosion rates dramatically increase and the uptake of nutrients decreases when vegetative cover is removed.

- Increase impervious area. Construction of structures, paved areas, and other impervious surfaces decreases infiltration and greatly increases surface runoff. Natural channels downstream of paved areas experience increased runoff rates and erosion.

- Create unstable conditions. Many areas stripped of vegetative cover are left bare. Cut and fill slopes often are steeper than the natural angle of repose and have no surface protection. Stream environment zones are overloaded by increased runoff and sediment loads. Construction and filling within stream environment zones converts slow sheet flow into channelized flow.

The level of sediment production in a watershed following development activities is related to the degree of urbanization and the natural erodibility of the soil. Sediment production increased over 100 times natural conditions after development on a highly erodible watershed on the west shore, studied by the State Board. Similar studies on Incline Village watersheds have shown sediment rates following development that are 13 times the natural level. Even construction on lands classified as low erosion hazard lands, following

TABLE III–1

SEDIMENT and NUTRIENT (Soluble and Particulate)
LOADING to LAKE TAHOE under NATURAL CONDITIONS
Metric Tons/Year

PARAMETER	LOADING
Suspended Sediment	3,100
Total Nitrogen, as N	26.3
Total Phosphate, as P	37.1
Total Iron, as Fe	340.2

best management practices to control erosion, has increased sediment generation to three or four times natural levels. (White, 1978).

(a) Land Capability System

A system developed by the Forest Service in 1971, in cooperation with the Tahoe Regional Planning Agency, provides a relative quantification of tolerance of land in the Basin to human disturbance (Bailey, 1974). Factors evaluated in determining an area's land capability include hazards from floods, high water tables, poorly drained soils, landslides, fragile flora and fauna, soil erodibility, and slope steepness. All of these factors affect sediment generation from an area following disturbance. The criteria used to assign lands to different capability classes are shown in Table III-2. Lands in the Basin are grouped into three general categories representing the hazard of disturbance from development:

- High Erosion Hazard
- Moderate Erosion Hazard
- Low Erosion Hazard

Based upon land capability characteristics a single numerical value representing the percentage of the land surface which may be covered with impervious surface without substantial damage to the land is assigned to each capability class. These coverages are listed in Table III-3. The land capability system also specifies that high erosion hazard lands in capability classes 1 and 2 are not suited for urbanization and should be left in their natural state. High erosion hazard lands should not be developed at all, even within the one percent coverage limit shown in Table III-3. Most of the development in the Basin has not conformed to the land capability system. Most of the subdivisions in the Basin were built before the regional planning agencies adopted ordinances implementing the land capability system. These ordinances still allow both residential and commercial development to override coverage limitations in many cases.

(b) Sediment and Nutrient Loadings Due to Development

The generation of sediment and nutrients above natural levels is related to the degree of disturbance caused by development and the land capability of the disturbed areas. An analysis of sediment data from 19 watersheds in the Basin shows a correlation between sediment yield, land capability, and degree of disturbance. The suspended

TABLE III–2

CRITERIA FOR ASSIGNMENT OF CAPABILITY CLASSIFICATION TO LAKE TAHOE BASIN LANDS

Capability Levels	Tolerance for Use	Slope Percent 1/	Relative Erosion Potential	Runoff Potential	Disturbance Hazards
7	Most	0–5	Slight	Low to Moderately Low	Low Hazard Lands
6		0–16	Slight	Low to Moderately Low	
5		0–16	Slight	Moderately High to High	
4		9–30	Moderate	Low to Moderately Low	Moderate Hazard Lands
3		9–30	Moderate	Moderately High to High	
2		30–50	High	Low to Moderately Low	High Hazard Lands
1a	Least	30+	High	Moderately High to High	
1b 1c		Poor Natural Drainage Fragile Flora and Fauna 2/			

1/ Most slopes occur within this range. There are, however, many areas that fall outside the range given.

2/ Areas dominated by rocky and stony land.

TABLE III–3 ALLOWABLE COVERAGE ON DIFFERENT CAPABILITY CLASSES		
Capability Class	Erosion Hazard	Allowable Impervious Surface Coverage, %
7	Low	30
6		30
5		25
4	Moderate	20
3		5
2	High	1
1		1

sediment production resulting from development activities can be evaluated using this relationship, which is described in detail in Appendix B and shown graphically on Figure III-1. Each of the 19 watersheds was assigned an average land capability class and percentage of watershed disturbance, which was then related to annual average suspended sediment production. The resulting empirical relationship is:

$$SS = 0.0467 - 0.0037(LCC) + [0.2901 - 0.0395(LCC)]PD$$

where: SS = suspended sediment yield rate (metric tons/hectare/year)

LCC = average land capability class

PD = percent of the total area which is disturbed

This relationship does not reflect natural and man-related anomalies in suspended sediment production from:

- Erosion due to a high degree of stream channelization, as in Blackwood Creek.

- High erosion areas which are unusually unstable, such as Ward Creek and the upland area of Incline Village.

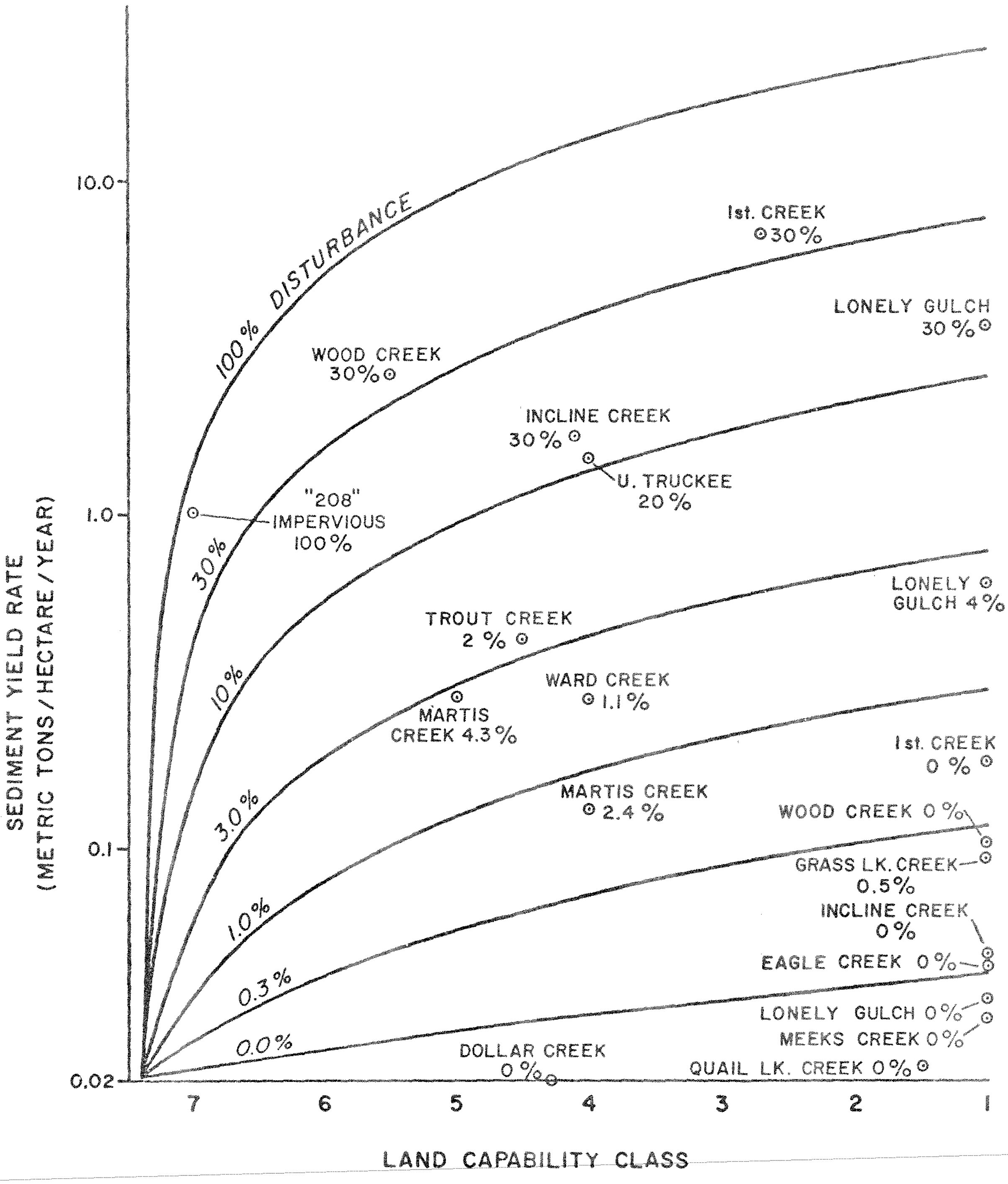
- Sediment reduction by natural treatment processes in very large stream environment zones or marshy areas.

- Sediment reduction due to settling in large lakes, such as Fallen Leaf and Cascade Lakes.

To determine the annual loading of suspended sediment materials on Lake Tahoe, this relationship can be used to estimate the natural load and the load associated with a given level of urbanization. The total load is the sum of these two loads, plus the loads from forest land disturbances (estimated to total approximately 10,000 metric tons per year), and jeep trails (estimated to total approximately 5,530 metric tons per year). The estimated suspended sediment yield for natural conditions, the present level of development and ultimate development in accordance with the Tahoe Regional Planning Agency land use plan is shown in Table III-4.

The suspended sediment load on Lake Tahoe from the present level of development is about 20 times the natural load. Full development of the Basin would increase the load to 27 times natural levels. Total nutrient loadings can be estimated on the basis of the relationship between sediment and nutrient loadings described in Appendix B. Estimated nutrient loadings for natural conditions, the present levels of development, and full development in accordance with the Tahoe

Figure III-1



Sediment Yield Rate as a Function of Percent Disturbance
and Land Capability Class for the Lake Tahoe Basin

TABLE III–4

ESTIMATED SEDIMENT LOADING to LAKE TAHOE

CONDITION	Estimated Sediment production, (metric tons/year)	Percent increase above natural
Natural	3,100	–
Present level of development	60,800	1,900
Full development–TRPA General Plan	83,900	2,600

TABLE III–5

ESTIMATED NUTRIENT LOADING (Dissolved and Particulate) to LAKE TAHOE

	ESTIMATED LOADING					
	Total Nitrogen as N		Total Phosphate as P		Total Iron	
CONDITION	Metric Tons/Yr	Percent Increase	Metric Tons/Yr	Percent Increase	Metric Tons/Yr	Percent Increase
Natural	26.3	––	37.1	––	340.2	––
Present level of development	383	1360	606	1530	3927	1050
Full development–TRPA	528	1900	835	2150	5418	1500

Regional Planning Agency land use plan are compared in Table III-5. Present nutrient loads are many times the natural load and would increase still more with full development of the Basin.

b. Surface Water Runoff Problems

Specific erosion and surface runoff problems which can be corrected or prevented can be classified as:

- Erosion and drainage problems;
- On-site surface runoff problems;
- Future development, particularly stream environment zone encroachment and development on high erosion hazard lands, or in excess of coverage limitations; or
- Problems on forest lands.

A field survey conducted in the summer and fall of 1975 provided information for the preparation of the Tahoe Regional Planning Agency's 1977 Draft Lake Tahoe Basin 208 Plan. The survey compiled and analyzed aerial photographs of each watershed, inspected all urbanized areas to identify problems in the field, and delineated problems on aerial photographs. The field survey was supplemented by an analysis of zoning plans and land capability system maps to identify those areas where conflicts between permitted uses and land tolerance would occur.

i. Erosion and Drainage Problems

Poor development practices have created a number of serious erosion problems which can be at least partially corrected to reduce sediment and nutrient generation.

(a) Problem Inventory

Erosion and drainage problems identified in the field survey are categorized as follows:

- Areas Striped of Vegetation -- Bare areas where vegetation was removed for previous uses such as gravel operations, dump sites, old parking areas, or utility easements, are a source of sheet and rill erosion. These areas cover about 220 acres.
- Unstable Roadway Slopes -- Many cut and fill slopes adjoining Basin roadways and subdivision streets are unstable because they are too steep or because the vegetative cover was removed and not replaced. The field survey identified nearly 84 miles of cut and

fill slopes steeper than the natural angle of repose. The survey also found approximately 454 acres of unvegetated roadway slopes.

- Unsurfaced Roads, Streets, and Driveways -- Areas of unprotected soil subject to automobile traffic experience heavy sheet and rill erosion. There are over 177 acres (73 miles) of dirt roads and streets in the Basin, not including roads on National Forest lands or large private land holdings. In addition, there are many unpaved driveways, small private access roads, and similar unpaved areas which were not included in the field survey but which undoubtedly generate significant quantities of sediment and nutrients.

- Eroding Roadway Shoulders and Roadside Ditches -- Most of the streets and roads in the Basin do not have paved shoulders or curbs. On many of these roadways erosion problems are created by the sheet flow from the road surface across the unpaved roadway shoulder which is then concentrated in unprotected roadside ditches. There are over 462 miles of eroding roadway shoulders and ditches in the Basin.

- Inadequate or Unstable Drainage Systems -- Without adequate drainage systems, the increase in concentration of surface runoff caused by the larger impervious surface in urbanized areas quickly erodes unprotected areas. Small storm drainage systems along streets or roadways collect surface runoff which is then discharged to adjacent unstable roadway slopes, unvegetated areas, or unstable channels. Many urbanized areas have no formal drainage facilities. Uncontrolled runoff flows through residential and commercial areas, along streets and roadways, and over roadway slopes and exposed areas. The field survey evaluated existing drainage systems both for adequacy of capacity and point of discharge. Where no facilities existed, the survey measured the length and extent of unstable areas being eroded. Drainage systems which are inadequate, unstable, or contain unstable discharge facilities total over 118 miles.

Table III-6 presents an inventory of all problems indentified in the field survey according to the erosion hazard rating of the area where the problem was located. Problems associated with eroding slopes and bare surfaces occur more frequently on the low erosion hazard lands where the most dense development is located and natural drainage patterns have been severely disrupted or eliminated. Most eroding roadway shoulders, ditches, and dirt roads are in California. Unvegetated and oversteepened slopes occur primarily in Nevada.

TABLE III-6

BASINWIDE INVENTORY of EROSION
and DRAINAGE PROBLEMS by LAND CAPABILITY

Erosion Hazard Rating	Areas Stripped of Vegetation (acres)	Unvegetated Roadway Slopes (acres)	Oversteepened Roadway Slopes (miles)	Eroding Roadway Shoulders and Ditches (miles)	Eroding Dirt Roads (acres)	Unstable Drainage Systems (miles)
HIGH						
California	36	79	12	37	47	13
Nevada	78	122	39	31	16	8
Total	114	201	51	68	63	21
MODERATE						
California	19	43	12	94	52	27
Nevada	13	41	6	7	9	3
Total	32	84	18	101	61	30
LOW						
California	46	63	8	226	40	43
Nevada	29	106	7	67	13	24
Total	75	169	15	293	53	67
TOTAL						
California	101	185	32	357	139	83
Nevada	120	269	52	105	38	35
Basin	221	454	84	462	177	118

(b) Problem Severity

To compare the relative loss of soil from these erosion and drainage problems, the Universal Soil Loss Equation developed by the Soil Conservation Service can be used. This equation was developed to predict sediment yields from eroding roadway slopes, areas cleared of vegetation, and a number of other situations. Appendix C explains the procedures used. The resulting soil loss includes only that due to sheet erosion. Losses from rill erosion and sloughing are not included in the empirical data upon which the equation is based. The soil loss predicted therefore greatly underestimates the actual loss. The equation can be used, however, to provide a rough comparison of problem severity.

Table III-7 shows the soil loss from each of the types of erosion and drainage problems. It can been seen from review of this table that:

- About 56 percent of the soil loss is generated by problems located on high erosion hazard lands. Only about 20 percent of the existing developed area in the Basin is located on high hazard lands. The high soil loss from high erosion hazard lands illustrates the fragility of these lands and intolerance to urbanization.

- Dense development in any area of the Basin greatly increases soil loss. About 60 percent of present development in the Basin is on low erosion hazard lands. Although the unit soil loss from these lands is low, dense development has created so many erosion and drainage problems that the cumulative soil loss is one-third of the Basin total.

ii. On-Site Surface Runoff Problems

The water quality of surface runoff from areas of intensive urban activities is substantially degraded from that found in undisturbed areas of the Basin. Construction sites and facilities where motor vehicles are used generate high sediment, nutrient, and other pollutant loadings. Table III-8 compares runoff data gathered for the Tahoe Regional Planning Agency's 1977 Draft 208 Plan from lands zoned general forest with that from urbanized areas. The values in the table are based on a relatively small number of samples, and therefore provide only a rough indication of the quality of surface runoff from various areas.

Surface runoff problems which can be attributed to site-specific activities were classified in the 1977 Draft 208 Plan as on-site problems. These include:

TABLE III-7

COMPARATIVE SOIL LOSSES BY HAZARD RATING

FOR EROSION AND DRAINAGE PROBLEMS (metric tons/year)

Erosion Hazard Rating	Areas Stripped of Vegetation	Unvegetated and Oversteepened Roadway Slopes	Eroding Roadway Shoulders and Ditches	Eroding Dirt Roads	Unstable Drainage Systems	TOTAL	PERCENT OF TOTAL
HIGH							
California	520	1,440	650	680	220	3,510	25
Nevada	1,130	2,210	550	230	150	4,270	31
Total	1,650	3,650	1,200	910	370	7,780	56
MODERATE							
California	50	780	310	140	40	1,320	10
Nevada	40	740	20	30	0	830	6
Total	90	1,520	330	170	40	2,150	16
LOW							
California	40	1,240	250	40	40	1,610	12
Nevada	30	2,130	70	10	20	2,260	16
Total	70	3,370	320	50	60	3,870	28
TOTAL							
California	610	3,460	1,210	860	300	6,440	47
Nevada	1,200	5,080	640	270	170	7,360	53
Basin	1,810	8,540	1,850	1,130	470	13,800	100

TABLE III-8

POLLUTANTS IN RUNOFF FROM VARIOUS ACTIVITIES

ACTIVITY	Suspended Solids mg/l	Turbidity FTU	Nitrate Nitrogen mg/N/l	Total Nitrogen mg N/l	Total Phosphate mg PO_4/l	Total Iron mg/l	Chloride mg/l	Grease & Oil mg/l
Lands Zoned General Forest	66	6	0.03	0.2	0.1	0.4	1	0.6
Disturbed Lands:								
Denuded Areas	990	320	0.25	4.1	1.7	1.9	31	8.0
Construction Sites	8,700	760	0.12	4.0	0.5	2.3	20	0.1
Land Use Related:								
Rooftop Drainage	30	7	0.02	0.8	0.5	4.7	13	7
Corporation Yards	440	140	0.07	3.3	0.8	7.7	170	57
Mobile Home Parks	5,700	930	0.10	0.9	0.8	4.4	34	24
Auto Service Stations	280	110	0.21	0.8	0.9	1.3	16	12
Horse Stables	71	27	0.02	1.8	2.2	6.2	10	9
Snow Storage Sites	140	90	0.10	3.5	0.6	0.2	13	10
Unstable Drainage Systems:								
Earthen Roadside Ditches	650	180	–	3.2	1.0	1.1	32	28
Earthen Channels	610	310	0.11	1.3	1.0	0.8	20	31
Transportation Related:								
Unpaved Parking Lots	17,000	1.000	–	9.2	3.5	3.4	33	76
Paved Parking Lots	320	110	0.56	3.8	1.6	1.0	24	43
Unpaved Roads and Driveways	7,800	5.100	0.88	2.6	1.2	3.2	21	38
Paved Streets	680	280	0.14	1.2	0.9	0.9	15	24
Roadway Cuts and Fills	440	300	0.16	1.0	0.7	0.5	9	7

- Areas of intensive vehicular use
- Unsurfaced private roads
- Snow storage and disposal areas
- Construction sites
- Golf courses

(a) Areas with Intensive Vehicular Use

This category includes parking lots, corporation yards, service stations, paved streets and roads, and other areas with heavy automobile traffic. Although most of these areas are paved, many sites include heavily disturbed unpaved areas. Runoff from areas of intensive vehicular use is high in grease, oil, suspended and settleable solids, nutrients and floatables. Table III-9 identifies the general location and extent of such areas in the Basin. A rough estimate of pollutant discharge from these areas is shown in Table III-10. The total estimated loadings are relatively small. Significant localized water quality problems can result in the area of discharge.

In addition to those areas shown in Table III-9, there are large sections of commercial development throughout the Basin with extensive areas of impervious surface and heavy vehicular use. There are 3,288 acres in the Basin now being used for general commercial, tourist commercial, and high-density residential purposes. About half of this land is paved and generates runoff similar to that of large parking lots. Runoff from streets and roads is also degraded.

(b) Unsurfaced Private Roads and Driveways

Frequent use of unsurfaced roads and driveways causes a significant amount of erosion in the Lake Tahoe Basin. The field survey did not quantify the extent of the problem, but there are several mobile home parks in the Basin where erosion can be seen on dirt streets and driveways.

(c) Construction Sites

Clearing and grading activities at construction sites leave soil surfaces bare and unprotected from erosion. Silt loads over 100 times that from general forest lands are common at construction sites. As illustrated in Table III-8, pollutant generation from the sites sampled is significant.

TABLE III-9

BASINWIDE INVENTORY of AREAS
with INTENSIVE VEHICULAR USE

LOCATION	LARGE PARKING LOTS 1/	CORPORATION YARDS	SERVICE STATIONS 2/	TOTAL AREA
CITY of SOUTH LAKE TAHOE				
Number	11	5	31	
Acres	54	5	8	67
EL DORADO COUNTY				
Number	2	3	3	
Acres	11	2	1	14
PLACER COUNTY				
Number	5	3	14	
Acres	29	3	4	36
WASHOE COUNTY				
Number	12	2	5	
Acres	33	6	1	40
DOUGLAS COUNTY				
Number	10	1	2	
Acres	73	1	1	75
BASINWIDE TOTAL				
Number	40	14	55	
Acres	200	17	15	232

1/ Includes only parking lots with surface area of one acre or more.
2/ Area determined by assuming 1/4 acre surface area as typical for each service station.

TABLE III-10

ESTIMATED POLLUTANT DISCHARGE
from HEAVY VEHICULAR USE AREAS (metric tons/year)

TYPE of AREA	TOTAL AREA BASINWIDE (acres)	SUSPENDED SOLIDS	TOTAL NITROGEN	TOTAL PHOSPHORUS	GREASE and OIL
Large Parking Lots	200	160	1.8	.78	20.9
Corporation Yards	17	18	0.14	0.04	2.4
Service Stations	15	10	0.03	0.04	0.44

Most samples from construction sites were collected during the spring with snow on the ground and little or no construction activities going on. Most of the data were obtained from sites where small, single-family residences were being built. Visual observations during the field survey indicated that construction sites, particularly the small, less conspicuous sites, cumulatively create significant water quality deterioration.

(d) Fertilizer use on Golf Courses and Other Landscaped Areas

Fertilizer, herbicides, fungicides, and other chemicals are used in the operation and maintenance of golf courses and other landscaped areas. Estimates of the total amount of nitrogen and phosphate applied as fertilizer, based on a study of fertilizer use in the Lake Tahoe Basin (Mitchell and Reisenauer, 1974), are shown in Table III-11. The percentage of nutrients applied in fertilizer which leaches into surface and groundwater is difficult to estimate. Based on information available for nitrogen addition to forest soils, shown in Table III-12, the fertilizer use study indicates that the percentage of nitrogen leached increases as the rate of fertilizer application increases. Applying the rates of leaching from Table III-13 to the total amount of nitrogen applied, the amount of nitrogen leached to surface and groundwater as a result of fertilizer application can be estimated, as is shown in Table III-13. The fertilizer use study concluded that applied phosphate is not readily leached, and reaches surface water only through erosion and transport of soil particles.

As shown in Table III-13, golf courses are the largest source of nitrogen leached from applied fertilizer. Not only is most of the fertilizer applied on golf courses, but it is applied at much higher rate, resulting in a higher percentage leaching to surface and groundwaters. In addition, golf courses are generally located within or adjacent to stream environment zones, where fertilizers and other chemicals can readily enter surface or groundwaters. There are eight golf courses in the Lake Tahoe Basin, covering about 783 acres.

iii. Problems from Future Development

Further urbanization in the fragile environment of the Tahoe Basin, no matter how well controlled, will increase the loading of sediment and nutrients on Lake Tahoe. Development causes erosion and increases nutrient loadings through:

TABLE III–11

ESTIMATED APPLICATION of NITROGEN and PHOSPHATE in FERTILIZER APPLIED in the LAKE TAHOE BASIN

AREA	ESTIMATED 1970 ACREAGE	NITROGEN as N Rate Applied (lbs/acre)	Total (tons) 1970	Total (tons) At Ultimate Development	PHOSPHATE as P_2O_5 Rate Applied (lbs/acre)	Total (tons) 1970	Total (tons) At Ultimate Development
Golf Courses	520	115	30	45	40	10	15
Home Yards	740	40	15	30	15	5	10
Multiple Units	60	40	2	6	15	$<$ 1	2
Schools	40	40	2	3	15	$<$ 1	2
TOTAL	1460		49	84		17	29

TABLE III–12

LEACHING of NITROGEN ADDED to FOREST SOIL

RATE OF ADDITION (lbs/acre)	AMOUNT LEACHED
90	6%
225	22%
450	28%
900	41%

TABLE III–13

ESTIMATES of NITROGEN LEACHED to SURFACE and GROUNDWATERS from FERTILIZER

AREA of FERTILIZER USE	TOTAL NITROGEN as N LEACHED (metric tons/year) 1970	At Ultimate Development
Golf Courses	2.7	4.1
Home Yards	0.6	1.2
Multiple Units	0.1	0.2
Schools	0.1	0.1
TOTAL	3.5	5.6

- Removal of vegetation, which increases surface runoff and sheet and rill erosion. Disturbing vegetation also reduces nutrient uptake. All undisturbed, vegetated lands act to reduce nutrients and sediments in runoff. Vegetation in stream environment zones plays an especially important role in trapping sediment and nutrients which otherwise would be transported to the Lake.

- Construction of impervious surfaces. Paved areas collect pollutants from vehicles and atmospheric sources and discharge them in surface runoff. Infiltration of precipitation is greatly reduced, surface runoff dramatically increases, and downstream rill and gully erosion is greatly increased by development.

(a) Increases In Erosion

The problem inventory has shown that development on lands classified as high erosion hazard creates tremendous erosion and drainage problems. The inventory also shows that development on low hazard lands causes a substantial increase in the nutrient and sediment loading on the Lake. Much of the loading from urbanization on low hazard lands comes from pollutant build-up on impervious areas.

An inventory of the Basin lands by their erosion hazard rating is shown on Table III-14. Nearly 2,000 acres of high erosion hazard land could be urbanized in the future. The resulting increase in nutrient and sediment loading on Lake Tahoe would be substantial. Development of an additional 4,300 acres of moderate and low erosion hazard land would also cause substantial increases in nutrient and sediment generation.

The area classified as urbanized represents developed or subdivided land. This area is only partially built-out. Future in-filling will increase the severity and extent of erosion and surface runoff problems, especially in the nearly 3,700 acres of developed or subdivided land on high erosion hazard land.

(b) Encroachment on Stream Environment Zones

Stream environment zones are areas influenced by the presence of streams and near-surface groundwater, including wetlands and floodplains. Movement of surface runoff as sheet flow through these areas allows larger sediments to settle out while vegetation filters out smaller suspended material. Nutrients are stripped out and support vegetative growth. A portion of the nutrients

TABLE III–14

INVENTORY of BASIN LANDS by EROSION HAZARD *
(Area in Acres)

BASIN LAND	EROSION HAZARD RATING			TOTAL
	HIGH	MODERATE	LOW	
Existing Urbanized Areas 1/	3,685	4,021	10,277	17,983
Areas of Potential Urbanization 2/	1,975	1,037	3,293	6,305
Private Holdings Zoned General Forest	60,625	1,790	3,716	66,131
SUBTOTAL	66,285	6,848	17,286	90,419
PUBLIC LAND 3/	104,278 4/	4,892	6,123	115,293
TOTAL	170,563	11,740	23,409	205,712

* Source: Tahoe Regional Planning Agency (1977)

1/ Areas of one acre or more with existing utilities and/or substantially surrounded by existing development.
2/ Zoned for urban uses but not now developed.
3/ Data from Land-Capability Classification Report, 1974.
4/ Includes an undeterminable amount of Ib Capability lands.

absorbed by plants is released to the atmosphere as gaseous products of organic decay, and some of the nutrients absorbed by plants later is bound up in the soil and buried by additional sediment. Thus, vegetation in stream environment zones reduces the amount of nutrients that would otherwise be transported to the Lake. Placement of fill material, structures, or any other encroachment by development limits the capacity of stream environment zones to convey surface and underground flows, and eliminates their treatment and filtration capacity.

Development in stream environment zones also creates erosion problems by concentrating surface runoff and by disturbing areas subject to periodic inundation by surface runoff.

(1) Natural Treatment Capability

The capability of an undisturbed stream environment zone to treat surface runoff is shown in Table III-15. The data were developed for the Tahoe Regional Planning Agency's Draft 208 Plan. Natural processes removed nearly 75 percent of the dissolved nitrogen and iron and 86 percent of the dissolved phosphate entering the stream environment zones. The sediment load was reduced by 94 percent.

In 1977, the United States Environmental Protection Agency conducted a study on the nutrient and sediment removal abilities of stream environment zones in the Tahoe Basin. The annual average percent removal of dissolved nutrients and total suspended solids were determined for several stream environment zones in the south shore area.

The study has not been released but the data collected indicate that:

- Stream environment zones where water moves as sheet flow provide effective treatment of surface runoff.

- This natural treatment capability is destroyed in stream environment zones where development causes channelized flow.

- Channelized stream environment zones may actually increase sediment and nutrient loadings in areas where erosion is caused by concentrated runoff.

TABLE III–15

NATURAL TREATMENT CAPABILITY
of UNDISTURBED STREAM ENVIRONMENT ZONE

STATION	CONCENTRATION (mg/l) SUSPENDED SOLIDS	TOTAL NITROGEN as N	PHOSPHATE as PO_4	IRON
Above	493	1.424	0.982	1.060
Midway	162	0.300	1.019	0.706
Below	29	0.395	0.141	0.300
Reduction in Concentration	94%	74%	86%	72%

Stream environment zones provide a natural, economical system for nutrient and sediment removal. Disturbing these areas reduces their natural cleansing capabilities. As a watershed is developed, meadows are filled and structures are constructed in the stream zone. The stream becomes channelized and the natural treatment of the stream zone is destroyed.

(2) Problem Inventory

In many of the heavily urbanized areas of the Basin, particularly the south shore, development has damaged stream environment zones. The extent of disruption varies with the density and percentage of build-out. Many other areas are zoned for development but have not yet been built on or subdivided.

An inventory of lands within the Basin identified 9,205 acres as stream environment zones. Results of this inventory are as follows:

- There are 2,739 acres which are in a natural state and zoned general forest.

- There are 2,090 acres which are in a natural state but zoned for potential urban use.

- There are 4,376 acres of stream environment zone lands which have been subdivided or otherwise developed. The level of disturbance in these areas ranges from moderate (where streets and other public services have been installed but most lots are vacant) to total (where the physical characteristics of the stream environment zone have been destroyed and its benefit as a conveyance and treatment system lost). Much of this subdivided area consists of lands which have not yet been built upon and are critical elements of the surface water treatment and conveyance system.

In addition to the 9,205 acres of stream environment zones on private land in the Lake Tahoe Basin, there are 15,971 acres of stream environment zones on National Forest lands.

iv. Forest Lands

Surface runoff from the forest lands of the Basin is of a much higher quality than that from urbanized areas, but still can be substantially degraded by certain uses. Water quality problems may be caused by:

- Timber harvesting
- Dirt Roads
- Off-road vehicle use
- Livestock confinement and grazing
- Campgrounds
- Ski Resorts

In addition to the 144,000 acres, or roughly 70 percent of the Basin, in National Forests or State Parks, approximately 36,000 acres are privately-owned forest lands. Most of the private forest land is held by some forty owners with holdings of up to several thousand acres. Surface runoff problems on both public and private forest lands are described below.

(a) Timber Harvest

Accessible pine and fir forest stands in the Lake Tahoe Basin were heavily logged by clear cut methods in the middle to late 1800's.

Timber removal on National Forest lands presently is limited to dead and dying trees, thinning, and removal of trees highly susceptible to insects or disease. Timber removal generally is confined to accessible areas or areas of moderate to gentle topography. The Forest Service has not permitted Christmas tree cutting. Removal of cordwood for fuel is primarily for personal use. The Forest Service permits a limited number of small-scale commercial timber harvest operations, but these operations are permitted primarily for the purpose of timber stand maintenance. The Forest Service has concluded, in Part 1 of its Land Management Plan for the Lake Tahoe Basin, adopted in 1978, that timber in the Lake Tahoe Basin has greater value for watershed protection and aesthetic use than as sawlogs and forest products. The Forest Service is now preparing Part 2 of the Land Management Plan, and has received comments on a Draft Environmental Impact Statement (Forest Service, 1979). Among the issues the Forest Service is considering in its preparation of Part 2 of the plan is the extent of timber harvesting to be allowed on National Forest lands.

Only a small number of commercial timber harvest operations currently are carried out on private lands in the Lake Tahoe Basin, but the number could increase. Inquiries have been made to the Lahontan Regional Water Quality Control Board about the possibility of an extensive private timber management operation, involving fertilization, irrigation, harvesting, and replanting.

Timber removal can create water quality problems if sites are left bare of vegetation, if riparian vegetation is disturbed, or if soil is disturbed by road construction, skid trails, or use of vehicles off of roadways. Even if best management practices are followed, some impact on water quality can be expected from timber removal.

Wildfire can cause serious erosion problems by removing vegetation and soil cover. Controlled burning, on the other hand, has relatively little effect on water quality, and can help prevent wildfires.

(b) Dirt Roads

Dirt roads through forested areas in the Basin remain from past logging activities. Because the soil surface is bare, these roads may cause heavy erosion. There are an estimated 320 miles of dirt roads on forest lands in the Lake Tahoe Basin, 256 miles in California and 64 miles in Nevada. Based on the land capability classification and degree of disturbance, over 5,500 metric tons of sediment per year are estimated to be generated on these roads. Approximately 4,000 metric tons per year are attributed to lands in California, and 1,500 metric tons per year to Nevada.

(c) Off-Road Vehicle Use

Off-road vehicles can cause serious erosion problems. The U.S. Geological Survey has conducted a study of the physical response of the land to off-road vehicle use. More than 200 sites were examined in California, Utah, and Nevada. The study found two basic responses to off-road vehicle use. Sandy and gravelly soils like those found in the Lake Tahoe Basin are susceptible to direct quarrying by off-road vehicles. When stripped of vegetation they are susceptible to rapid soil loss from rill and gully erosion. Volcanic soils, limited to the north shore of the Basin, are less sensitive to direct mechanical displacement by off-road vehicles, but the rates of erosion are much higher with off-road vehicle use than under natural conditions. Pounding of the soil causes strong surface seals to form, reduces infiltration, increases surface runoff, and accelerates gullying in the downslope areas of the watershed. Once soil erosion begins, it will stop only after off-road vehicle use stops and the native vegetation has had a chance to reestablish itself and stabilize the soil. In the Lake Tahoe Basin, this recovery is extremely slow.

Vegetation is also damaged through direct contact or from intensive vehicular use around plants, causing soil loss and plant collapse from root failure. Soil compaction injures root systems of larger perennials. Seedlings can be crushed under wheels and seed germination can be adversely affected. This loss of vegetation can greatly increase erosion.

In addition to the summer use of off-road vehicles, snowmobile use during the winter can also affect water quality. Snowmobiles compact the snow, especially on heavily-traveled routes. Compacted snow, which is mostly ice, is a good thermal conductor which can cause underlying soil to freeze readily. Rapid soil freezing and thawing loosens the soil surface and can dislodge small plants. Disruption of the stabilizing plant layer causes erosion when snowmelt occurs. Disruption is less severe where the roots of the dominant plants are deep and freezing due to snowmobile activity would affect only a small part of the total root system. Compaction-induced freezing is much more likely to cause damage where small individual plants are covered by a single snowmobile path. At present, there is relatively little use of snowmobiles in the Lake Tahoe Basin, and dispersion of use limits the severity of snow compaction problems. If snowmobiles are driven on adequate snow cover and in designated areas outside fragile locations the water quality impacts can be minimized.

The Forest Service adopted an off-road vehicle plan in November 1976 which limits off-road vehicle use on National Forest lands in the Lake Tahoe Basin to designated trails and areas. The plan provides a separate designation for summer and winter off-road vehicle uses. The California Tahoe Regional Planning Agency's Vegetation and Soil Protection Ordinance, adopted in September 1978, prohibits operation of off-road vehicles in a manner damaging to the environment on high erosion hazard lands or in stream environment zones, except on designated trails or with a permit from the agency. It has been difficult to enforce the ordinance. Except in the case of new commercial operations, the ordinance has not been effective in controlling off-road vehicle use.

(d) Livestock Confinement and Grazing

Runoff from areas where livestock are confined and fed is high in nutrients from the animal manure. Sediment is also generated by runoff from the area of confinement, which is tramped bare and heavily eroded. A facility's severity as a water quality problem directly relates to its location and its nearness to a surface stream or the Lake. Five commercial livestock confinement or corral areas in the Basin cover 12 acres of land. Most livestock remain in the Basin for less than half the year and total numbers of livestock within the Basin in such facilities are quite small. Localized runoff and water quality problems can result from facilities located within stream environment zones or that have inadequate surface water management systems.

For nearly 130 years, the Lake Tahoe Basin has been used for summer livestock grazing. Past grazing has caused excessive surface runoff and erosion. Grazing in the Basin has declined at a rapid rate over the past decade, permitting the natural restoration of range lands. There is still some evidence of localized erosion. Data from the Environmental Protection Agency's stream environment zone study indicate that heavy grazing in one stream environment zone has altered its capacity to trap sediment and nutrients and has increased leaching of soil nutrients. On national forest lands, the Forest Service follows best management practices to prevent over-grazing.

(e) Campgrounds

Soil and vegetation are disturbed during campground development and periodic disruption occurs through campground use. The magnitude of the potential for water quality impact depends on the site specific characteristics of the area and the erosion and drainage controls installed.

(f) Ski Resorts

There are six ski areas in the Lake Tahoe Basin. Five of these areas, two of which are very small, are in California. The ski areas all contain areas where vegetation was removed and roads constructed for slopes, trails, and vehicular access. Ski areas are usually located on steep terrain with high annual precipitation and high erosion potential.

Ski area construction impacts water quality even if best management practices are employed. The State Water Resources Control Board has conducted an erosion control study which evaluated the impacts of ski run construction at Northstar-at-Tahoe, an area just north of the Tahoe Basin (White, 1978). Construction employed a wide range of best management practices, including drainage control and extensive revegetation. Soil disturbance on high erosion hazard lands and in stream environment zones was kept to a minimum. Thirty percent of the ski area was disturbed for trails and lift lines. The area had an erosion rate of 0.20 metric tons/hectare/year, roughly six times the natural erosion rate for moderate erosion hazard lands. Although there was relatively little soil disturbance on high erosion hazard lands, increased surface runoff as a result of vegetation removal on high erosion hazard lands was a major factor contributing to the increased erosion rates. Much of the increased erosion rate can be attributed to soil disturbance in or near stream environment zones. With greater disturbance of high erosion hazard lands or stream environment zones, or if best management practices had not been employed, erosion rates would have been much higher than were observed.

Transport of suspended sediment from disturbed areas to adjacent surface waters often is accelerated by continual disruption of ski areas by vehicular traffic and ski run maintenance equipment.

2. Other Water Quality Problems

Pollution from surface water runoff is by far the most important threat to the quality of Lake Tahoe, but there are other sources of pollution which should be controlled wherever possible. These include:

- Groundwater pollution
- Atmospheric sources
- Municipal sewage

In addition, there are several miscellaneous sources of minor or localized pollution problems, as well as sources which could create problems if controls now in force are not continued.

a. Groundwater

Groundwater appears to be a minor source of nutrients, but it could become more significant. Destruction of vegetation which now acts to intercept nutrients percolating into the ground would increase the amount of nutrients transported to Lake Tahoe in groundwater.

Infiltration of on-site runoff, one of the methods for controlling surface runoff, could also increase the amount of nutrients transported in groundwater. Groundwater disposal of runoff is generally preferable to surface discharge because it provides for prolonged contact with soils and vegetation which remove sediment and nutrients. Infiltration should be encouraged. It should be recognized, however, that infiltration of surface runoff does not completely eliminate the water quality problems associated with development.

b. Atmospheric Sources

To the extent that the nutrients in precipitation are the result of air pollution caused by human activities, an increase in these activities could increase the nutrients reaching the Lake.

Increases in automobile traffic, which result in increased emissions of oxides of nitrogen, could cause more nitrogen to reach the Lake in precipitation. Other nitrogen emissions may also be important.

Destruction of vegetation also increases the amount of nitrogen reaching the Lake from atmospheric sources. Most of the nitrogen in precipitation which falls on land within the Basin is removed before the water reaches the Lake. Disturbing the plants responsible for removing this nitrogen increases nutrient loadings to the Lake.

c. Municipal Sewage

By the early 1960's the practice of disposing treated effluent from community waste treatment plants on land within the Lake Tahoe Basin, and the use of individual septic tanks in the Basin, prompted grave concern about the future of the Lake. Extensive scientific studies were conducted to determine the effect of sewage disposal in the Basin on the water quality of Lake Tahoe. The most authoritive study, published in 1963 by the Lake Tahoe Area Council concludes:

> "Increasing human activities in the Lake Tahoe Basin and the associated increase in waste production and disposal within the Basin, pose a serious threat to maintenance and preservation of the clarity and beauty of the Lake waters. The problem primarily stems from the effects on the Lake of nutrients, such as nitrogen and phosphorus, which are contained in waste effluents. Even though discharged to the ground, these nutrients ultimately gain access to the Lake waters. There is evidence that the clarity of the Lake has already been affected by nutrient buildup, and it can be expected that continuation of the present methods of sewage disposal will result in a progressive decrease in clarity and that within a matter of years eutrophication may occur."

California later enacted a statute to require the export of domestic sewage from the Basin. In Nevada, an executive order requires export of sewage from the Basin. Although improvements have been made in wastewater treatment technology, it still is not feasible to provide sufficient nutrient removal to allow the discharge of domestic sewage in the Basin without affecting the Lake.

Completion of systems for the treatment and export of domestic sewage from the Lake Tahoe Basin has eliminated most of the threat to Lake Tahoe from domestic sewage. Several problems remain.

i. Unlined Sewage Pond

The Douglas County Sewer Improvement District No. 1 makes use of an oxidation pond as part of its treatment facility. The pond, located within the Basin, is not lined. Some of the sewage in the 75 million gallon pond percolates into the soil, and eventually will reach the Lake.

ii. Raw Sewage Overflows

The most serious wastewater related water quality problem in the Basin is the incidental overflow of raw sewage from municipal collection facilities. Frequently these discharges are caused by blockages in gravity sewerlines due to accumulations of grease and other solid matter. Raw wastewater backs up until a discharge begins at the lowest exit point in the line. Another cause of raw sewage overflows is pumping station malfunction, leading to spills at the pump station itself or from a low exit point in an upstream gravity sewerline. Many times these overflows go undetected due to snow cover or remote location, allowing discharges to continue unabated for long periods. Incidents have involved discharges for as long as several days and volumes in excess of 60,000 gallons. Many of the sewerlines are close to the Lake or to streams, drainage channels, and urban storm drains that discharge directly to Lake Tahoe.

iii. Exfiltration from Sewerlines

The Lake Tahoe area sewage collection systems have infiltration and inflow. In some years, as much as 50 percent of the incoming raw wastewater at north Lake Tahoe during the spring runoff peak has been extraneous water entering the sewerlines. This raises the possibility that sewage escapes from the collection lines through exfiltration during the remainder of the year when infiltration is not occurring.

The State Water Resources Control Board's 1980 Report on Water Use and Water Rights in the Lake Tahoe Basin projects the amount of water entering community sewers. This amount exceeds the amount actually measured at the treatment plant. The difference may reflect losses through exfiltration. Monitoring by the University of California Tahoe Research Group has disclosed that some areas of the Lake Tahoe Basin exhibit elevated levels of nutrients in groundwater although there is no appreciable land development in the area except for sewerlines. The presence of these nutrients in the groundwater may be caused by exfiltration. In addition, data collected as part of the Environmental Protection Agency's study of stream environment zones show high nitrogen concentrations at one site which may be due to sewerline or holding pond exfiltration.

iv. Domestic Wastewater Not Connected to Export Systems

When sewage collection systems were put in place, some developments, especially single family homes, were overlooked. These homes still use septic tanks. Failure to connect these homes to export systems has been discovered when property is transferred and the utility district is asked to certify that the structure is connected to the sewer system. About 25 unconnected units are discovered each year.

The Lahontan Regional Board has granted about 100 exemptions to the prohibition against use of septic tanks in the Basin. These exemptions were made only after determining that the discharges would not affect the quality of Lake Tahoe. They have only been granted in remote areas where installation of conventional sewers would damage the environment. The exemptions are for the summer months only.

The exemptions do not apply to toilet wastes, which still must be exported. Bifurcated systems are required so that only sink and shower waste is discharged through septic tanks. Food wastes must be exported or incinerated. Garbage grinders, washing machines, dishwashers, and phosphate based detergents are not allowed. No government agency has conducted a thorough investigation to determine if these conditions are being complied with, however.

d. Miscellaneous Water Quality Problems

Possible miscellaneous water quality problems include:

- Industrial Discharges
- Solid Waste Disposal
- Construction and Dredging in Lake Tahoe
- Vessel Wastes
- Toxic and Hazardous Substance Spills

i. Industrial Discharges

Except for surface runoff, which is addressed in an earlier discussion, no industrial discharges are allowed in the Lake Tahoe Basin. Discharge of industrial waste into Lake Tahoe or any stream in the Basin is prohibited in both California and Nevada.

ii. Solid Waste Disposal

The potential impact of solid waste disposal on water quality was recognized by the 1966 Conference in the Matter of Pollution of the Interstate Waters of Lake Tahoe and its Tributaries. Leachate from the disposal site, and erosion due to lack of vegetation and uncontrolled runoff from the landfill surface, can pollute ground and surface waters. The Conference called for export of all solid waste from the Basin. No solid waste disposal has been permitted since 1972.

iii. Construction and Dredging in Lake Tahoe

Construction and dredging in the Lake can cause localized pollution problems by disturbing sediments. Disturbing these sediments increases turbidity and reintroduces nutrients which had settled out of the water. The sediments may also be redeposited elsewhere. Construction in the Lake may also affect current flow, causing currents to disturb bottom sediments.

iv. Vessel Wastes

Discharge of vessel toilet wastes introduces pollution which can affect domestic water intakes. Although not a serious threat to the clarity of Lake Tahoe, vessel wastes present a public health risk because the domestic water supplies receive only chlorination before distribution. Discharge of vessel wastes to Lake Tahoe is prohibited, but violations still occur. Many boats are not equipped with self-contained heads, and there is no inspection program.

v. Toxic and Hazardous Substance Spills

Spills of toxic and hazardous materials as a result of transportation and handling accidents could affect water quality. The greatest threat is presented by potential oil, oil product, toxic and hazardous chemical, pesticide, explosive, and corrosive spills. Infrequent spills of oil and oil products have resulted from transportation accidents in the Lake Tahoe Basin. Numerous small spills occur at construction sites in the Basin, usually due to vandalism or improper storage.

The Forest Service has a contingency plan for spills which occur on or may affect National Forest lands. California and Nevada have statewide spill contingency plans, but there is no regional plan formalizing the response to be taken to spills in the Lake Tahoe Basin.

B. CONTROL NEEDS

Since water quality is now deteriorating, no increase in pollution can be permitted. Preventing new sources of pollution is not enough, however. Some deterioration is already evident, but the full impact of continuing nutrient loadings to the Lake at current levels will not be seen for many years. If pollution continues, deterioration will continue. A significant reduction in nutrient and sediment loads is required if the quality of the Lake is to be preserved.

Major reductions in sediment and nutrient generation can be achieved through controls on existing erosion and surface runoff problems. At the same time, new sources of pollution must be controlled. It would do little good to correct existing problems if new sources add as much pollution as the corrective measures eliminate. The greatest threat of additional pollution is the erosion and surface runoff caused by development.

Other potential sources, including discharges to groundwater, atmospheric pollution, and municipal sewage discharges must also be controlled. The need to control new sources does not mean that no new development can be allowed, however. With proper controls over the location of development and the extent of land disturbance, the increased pollution from development can be kept to a low level. Provided the measures to reduce pollution from existing sources are carried out, it is possible to allow some development and still achieve the significant reduction in nutrient loadings needed to protect the Lake.

Table III-16 summarizes the control measures called for by this plan.

1. Erosion, Urban Runoff, and Surface Water Management Problems

A wide range of controls must be used to correct existing erosion and surface runoff problems and to prevent further problems from occurring. These controls can be broken down into four categories:

- Erosion and urban runoff control projects
- On-site surface runoff control measures
- Prevention of pollution from new development
- Forest practices

The erosion and urban runoff control projects are designed to control large-scale problems on public lands, such as roadways, and on private lands where the problem is associated with discontinued uses, as in the case of an abandoned quarry. The projects provide for restoration, especially stabilization of eroding areas, as well as physical drainage improvements to convey surface waters to naturally stable waterways.

On-site control measures are techniques to control surface runoff from existing land use practices in areas such as corporation yards and construction sites. Controls include both maintenance practices and installation of drainage facilities.

Controls must also be set to prevent any new development from causing water quality problems. Controls on future development should not allow:

- New subdivision development

- Further construction on high erosion hazard lands

- Coverage on individual parcels in excess of the allowable percentage of impervious cover set by the land capability system

TABLE III-16

CONTROL NEEDS

PROBLEM	SOLUTION
EROSION AND SURFACE RUNOFF	SOURCE CONTROL AND RUNOFF MANAGEMENT
• Erosion and Drainage Problems Caused by Previous Development:	• Erosion and Urban Runoff Control Projects:
Bare Areas	Revegetation
Unstable Slopes	Stabilization and Revegetation
Dirt Roads	Protective Cover
Eroding Roadside Ditches and Shoulders	Roadside Drainage
Concentrated Runoff	Storm Drainage
• On-Site Runoff Problems:	• On-Site Surface Runoff Control Measures:
Areas of Intensive Vehicular Use	Runoff Management Facilities and Best Management Practices
Unsurfaced Roads and Driveways	Protective Cover
Snow Disposal Facilities	Best Management Practices
Construction Sites	Best Management Practices
Golf Courses	Best Management Practices
• Erosion and Runoff from Future Development	• Development Restrictions (prohibiting new subdivisions, construction on high erosion hazard lands, stream environment zone encroachment, coverage in excess of land capability, and development before offsetting erosion control measures are implemented) and Best Management Practices.
• Erosion on Forest Lands	• Forest Practices
Tree Removal	Best Management Practices
Dirt Roads	Closure, Stabilization and Revegetation where Possible
Off-Road Vehicles	Restriction to Designated Areas and Trails
Grazing and Livestock Confinement	Best Management Practices
Campgrounds	Development Restrictions and Best Management Practices
Ski Resorts	Best Management Practices and Controls on Expansion
NUTRIENTS CARRIED IN GROUNDWATER	VEGETATION PROTECTION
ATMOSPHERIC SOURCES OF NUTRIENTS	STUDY OF AUTOMOBILE AND OTHER EMISSIONS
MUNICIPAL SEWAGE	
• Discharge from Unlined Pond	• Cease Use of Pond Unless it is Lined
• Sewage Overflows	• Maintenance and Surveillance
• Sewerline Exfiltration	• Study Extent of Problem
• Septic Tanks	• Survey to Identify Structures which use Septic Tanks but have not been Exempted from Export Requirements; Review of Exemptions in light of improved Wastewater Collection Technology.
DREDGING AND PIER CONSTRUCTION	BEST MANAGEMENT PRACTICES
INDUSTRIAL DISCHARGES, SOLID WASTE DISPOSAL, AND DISCHARGE OF VESSEL WASTES	PROHIBITIONS
TOXIC AND HAZARDOUS SUBSTANCE SPILLS	CONTINGENCY PLAN FOR SPILL CLEANUP

- Construction in stream environment zones
- Development before implementation of offsetting erosion and urban runoff control projects.

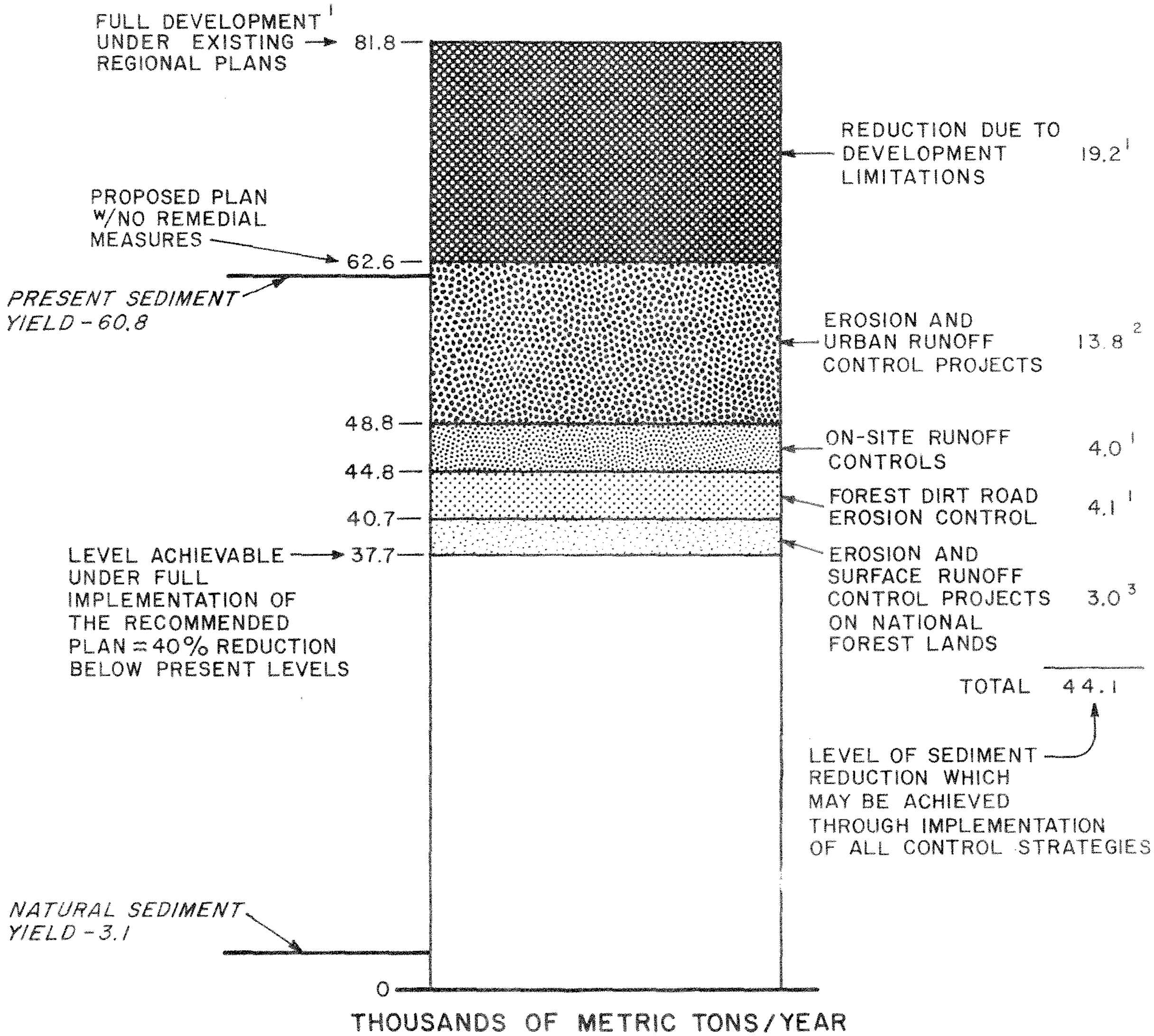
Measures needed to prevent pollution from forest lands include controls on timber harvesting, revegetation of old roads, regulation of off-road vehicle use, control of runoff from livestock confinement areas, and control of erosion from campgrounds and ski resorts.

Figure III-2 depicts the effect on total sediment loads of implementing the erosion and urban runoff control projects, on-site controls, development restrictions, and forest practices proposed here. These controls will reduce the total suspended sediment load to about 60% of existing levels, or about 45% of the total load to be expected without these controls at full development of the Basin in accordance with existing land use ordinances. The reduction in total suspended sediment loads reflects a comparable reduction in total nutrient loads. The most important control measures are restrictions on future development and erosion and urban runoff control projects. Development restrictions will prevent an increase in sediment yields, which would otherwise occur when land currently zoned for development is used for residential and commercial construction, of an estimated 19,200 metric tons per year. Erosion and urban runoff control projects will reduce sediment yields by an estimated 13,800 metric tons per year.

To achieve a higher level of sediment and nutrient control would require installation of extensive treatment systems to handle storm and snowmelt runoff from urban areas. Treatment of surface runoff is feasible only in a few instances where concentrated flows contain large amounts of pollutants, however. Examples may include large parking lots, corporation yards, and automobile service stations. Infiltration systems are more effective even in these instances. Source control is by far the best method for surface water runoff management. Factors which limit the ability to use treatment systems for surface water management include:

- Treatment facilities at the base of a major drainage system would occupy large areas near the Lake shore.
- Removal of nutrients from the surface runoff would require advanced chemical treatment. This treatment would have high capital and operation costs and create environmental problems.
- Treatment systems require drainage systems to collect and convey runoff to a single location. Treatment systems do not eliminate the need for facilities for control of erosion and drainage.
- Conventional treatment methods for removal of sediment and nitrogen are not reliable.

FIGURE III-2



1. Sediment yield estimates based on relation among land capability, percent disturbance, and sediment generation set forth in Appendix B. Estimate for full development assumes California Tahoe Regional Planning Agency General Plan governs development in California, Tahoe Regional Planning Agency General Plan governs development in Nevada. Estimate for on-site runoff controls is based on measures of runoff quality from areas of 100 percent impervious surface, discussed in Appendix B.
2. Sediment yield estimate based on Universal Soil Loss Equation set forth in Appendix C.
3. Sediment yield estimate based on comparison of observed levels with levels expected under natural conditions for specific sites on National Forest lands having erosion problems caused by previous human activities.

Estimated Sediment Yield Levels Achievable through Implementation of the Proposed Plan

a. Erosion and Urban Runoff Control Projects

i. Control Measures

Erosion and urban runoff control projects are large-scale remedial measures to control runoff and erosion from past development, especially street and highway construction. These projects involve source control systems for erosion and surface runoff problems on public lands and for problems on private lands caused by activities which have been discontinued.

The systems proposed indicate a need for a facility to control erosion and provide a basis for estimating costs. The basic information used to identify these sites is contained in the Tahoe Regional Planning Agency's 1977 Draft 208 Plan (Tahoe Regional Planning Agency, 1977). The systems proposed are source controls, which incorporate the methods presented in the Handbook of Best Management Practices, prepared as part of the 208 planning for Lake Tahoe and published by the Tahoe Regional Planning Agency (Tahoe Regional Planning Agency, 1978). Detailed facilities planning will be required to determine exactly what systems will be put on the ground.

Completion of these projects is essential if the load of sediment and nutrients causing deterioration of the Lake is to be reduced. Completion of the projects will eliminate almost one quarter of the sediment generation attributable to human activities, a far greater reduction than can be achieved by control measures on other sources. The cost of completing the erosion and urban runoff control projects will be approximately $95 million in 1979 dollars, requiring development of a phased program to complete these projects.

Projects will provide the following kinds of controls:

- Revegetation of bare areas
- Slope stabilization and revegetation
- Protective surface cover on dirt roads
- Roadside drainage
- Storm drainage

The individual projects listed in this discussion do not include projects on National Forest lands, although similar projects must be carried out to control sources of pollution from National Forest lands. An inventory of erosion and surface runoff problems on National Forest lands, and implementation of specific projects such as those proposed here, are required. The Forest Service is near completion of the necessary inventory, and has already initiated projects to control several of the problems identified.

(a) Revegetation of Bare Areas

For areas such as old dump sites and gravel operations where it is no longer necessary to keep the sites clear, revegetation can most effectively provide the protection necessary to prevent erosion in areas stripped of vegetation. Native plants should be used to provide a permanent surface cover.

(b) Slope Stabilization and Revegetation

Oversteepened slopes must be mechanically stabilized or regraded. The proper method of physical stabilization will depend on the characteristics of the specific site, including the size of the slope, soil conditions and access. Regrading to a stable angle may not always be feasible. Regrading may require removal of large quantities of soil and vegetation, making construction of retaining walls at the base of the slope the preferred solution. Bin walls using native rock or other major physical stabilization facilities are needed for large slopes. Stabilization with wattling may be possible at some sites.

Backfilling may be used to stabilize some oversteepened slopes, especially at abandoned gravel pits and borrow areas. Backfilling should be employed only where no sloughing, erosion, or gully formation of the backfilled material will occur.

Stabilization will also require vegetation of exposed surfaces. Revegetation provides a low-cost but very effective permanent surface cover which can blend into surrounding areas. Native plants are available and should be used to the maximum extent possible.

(c) Protective Surface Cover on Dirt Roads

On dirt roads which provide only seasonal access and receive low to moderate vehicular use with no winter snow removal, a protective covering of gravel, crushed rock, or similar materials is adequate. Roadways with intensive year-round use must be paved. Some roadways and trails should be abandoned and revegetated, particularly old logging roads,jeep trails, and dirt bike trails which are not suitable for vehicular traffic. Successful stabilization of these areas requires prohibition of use by off-road vehicles.

(d) Roadside Drainage

In steep areas, construction of curbs and paved shoulders to collect and convey the runoff from road surfaces is essential to control erosion from roadside drainage. Curbs and paved shoulders allow the roadsides to function as an integral part of the overall erosion and surface runoff control systems for the Basin.

Roadside areas in sparsely developed areas on flatter terrain may be stabilized with vegetation or gravel. Heavily urbanized areas will require some form of curb and gutter runoff collection to provide drainage and protect against ponding and flooding. In some instances, infiltration facilities such as dry wells and infiltration trenches can be installed to dispose of small volumes of surface runoff, eliminate local ponding, and eliminate the need for major storm drainage systems.

The practice of regrading roadway shoulders and roadside ditches often removes the vegetation which had been providing surface protection. Maintenance practices should be revised to encourage growth of vegetation along roadways unless public safety problems are created.

(e) Storm Drainage

Protection against erosion from inadequate storm drainage systems can be provided by culverts, rock-lined ditches, and rock aprons where culverts discharge to unprotected surfaces. Drainage system planning should be directed towards protection and use of natural drainageways. Design of surface water management systems should include an evaluation of perforated metal pipe and ungrouted channel lining to permit infiltration and reduce surface runoff. Sediment traps or debris basins may be needed to reduce peak flows and remove sediments.

ii. Project Priorities

Priorities for implementation of erosion and urban runoff control projects can be set based on the cost of these projects and their effectiveness in controlling erosion. Priority groups are set here based on the cost-effectiveness of the five kinds of projects discussed above on high, moderate and low erosion hazard lands. Effectiveness is estimated using the Universal Soil Loss Equation described in Appendix C. Although the equation underestimates sediment generation rates because it does not quantify rill and gully erosion, it provides a useful basis for comparing erosion problems and control systems. Cost figures are in terms of July 1979 dollars.

Table III-17 compares the cost and effectiveness of the control systems. The total cost for the entire Lake Tahoe Basin is $95 million and the expected reduction in sediment yield is 13,800 metric tons. The priority groups are ranked as follows:

(1) Revegetation of areas stripped of vegetation on all erosion hazard lands.

(2) Stabilization and revegetation of oversteepened and unvegetated slopes on low erosion hazard lands.

(3) Stabilization and revegetation of oversteepened and unvegetated slopes on moderate erosion hazard lands.

(4) Stabilization and revegetation of oversteepened and unvegetated slopes on high erosion hazard lands.

(5) Eroding dirt roads on high erosion hazard lands.

(6) Roadside drainage on high erosion hazard lands.

(7) Storm drainage for complete systems all or part of which are on high erosion hazard lands.

(8) Protective surface cover on eroding dirt roads on moderate erosion hazard lands.

(9) Roadside drainage on moderate erosion hazard lands.

(10) Roadside drainage on low erosion hazard lands.

(11) Protective surface cover on eroding dirt roads on low erosion hazard lands.

(12) Storm drainage on moderate and low erosion hazard lands.

The top four priorities address erosion source control for steep slopes and bare areas on all erosion hazard lands. The next three priorities deal primarily with dirt roads, eroding shoulders and drainage control for areas with high erosion hazard lands. The remaining five priorities deal with dirt roads, eroding shoulders, and drainage control on moderate and low erosion hazard lands.

Priorities 2, 3, and 4 are for control of erosion from roadway slopes and oversteepened areas. Control of these problems on low erosion hazard lands is more cost-effective than on high erosion hazard lands due to comparable returns in sediment reduction for considerably lower costs.

TABLE III–17

EROSION AND URBAN RUNOFF CONTROL PROJECTS IN THE LAKE TAHOE BASIN

COST IN 1979 DOLLARS, ESTIMATED ANNUAL SEDIMENT REDUCTION

EROSION HAZARD	SLOPES	UNVEGETATED AREAS	CURBS AND GUTTERS	DIRT ROADS	STORM DRAINS
HIGH	Priority 4 $14.7 million 3,650 Tons 0.25 kg/$	Priority 1 $0.9 million 1,650 Tons 1.83 kg/$	Priority 6 $10.2 million 1,200 Tons 0.12 kg/$	Priority 5 $4.6 million 910 Tons 0.20 kg/$	Priority 7 $7.1 million 370 Tons 0.05 kg/$
MODERATE	Priority 3 $4.7 million 1,520 Tons 0.32 kg/$	Priority 1 $0.4 million 90 Tons 0.23 kg/$	Priority 9 $13.4 million 330 Tons 0.02 kg/$	Priority 8 $3.2 million 170 Tons 0.05 kg/$	Priority 12 $5.4 million 40 Tons 0.01 kg/$
LOW	Priority 2 $3.3 million 3,370 Tons 1.02 kg/$	Priority 1 $0.3 million 70 Tons 0.23 kg/$	Priority 10 $13.6 million 320 Tons 0.02 kg/$	Priority 11 $4.7 million 40 Tons 0.01 kg/$	Priority 12 $8.4 million 60 Tons 0.01 kg/$

TOTAL DOLLARS = $95 Million

SEDIMENT REDUCTION = 13,800 Metric Tons

AVERAGE UNIT SEDIMENT REDUCTION RATE = 0.145 kg/$

Figure III-3 compares sediment reduction with project costs. Expenditure of 30 percent of the total basinwide cost results in an estimated reduction of over 80 percent of the controllable sediment yield. At a 50 percent expenditure level, 93 percent of the controllable sediment production can be eliminated.

As shown in Figure III-3, the priorities are further subdivided into four control levels:

Control Level	Priorities	Cumulative Sediment Reduction	Cumulative Cost
I	1-4	75%	26%
II	5-8	94%	52%
III	9-10	98%	80%
IV	11-12	100%	100%

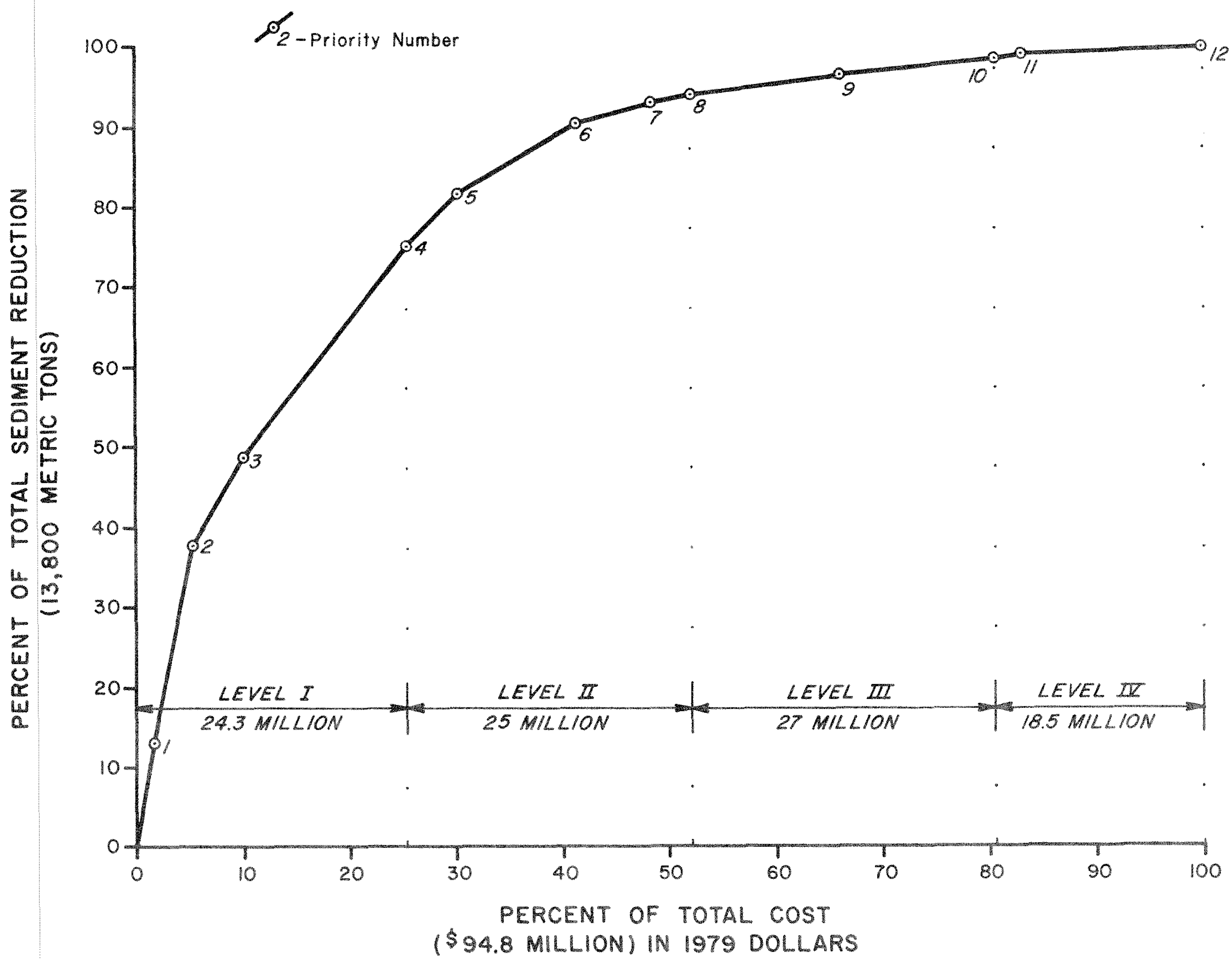
These levels of control should be achieved in 5 year increments. Over a twenty-year period all of the controllable erosion and urban runoff problems will be addressed.

Table III-18 lists the projects in the California portion of the Basin according to their priority. The ranking of this priority list is not meant to preclude construction of a lower priority project which can be incorporated into a higher priority project. A project priority list for the Nevada side of the Basin is provided in Table III-19.

In Tables III-18 and III-19, the cost for each project includes only the base construction costs. The cost for design, contract administration, contingencies, and inspection are not included. The cost of these design and administration costs is estimated to be 25 percent of the base cost and is included at the end of each Table. The total design and administration cost for all project priorities in the Lake Tahoe Basin is estimated at $19 million.

A portion of the system costs are for construction within lands or rights-of-way owned by state transportation agencies or other state agencies. An allocation of system costs to local and state agencies, based on the cost of systems within lands owned or controlled by these agencies, is shown in Tables III-18 and III-19. Local costs include problems within city or county lands or rights of way, on lands controlled by public utility districts, and on private lands bordering roadways. No attempt has been made to define the rights-of-way along local roadways, and some slope stabilization and revegetation required in these systems may be on private lands.

Figure III-3



COST EFFECTIVENESS CURVE FOR EROSION CONTROL
WITHIN THE LAKE TAHOE BASIN

TABLE III-18

EROSION and URBAN RUNOFF CONTROL PROJECTS
for CALIFORNIA PORTION of TAHOE BASIN
and ASSOCIATED COSTS

(Millions of 1979 Dollars)*

PRIORITY 1: REVEGETATION of AREAS STRIPPED of VEGETATION on ALL EROSION HAZARD LANDS

	LOCAL	STATE	TOTAL
CITY OF LAKE TAHOE			
44B – South Tahoe "Y"	.04	–	.04
44C – Tahoe Valley School	.01	–	.01
43B – East Sierra Tract	.03	–	.03
42B – Bijou Creek	.01	–	.01
SUBTOTAL	.09	0	.09
EL DORADO COUNTY			
54 – Rubicon Properties	.01	–	.01
43D – Montgomery Estates	.01	–	.01
44D – Airport	.04	–	.04
43F – Osgood Swamp	.01	–	.01
44L – Country Club Heights	.01	–	.01
57B – Tahoma	.01	–	.01
43E – Black Bart	.01	–	.01
44H – Christmas Valley	.17	–	.17
SUBTOTAL	.28	0	.28
PLACER COUNTY			
9 – Flick Point	.04	–	.04
12 – Kings Beach	.04	–	.04
63B – Sunnyside	.03	–	.03
1 – Tahoe City	.12	–	.12
11 – Griff Creek	.01	–	.01
4 – Dollar Point	.01	–	.01
57A – Chambers Landing	.01	–	.01
G2 – Homewood	.24	–	.24
SUBTOTAL	.50	0	.50
PRIORITY TOTAL	.86	0	.86

PRIORITY 2: MECHANICAL STABILIZATION and REVEGETATION of OVERSTEEPENED and UNVEGETATED SLOPES on LOW EROSION HAZARD LANDS

	LOCAL	STATE	TOTAL
EL DORADO COUNTY			
44N – Echo View	.32	–	.32
47 – Fallen Leaf Lake	.03	–	.03
44G & D – Meyers and Airport	–	.11	.11
57B – Tahoma	.04	–	.04
43E – Black Bart	.04	–	.04
44H – Christmas Valley	.01	–	.01
SUBTOTAL	.43	.11	.54
PLACER COUNTY			
11 – Griffs Creek	.06	.23	.29
4 – Dollar Point	.10	.13	.23
57A – Chambers Landing	.14	.06	.20
G2 – Homewood	.08	.03	.11
SUBTOTAL	.38	.44	.82
PRIORITY TOTAL	.81	.56	1.37

PRIORITY 3: MECHANICAL STABILIZATION and REVEGETATION of OVERSTEEPENED and UNVEGETATED ROADWAY SLOPES on MODERATE EROSION HAZARD LANDS

	LOCAL	STATE	TOTAL
CITY OF SOUTH LAKE TAHOE			
44D – Gardner Mt.	.01	–	.01
SUBTOTAL	.01	0	.01
EL DORADO COUNTY			
44F – Osgood Swamp	.03	–	.03
43D – Montgomery Estates	.47	–	.47
44K – Angora Creek	.15	–	.15
44D – Airport	.19	–	.19
43F – Tahoe Paradise	.43	–	.43
44L – Country Club Heights	.27	–	.27
44M – Tahoe Paradise Golf Course	.24	–	.24
53, 54, 55, 57B – Rubicon-Tahoma	–	.17	.17
SUBTOTAL	1.78	.17	1.94
PLACER COUNTY			
63A – Talmont Estates	.11	–	.11
63B – Sunnyside	.04	.06	.10
10 – Tahoe Vista	.17	–	.17
1 – Tahoe City	.09	.04	.13
SUBTOTAL	.41	.10	.51
PRIORITY TOTAL	2.20	0.27	2.47

PRIORITY 4: MECHANICAL STABILIZATION and REVEGETATION of OVERSTEEPENED and UNVEGETATED ROADWAY SLOPES on HIGH EROSION HAZARD LANDS

	LOCAL	STATE	TOTAL
CITY OF SOUTH LAKE TAHOE			
41B – Keller Road	.25	–	.25
SUBTOTAL	.25	0	.25
EL DORADO COUNTY			
54 – Rubicon Properties	.19	–	.19
55 – Meeks Bay	.17	–	.17
53 – Rubicon Bay	.38	–	.38
48 – Emerald Bay	.05	.91	.96
44I – Luther Pass	–	.43	.43
44J – Echo Summit	–	.11	.11
SUBTOTAL	.79	1.46	2.25
PLACER COUNTY			
63C – Ward Valley	.25	–	.25
9 – Flick Point	.03	–	.03
6 – Carnelian Bay	.09	.10	.19
12 – Kings Beach	.11	.06	.17
SUBTOTAL	.48	.17	.65
PRIORITY TOTAL	1.52	1.63	3.15

(continued on next page)

* Listed values may not add up precisely to totals indicated due to rounding.

TABLE III–18 (continued)

PRIORITY 5: ERODING DIRT ROADS on HIGH EROSION HAZARD LANDS

	LOCAL	STATE	TOTAL
CITY OF SOUTH LAKE TAHOE			
41D – Heavenly Valley	.81	–	.81
SUBTOTAL	.81	0	.81
EL DORADO COUNTY			
48 – Emerald Bay	1.32	–	1.32
SUBTOTAL	1.32	0	1.32
PLACER COUNTY			
9 – Flick Point	.20	–	.20
6 – Carnelian Bay	.22	–	.22
12 – Kings Beach	.17	–	.17
SUBTOTAL	.58	0	.58
PRIORITY TOTAL	2.71	0	2.71

PRIORITY 6: ERODING ROADWAY SHOULDERS on HIGH EROSION HAZARD LANDS

	LOCAL	STATE	TOTAL
CITY OF SOUTH LAKE TAHOE			
41B – Keller Road	.56	–	.56
41D – Heavenly Valley	.50	–	.50
SUBTOTAL	1.06	0	1.06
EL DORADO COUNTY			
54 – Rubicon Properties	.10	–	.10
55 – Meeks Bay	.20	–	.20
53 – Rubicon Bay	.36	–	.36
48 – Emerald Bay	–	.39	.39
44J – Echo Summit	–	.23	.23
44I – Luther Pass	–	.18	.18
SUBTOTAL	.66	.80	1.46
PLACER COUNTY			
63C – Ward Valley	.13	–	.13
9 – Flick Point	.39	.10	.49
6 – Carnelian Bay	.64	.06	.70
12 – Kings Beach	.50	.04	.54
SUBTOTAL	1.65	.20	1.85
PRIORITY TOTAL	3.37	1.00	4.37

PRIORITY 7: STORM DRAINAGE CONTROL for COMPLETE SYSTEMS with HIGH EROSION HAZARD LANDS

	LOCAL	STATE	TOTAL
CITY OF SOUTH LAKE TAHOE			
41B – Keller Road	.71	–	.71
41D – Heavenly Valley	.29	–	.29
41E – Blackwood Meadow	.53	–	.53
41C – Tahoe Meadows	.52	.09	.61
SUBTOTAL	2.05	.09	2.14
EL DORADO COUNTY			
54 – Rubicon Properties	.14		
55 – Meeks Bay	.42	.17	.94
53 – Rubicon Bay	.22		
48 – Emerald Bay	–	.03	.03
44J – Echo Summit	–	.09	.09
SUBTOTAL	.78	.29	1.05
PLACER COUNTY			
63C – Ward Valley	.01	–	.01
9 – Flick Point	.15	.01	.16
6 – Carnelian Bay	.26	–	.26
12 – Kings Beach	.26	.03	.29
SUBTOTAL	.68	.04	.72
PRIORITY TOTAL	3.50	.42	3.92

PRIORITY 8: ERODING DIRT ROADS on MODERATE EROSION HAZARD LANDS

	LOCAL	STATE	TOTAL
CITY OF SOUTH LAKE TAHOE			
44B – South Tahoe "Y"	.18	–	.18
41A – Crescent "V" Center	.03	–	.03
SUBTOTAL	.21	0	.21
EL DORADO COUNTY			
44F – Osgood Swamp	.86	–	.86
43D – Montgomery Estates	.12	–	.12
44K – Angora Creek	.09	–	.09
44O – Airport	.42	–	.42
43F – Tahoe Paradise	.01	–	.01
44M – Tahoe Paradise Golf Course	.01	–	.01
SUBTOTAL	1.50	0	1.50
PLACER COUNTY			
65B – Sunnyside	.08	–	.08
10 – Tahoe Vista	.20	–	.20
1 – Tahoe City	.13	–	.13
SUBTOTAL	.40	0	.40
PRIORITY TOTAL	2.12	0	2.12

(continued on next page)

TABLE III–18 (continued)

PRIORITY 9: ERODING ROADWAY SHOULDERS and DITCHES on MODERATE EROSION HAZARD LANDS

	LOCAL	STATE	TOTAL
CITY OF SOUTH LAKE TAHOE			
42A – Upper Glenwood	.20	–	.20
44D – Gardner Mt.	.19	–	.19
44E – Tallac Lagoon	.64	–	.64
44A – West Sierra Tract	.48	–	.48
44B – South Tahoe "Y"	1.32	–	1.32
41A – Crescent "V" Center	.15	–	.15
SUBTOTAL	2.99	0	2.99
EL DORADO COUNTY			
44F – Osgood Swamp	1.35	–	1.35
43D – Montgomery Estates	.40	–	.40
44K – Angora Creek	.68	–	.68
44D – Airport	.05	–	.05
43F – Tahoe Paradise	.82	–	.82
44L – Country Club Heights	.58	–	.58
44M – Tahoe Paradise Golf Club	1.02	–	1.02
53, 55, 57B, – Rubicon-Tahoma	–	.38	.38
SUBTOTAL	4.90	.38	5.28
PLACER COUNTY			
63A – Talmont Estates	.13	–	.13
10 – Tahoe Vista	.29	.01	.30
63B – Sunnyside	.26	.13	.39
1 – Tahoe City	.58	.28	.86
SUBTOTAL	1.26	.42	1.68
PRIORITY TOTAL	9.15	.79	9.94

PRIORITY 10: ERODING ROADWAY SHOULDERS and DITCHES on LOW EROSION HAZARD LANDS

	LOCAL	STATE	TOTAL
CITY OF SOUTH LAKE TAHOE			
44C – Tahoe Valley School	.42	–	.42
43B – East Sierra Tract	.52	–	.52
41C – Tahoe Meadows	.60	–	.60
41E – Blackwood Meadow	.28	–	.28
42B – Bijou Creek	.73	–	.73
43C – Country Cross Roads	.11	–	.11
43A – Al Tahoe	.30	–	.30
44B – South Tahoe "Y"	–	.14	.14
SUBTOTAL	2.95	.14	3.09
EL DORADO COUNTY			
44N – Echo View	.89	–	.89
47 – Fallen Leaf Lake	.06	.05	.11
44G & O – Meyers-Airport	.24	.45	.69
57B – Tahoma	.42	–	.42
43F – Black Bart	.34	–	.34
44H – Christmas Valley	.66	.19	.85
SUBTOTAL	2.61	.68	3.29
PLACER COUNTY			
11 – Griff Creek	.21	.08	.29
4 Dollar Point	.49	.21	.70
57A – Chambers Landing	.50	.09	.59
62 – Homewood	.28	.06	.34
SUBTOTAL	1.49	.44	1.93
PRIORITY TOTAL	7.04	1.26	8.30

PRIORITY 11: ERODING DIRT ROADS on LOW EROSION HAZARD LANDS

	LOCAL	STATE	TOTAL
CITY OF SOUTH LAKE TAHOE			
42B – Bijou Creek	.76	–	.76
SUBTOTAL	.76	0	.76
EL DORADO COUNTY			
44N – Echo View	.47	–	.47
57B – Tahoma	1.10	–	1.10
43E – Black Bart	.08	–	.08
44H – Christmas Valley	.04	—	.04
SUBTOTAL	1.68	0	1.68
PLACER COUNTY			
11 – Griff Creek	.01	–	.01
4 – Dollar Point	.01	–	.01
57A – Chambers Landing	.16	–	.16
62 – Homewood	.19	–	.19
SUBTOTAL	.37	–	.37
PRIORITY TOTAL	2.80	0	2.80

PRIORITY 12: REMAINING STORM DRAINAGE CONTROL on MODERATE and LOW EROSION HAZARD LANDS

	LOCAL	STATE	TOTAL
CITY OF SOUTH LAKE TAHOE			
42A – Upper Glenwood	.21	–	.21
44D – Gardner Mt.	.38	–	.38
44A – West Sierra Tract	.33	–	.33
44B – South Tahoe "Y"	.57	.09	.67
41A – Crescent "V" Center	.21	–	.21
44C – Tahoe Valley School	.14	–	.14
43B – East Sierra Tract	.38	–	.38
42B – Bijou Creek	.37	–	.37
43C – Country Cross Roads	.13	–	.13
43A – Al Tahoe	.11	–	.11
SUBTOTAL	2.82	.09	2.91
EL DORADO COUNTY			
44F – Osgood Swamp	.62	–	.62
43D – Montgomery Estates	.28	–	.28
44K – Angora Creek	.35	–	.35
44D – Airport	.01	–	.01
43F – Tahoe Paradise	.14	–	.14
44L – Country Club Heights	.37	–	.37
44M – Tahoe Paradise Golf Club	.48	–	.48
44N – Echo View	.34	–	.34
44G – Meyers	.03	.01	.03
57B – Tahoma	.63	–	.63
43E – Black Bart	.11	–	.11
44H – Christmas Valley	.04	–	.04
SUBTOTAL	3.39	.01	3.40
PLACER COUNTY			
63A – Talmont Estates	.40	–	.40
63B – Sunnyside	.08	.09	.17
10 – Tahoe Vista	.16	.01	.17
1 – Tahoe City	.13	.04	.17
11 – Griff Creek	.14	.04	.18
4 – Dollar Point	.38	.01	.39
57A – Chambers Landing	.24	.07	.31
62 – Homewood	.08	.01	.09
SUBTOTAL	1.60	.25	1.85
PRIORITY TOTAL	7.81	.34	8.15

	LOCAL	STATE	TOTAL
CONSTRUCTION TOTAL	43.89	6.29	50.18
DESIGN & ADMINISTRATION (25%)	10.97	1.57	12.54
GRAND TOTAL	54.86	7.86	62.72

TABLE III–19

EROSION and URBAN RUNOFF CONTROL PROJECTS

for NEVADA PORTION of TAHOE BASIN

and ASSOCIATED COSTS

(Millions of 1979 Dollars)*

PRIORITY 1: REVEGETATION of AREAS STRIPPED of VEGETATION on ALL EROSION HAZARD LANDS

WASHOE COUNTY	LOCAL	STATE	TOTAL
16B Incline Village Unit No. 2	.02	–	.02
13 Crystal Bay	.02	–	.02
18A Country Club	.01	–	.01
19B Whispering Pines	.01	–	.01
17 Incline Village Unit No. 5	.01	–	.01
15B Incline Village Unit No. 4	.01	–	.01
16A Ponderosa	.01	–	.01
16C Northwood	.01	–	.01
16A Lakeview	.02	–	.02
18B Fairway	.01	–	.01
18C Third Creek	.04	–	.04
SUBTOTAL	.18	0	.18
DOUGLAS COUNTY			
40B Kingsbury Summit	.01	–	.01
40A Kingsbury Village	.01	–	.01
40C Kingsbury Highlands	.04	–	.04
33 Cave Rock	< .01	–	< .01
39D Round Hill	< .01	–	< .01
38 Zephyr Cove	< .01	–	< .01
30 Logan Shoals	< .01	–	< .01
39A Kingsbury	< .01	–	< .01
34 Skyland	< .01	–	< .01
39B Foothill Estates	.07	–	.07
40D Lower Edgewood Creek	.05	–	.05
37 Whittell High School	.01	–	.01
39 Stateline	.05	–	.05
29 Glenbrook	< .01	0	< .01
SUBTOTAL	.25		.25
PRIORITY TOTAL	.43	0	.43

PRIORITY 2: MECHANICAL STABILIZATION and REVEGETATION of OVERSTEEPENED and UNVEGETATED SLOPES on LOW EROSION HAZARD LANDS

WASHOE COUNTY	LOCAL	STATE	TOTAL
16C Northwood	.01	–	.01
16A Lakeview	.13	.26	.39
18B Fairway	.08	–	.08
18C Third Creek	.38	.01	.39
19A Mill Creek	–	.08	.08
SUBTOTAL	.60	.36	.96
DOUGLAS COUNTY			
39C Stateline	.07	–	.07
29 Glenbrook	.21	–	.21
SUBTOTAL	.29	–	.29
PRIORITY TOTAL	.89	.36	1.25

PRIORITY 3: MECHANICAL STABILIZATION and REVEGETATION of OVERSTEEPENED and UNVEGETATED SLOPES on MODERATE EROSION HAZARD LANDS

WASHOE COUNTY	LOCAL	STATE	TOTAL
17 Incline Village Unit No. 5	.23	–	.23
15B Incline Village Unit No. 4	.15	–	.15
15A Ponderosa	.15	0.5	.20
SUBTOTAL	.52	0.5	.57
DOUGLAS COUNTY			
34 Skyland	.12	–	.12
39B Foothill Estates	.17	–	.17
40D Lower Edgewood Creek	.07	–	.07
37 Whittell High School	.13	–	.13
39D Round Hill	–	.04	.04
39A & C Kingsbury Heights-Stateline	–	.21	.21
SUBTOTAL	.48	.26	.75
PRIORITY TOTAL	1.00	.31	1.31

PRIORITY 4: MECHANICAL STABILIZATION and REVEGETATION of OVERSTEEPENED and UNVEGETATED SLOPES on HIGH EROSION HAZARD LAND

WASHOE COUNTY	LOCAL	STATE	TOTAL
16B Incline Village Unit No. 2	.45	–	.45
19C Tyrolian Village	.20	–	.20
13 Crystal Bay	.50	.22	.71
18A Country Club	.53	–	.53
19B Whispering Pines	.25	–	.25
23 Sand Harbor	–	.51	.51
17 Incline Village Unit No. 5	–	.07	.07
SUBTOTAL	1.93	.81	2.72
CARSON CITY			
25 Secret Harbor	–	.88	.88
SUBTOTAL	–	.88	.88
DOUGLAS COUNTY			
40B Kingsbury Summit	.77	.12	.88
40A Kingsbury Village	.70	.11	.81
40C Kingsbury Highlands	.17	–	.17
33 Cave Rock	.43	.15	.58
39D Round Hill	.18	–	.18
38 Zephyr Cove	.39	.14	.53
30 Logan Shoals	.11	.11	.21
39E Nevada Beach	.07	–	.07
39A Kingsbury Heights	.39	–	.39
29 Glenbrook	–	.93	.93
28 Spooner Summit	–	.19	.19
35 Skyland	–	.06	.06
SUBTOTAL	3.18	1.82	5.00
PRIORITY TOTAL	5.11	3.52	8.63

(continued on next page)

*Listed values may not add up precisely to totals indicated due to rounding.

TABLE III–19 (continued)

PRIORITY 5: ERODING DIRT ROADS on HIGH EROSION HAZARD LANDS

WASHOE COUNTY	LOCAL	STATE	TOTAL
16B Incline Village Unit No. 2	.01	–	.01
19C Tyrolian Village	.12	–	.12
13 Crystal Bay	.16	–	.16
18A Country Club	.07	–	.07
19B Whispering Pines	.07	–	.07
SUBTOTAL	.44	0	.44
CARSON CITY			
22 Secret Harbor	.01	–	.01
SUBTOTAL	.01	–	.01
DOUGLAS COUNTY			
40B Kingsbury Summit	.01	–	.01
40A Kingsbury Village	.01	–	.01
40C Kingsbury Highlands	.23	–	.23
33 Cave Rock	.02	–	.02
39D Round Hill	.04	–	.04
38 Zephyr Cove	.02	–	.02
30 Logan Shoals	.13	–	.13
39E Nevada Beach	.01	–	.01
39A Kingsbury Heights	.01	–	.01
SUBTOTAL	.48	0	.48
PRIORITY TOTAL	.93	0	.93

PRIORITY 6: ERODING ROADWAY SHOULDERS and DITCHES on HIGH EROSION HAZARD LANDS

	LOCAL	STATE	TOTAL
WASHOE COUNTY			
16B Incline Village Unit No. 2	.06	–	.06
19C Tyrolian Village	.04	–	.04
13 Crystal Bay	.29	.26	.56
18A Country Club	.44	–	.44
19B Whispering Pines	.14	–	.14
23 Sand Harbor	–	.09	.09
17 Incline Village Unit No. 5	–	.13	.13
SUBTOTAL	.98	.48	1.46
Carson City	–	.07	.07
SUBTOTAL	0	.07	.07
DOUGLAS COUNTY			
40B Kingsbury Summit	.76	.07	.83
40A Kingsbury Village	.18	–	.18
40C Kingsbury Highlands	.06	.06	.13
39D Round Hill	.27	–	.26
38 Zephyr Cove	.12	.06	.18
39E Nevada Beach	.04	–	.04
39A Kingsbury Heights	.14	–	.14
29 Glenbrook	–	.04	.04
28 Spooner Summit	–	.04	.04
33 Cave Rock	–	.20	.20
34 Skyland	–	.08	.08
SUBTOTAL	1.60	.60	2.20
PRIORITY TOTAL	2.58	1.15	3.73

PRIORITY 7: STORM DRAIN CONTROL for COMPLETE SYSTEMS with HIGH EROSION HAZARD LANDS

	LOCAL	STATE	TOTAL
WASHOE COUNTY			
16B Incline Village Unit No. 2	.02	–	.02
19C Tyrolian Village	.06	–	.06
13 Crystal Bay	.07	.02	.09
18A Country Club	.35	–	.35
19B Whispering Pines	.11	–	.11
17 Incline Village Unit No. 5	–	.01	.01
SUBTOTAL	.61	.04	.65
CARSON CITY			
25 Secret Harbor	–	.01	.01
SUBTOTAL	0	.01	.01
DOUGLAS COUNTY			
40B Kingsbury Summit	.07	.05	.13
40A Kingsbury Village	.08	–	.08
40C Kingsbury Highlands	.04	.04	.08
33 Cave Rock	.07	.04	.12
39D Round Hill	.11	–	.11
38 Zephyr Cove	.21	.05	.26
30 Logan Shoals	.05	.04	.09
39E Nevada Beach	.05	–	.05
29 Glenbrook	–	.01	.01
28 Spooner Summit	–	.05	.05
34 Skyland	–	.06	.06
SUBTOTAL	.76	.34	1.09
PRIORITY TOTAL	1.37	.39	1.75

PRIORITY 8: ERODING DIRT ROADS on MODERATE EROSION HAZARD LANDS

	LOCAL	STATE	TOTAL
WASHOE COUNTY			
17 Incline Village Unit No. 5	.01	–	.01
15B Incline Village Unit No. 4	.01	–	.01
15A Ponderosa	.05	–	.05
SUBTOTAL	.07	0	.07
DOUGLAS COUNTY			
34 Skyland	.01	–	.01
39B Foothill Estates	.15	–	.15
37 Whittell High School	.18	–	.18
SUBTOTAL	.34	0	.34
PRIORITY TOTAL	.41	0	.41

(continued on next page)

TABLE III–19 (continued)

PRIORITY 9: ERODING ROADWAY SHOULDERS and DITCHES on MODERATE EROSION HAZARD LANDS

	LOCAL	STATE	TOTAL
WASHOE COUNTY			
17 Incline Village Unit No. 5	.04	–	.04
15B Incline Village Unit No. 4	.02	–	.02
15A Ponderosa	.39	.04	.43
SUBTOTAL	.45	.04	.49
DOUGLAS COUNTY			
34 Skyland	.06	–	.06
39B Foothill Estates	.03	–	.03
40D Lower Edgewood Creek	.01	–	.01
37 Whittell High School	.01	–	.01
39D Round Hill	–	.04	.04
39A & C Kingsbury Heights-Stateline	–	.11	.11
SUBTOTAL	.12	.15	.26
PRIORITY TOTAL	.57	.19	.76

PRIORITY 10: ERODING ROADWAY SHOULDERS and DITCHES on LOW EROSION HAZARD LANDS

	LOCAL	STATE	TOTAL
WASHOE COUNTY			
16C Northwood	.58	–	.58
16A Lakeview	.45	.15	.60
18B Fairway	.46	–	.46
18C Third Creek	.29	.06	.36
19A Mill Creek	.36	.05	.41
SUBTOTAL	2.14	.26	2.40
DOUGLAS COUNTY			
39C Stateline	.01	.11	.12
29 Glenbrook	.02	–	.02
29D Round Hill	–	.04	.04
SUBTOTAL	.03	.15	.18
PRIORITY TOTAL	2.17	.41	2.58

PRIORITY 11: ERODING DIRT ROADS on LOW EROSION HAZARD LANDS

	LOCAL	STATE	TOTAL
WASHOE COUNTY			
16C Northwood	.05	–	.05
16A Lakeview	.07	–	.07
18C Third Creek	.23	–	.23
19A Mill Creek	.01	–	.01
SUBTOTAL	.37	0	.37
DOUGLAS COUNTY			
39C Stateline	.49	–	.49
29 Glenbrook	.06	–	.06
SUBTOTAL	.56	0	.56
PRIORITY TOTAL	.92	0	.92

PRIORITY 12: STORM DRAINAGE CONTROL on LOW and MODERATE EROSION HAZARD LANDS

	LOCAL	STATE	TOTAL
WASHOE COUNTY			
17 Incline Village Unit No. 5	.13	–	.13
15B Incline Village Unit No. 4	.06	–	.06
15A Ponderosa	.26	.01	.27
16C Northwood	.49	–	.49
16A Lakeview	.27	.13	.40
18B Fairway	.32	–	.32
18C Third Creek	.29	.04	.33
19A Mill Creek	.27	.29	.58
SUBTOTAL	2.11	.48	2.59
DOUGLAS COUNTY			
34 Skyland	.04	–	.04
39B Foothill Estates	.05	–	.05
40D Lower Edgewood Creek	.04	–	.04
37 Whittell High School	.01	–	.01
39C Stateline	.04	.07	.12
39D Round Hill	–	.01	.01
SUBTOTAL	.18	.08	.26
PRIORITY TOTAL	2.29	.57	2.86

	LOCAL	STATE	TOTAL
CONSTRUCTION TOTAL	18.67	6.93	25.60
DESIGN & ADMINISTRATION (25%)	4.67	1.73	6.40
GRAND TOTAL	23.34	8.66	32.00

These areas should be clearly defined in the facilities plans. Table III-20 summarizes the approximate allocation of the cost of projects in California between the state and the three units of local government. The state costs are probably somewhat lower than indicated by the table, because some highway drainage improvements have been constructed since the data forming the basis for the tables were collected.

b. On-Site Surface Runoff Control Measures

The control measures needed to prevent runoff from areas with on-site surface runoff control problems from reaching surface waters without adequate treatment must be adapted to each individual site. This discussion sets forth the general kinds of controls required. Further detail is provided by the Handbook of Best Management Practices (Tahoe Regional Planning Agency, 1978).

Street and parking lot sweeping are the most important control measures for on-site problems. Street and parking lot sweeping probably accounts for about 80 percent of the total suspended sediment reduction of approximately 4,000 metric tons which can be achieved through application of on-site controls. The reduction in dissolved nutrients will be minor, but the reduction in particulate bound nutrients from street sweeping will be comparable to the reduction in suspended sediments. Street and parking lot sweeping also helps prevent clogging of infiltration facilities.

i. Areas of Intensive Vehicular Use

Table III-21 lists specific areas of intensive vehicular use. Proper management of runoff from these areas requires installation of on-site drainage facilities and adherence to operating practices to control water quality deterioration. A program of intensive maintenance including periodic vacuum sweeping and cleanup of debris is required in all cases. Drainage systems should be designed to convey runoff to the treatment or infiltration facility and then to a stable discharge point.

ii. Unsurfaced Private Roads and Driveways

Heavily used roads and driveways requiring winter snow removal should be paved. Less heavily used roads and driveways should be surfaced with gravel. Unneeded dirt roads and driveways should be revegetated.

iii. Snow Disposal Facilities

Snow disposal areas should be located entirely upon high capability land with rapid permeability, should be separated from stream environment zones, and should be contained within berms to avoid surface runoff.

TABLE III–20

APPROXIMATE ALLOCATION of COST
for EROSION and RUNOFF PROJECTS in CALIFORNIA

(Millions of 1979 dollars)

	LOCAL	STATE	TOTAL
South Lake Tahoe	17.5	0.4	17.9
El Dorado County	25.1	4.9	30.0
Placer County	12.3	2.6	14.9
TOTAL	54.9	7.9	62.8

TABLE III–21

AREAS of INTENSIVE VEHICULAR USE

NAME	LOCATION
LARGE PARKING AREAS	
Outdoorsman	CSLT*
Lampson Plaza	CSLT
Safeway at "Y"	CSLT
Raley's at "Y"	CSLT
South Lake Tahoe High School	CSLT
Lucky's–Payless	CSLT
Fremont Mall	CSLT
Safeway at Bijou	CSLT
Inks at Bijou	CSLT
Lakeland Village	CSLT
Crescent V	CSLT
Heavenly Valley	El Dorado County
South Lake Tahoe Airport	El Dorado County
Yanks Station	El Dorado County
Safeway at Tahoe Vista	Placer County
Homewood Ski Area	Placer County
Tahoe Ski Bowl	Placer County
Lucky's at Tahoe City	Placer County
Safeway at Tahoe City	Placer County
Cal-Neva Lodge	Washoe County
Crystal Bay Club	Washoe County
Safeway at Incline	Washoe County
Ponderosa Ranch	Washoe County
Village Shopping Center	Washoe County
Incline Center	Washoe County
Country Club Mall	Washoe County
Whittell High School	Douglas County
Zephyr Cove Lodge	Douglas County
Round Hill Shopping Center	Douglas County
Harvey's Inn	Douglas County
Barney's	Douglas County
Harvey's	Douglas County
Sahara	Douglas County
Harrah's	Douglas County
Nugget	Douglas County
Heavenly Valley North	Douglas County
CORPORATION YARDS	
City of South Lake Tahoe	CSLT
Sierra Pacific Power Company	CSLT
Standard Oil	CSLT
Delta Trucking	CSLT
California Department of Transportation	El Dorado County, CSLT
El Dorado County	El Dorado County
South Tahoe PUD	El Dorado County
California Department of Transportation	Placer County
North Tahoe PUD	Placer County
Tahoe City PUD	Placer County
Nevada Department of Transportation	Washoe County
Incline Village GID	Washoe County
Douglas County SID No. 1	Douglas County
SERVICE STATIONS (all stations in Basin)	

* City of South Lake Tahoe

iv. Construction Sites

To prevent excessive erosion from construction sites, grading or other soil disturbance should not be allowed between October 15 and May 1 or when soils are saturated or covered with snow. Construction sites should also be kept out of stream environment zones and high erosion hazard lands because of the severe impact of soil and vegetation disturbance in these areas. When construction is allowed both temporary and permanent stabilization and runoff management measures are required.

Temporary stabilization measures must be installed as soon as possible after soil is disturbed to provide surface protection during construction. Mulches, resins and tackifiers, and matting may all be useful. On large sites filter berms, temporary runoff conveyance facilities, and sediment or flow detention basins may be required.

Permanent stabilization measures must be integrated into the construction plan. Revegetation must be provided as soon as possible. During construction, protective measures must be undertaken to prevent unnecessary destruction of vegetation. The Handbook of Best Management Practices (Tahoe Regional Planning Agency, 1978), and the State Water Resources Control Board's report, "Demonstration of Erosion and Sediment Control Technology" (White, 1978), describe the temporary and permanent erosion control measures which should be employed at construction sites.

v. Golf Courses

Each golf course in the Basin should follow a control plan detailing nutrient loads, pathways and control strategies. Use of chemicals other than fertilizer should be prohibited in stream environment zones. Fertilizer use must be limited. The control strategies for golf courses should include:

- strict annual, monthly and daily fertilizer limitations
- controlled drainage, including holding ponds where necessary
- maintenance of drainage systems
- surface and groundwater monitoring programs

Strict limitations must be imposed on further golf course development and expansion, with no further encroachment of stream environment zones.

c. Erosion and Runoff from Additional Development

i. Development Restrictions

To ensure that further development will not lead to further deterioration of water quality, the following development restructions must be imposed:

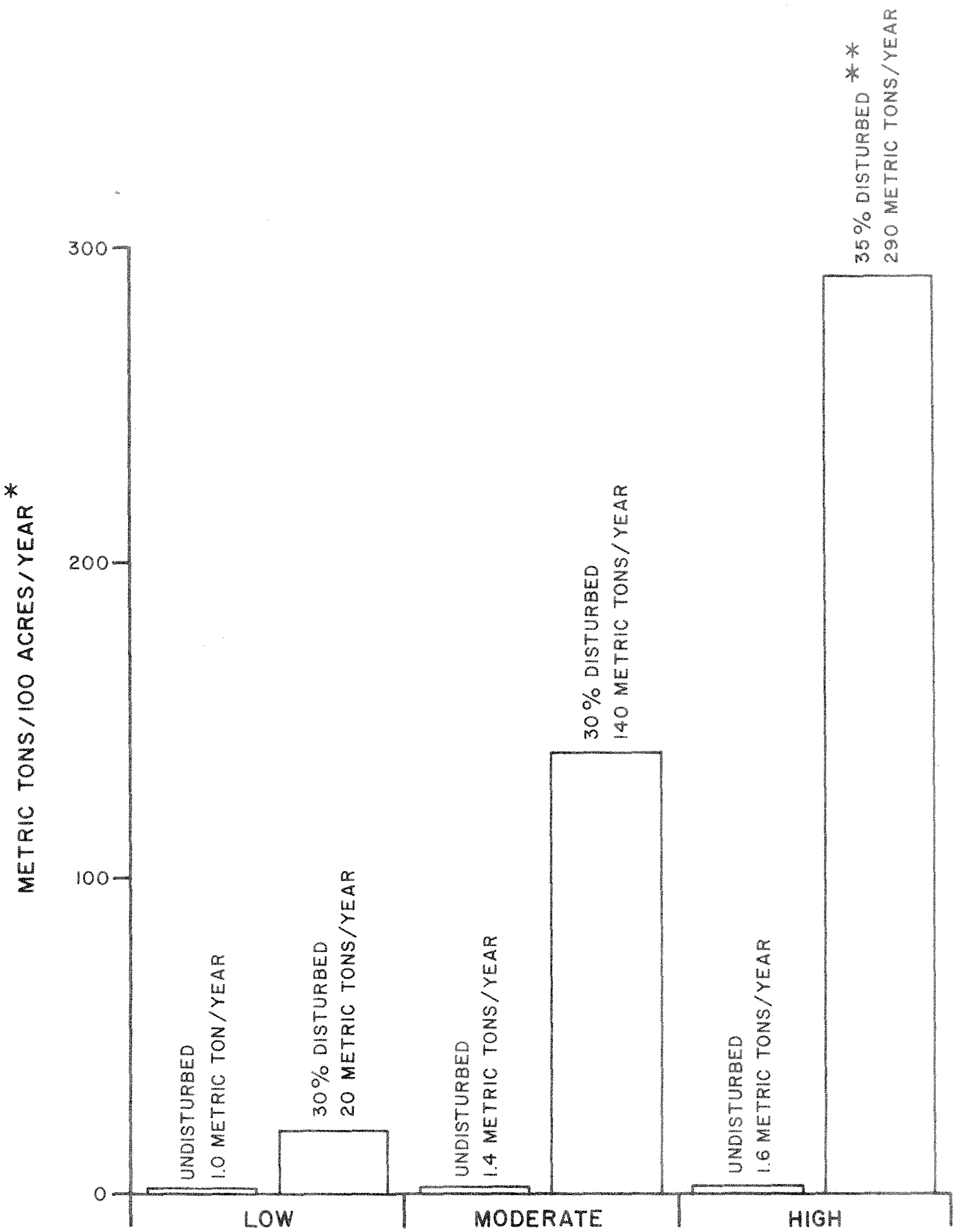
- No new subdivision development
- No further construction on high erosion hazard lands
- No coverage on individual parcels in excess of the allowable percentage of impervious cover set by the land capability system
- No further construction in stream environment zones
- No further development until offsetting erosion and urban runoff control projects are implemented.

These restrictions will prevent any major increase in erosion and urban runoff problems. Coupled with implementation of erosion and urban runoff control projects and on-site control measures, the restrictions will ensure that nutrient and sediment levels are reduced significantly below present levels. These restrictions will also greatly reduce the number of lots which may be used for residential or commerical construction. Because most subdivisions were created without regard to the land capability system and without regard to the need to protect stream environment zones, three-quarters or more of the lots in existing subdivisions cannot be developed under these restrictions. Land capability and stream environment zone maps at the Tahoe Regional Planning Agency and the California Tahoe Regional Planning Agency offices can be used to provide an initial indication as to which lots may be affected by the restrictions. Field inspections to determine land capability will be necessary in many cases before making a final decision.

(a) New Subdivisions

Construction of new subdivisions causes major increases in sediment and nutrient loads. Figure III-4 depicts the sediment yield rate for a typical 100-acre subdivision on low, moderate and high erosion hazard lands, as compared to the sediment yield under natural conditions. On low erosion hazard lands, subdivision construction will increase sediment yields 20-fold, and the increases on moderate and high erosion hazard lands are even greater.

Figure III–4



* Sediment yield estimates based on relation among land capability, percent disturbance, and sediment generation set forth in Appendix B.

** Slightly higher percent disturbance due to steep terrain on most high erosion hazard lands

Comparison of Natural vs. Disturbed Suspended Sediment Production for a "Typical" 100-acre Subdivision Development with 400 Single Family Homes resulting in about 30% Disturbance on Low, Moderate, and High Erosion Hazard Lands in the Lake Tahoe Basin

The sediment yields depicted in Figure III-5 are based on typical subdivision developments. Close attention to land capability and installation of surface runoff management systems can reduce sediment yields. Even development on low erosion hazard land following best management practices to control erosion and surface runoff will at least double sediment yields over natural levels, however.

New subdivisions disturb large areas for road construction and utility installation. Even before the first house is built the average subdivision disturbs about 20 percent of the area. New subdivisions therefore yield a great deal more sediment per unit constructed than does construction of additional units in existing subdivisions. Figure III-5 depicts the sediment yield per unit for construction in existing and new subdivisions in California under different development controls. If building stays outside high erosion hazard lands and stream environment zones, and the coverage limits set by the land capability system are applied to each lot, additional units in existing subdivisions will increase the annual suspended sediment yield by an average of 0.20 metric tons per additional unit. If similar restrictions are applied to new subdivisions, with subdivision roads as well as coverage within each lot counted against the coverage limits, new subdivision construction will yield 0.75 metric tons per year per unit built. If construction is allowed as permitted by the California Tahoe Regional Planning Agency General Plan, the suspended sediment yield per unit built will be over three times as much for new subdivisions as for buildout of existing subdivisions.

Figure III-6 depicts the estimated total annual suspended sediment generation in the Basin under various growth scenarios. Sediment yields for buildout of existing subdivisions and for construction of additional subdivisions are shown. The growth scenarios are defined in Table III-22. Under all but scenarios 1 and 2 the number of units which can be built in existing subdivisions far exceeds the number which can be built in new subdivisions.

As Figure III-6 indicates, new subdivisions would cause a significant increase in sediment loads. In view of the increase in sediment loads which would result, and because new subdivisions add far more sediment per unit than construction in existing subdivisions, no new subdivisions in the Basin should be allowed. In California, a subdivision moratorium set by the California Tahoe Regional Planning Agency's Land Use Ordinance prohibits any new subdivision until 85 percent of all parcels which were vacant as of August 29, 1975 have been developed.

* Sediment yield estimates based on relation among land capability, percent disturbance, and sediment generation set forth in Appendix B.

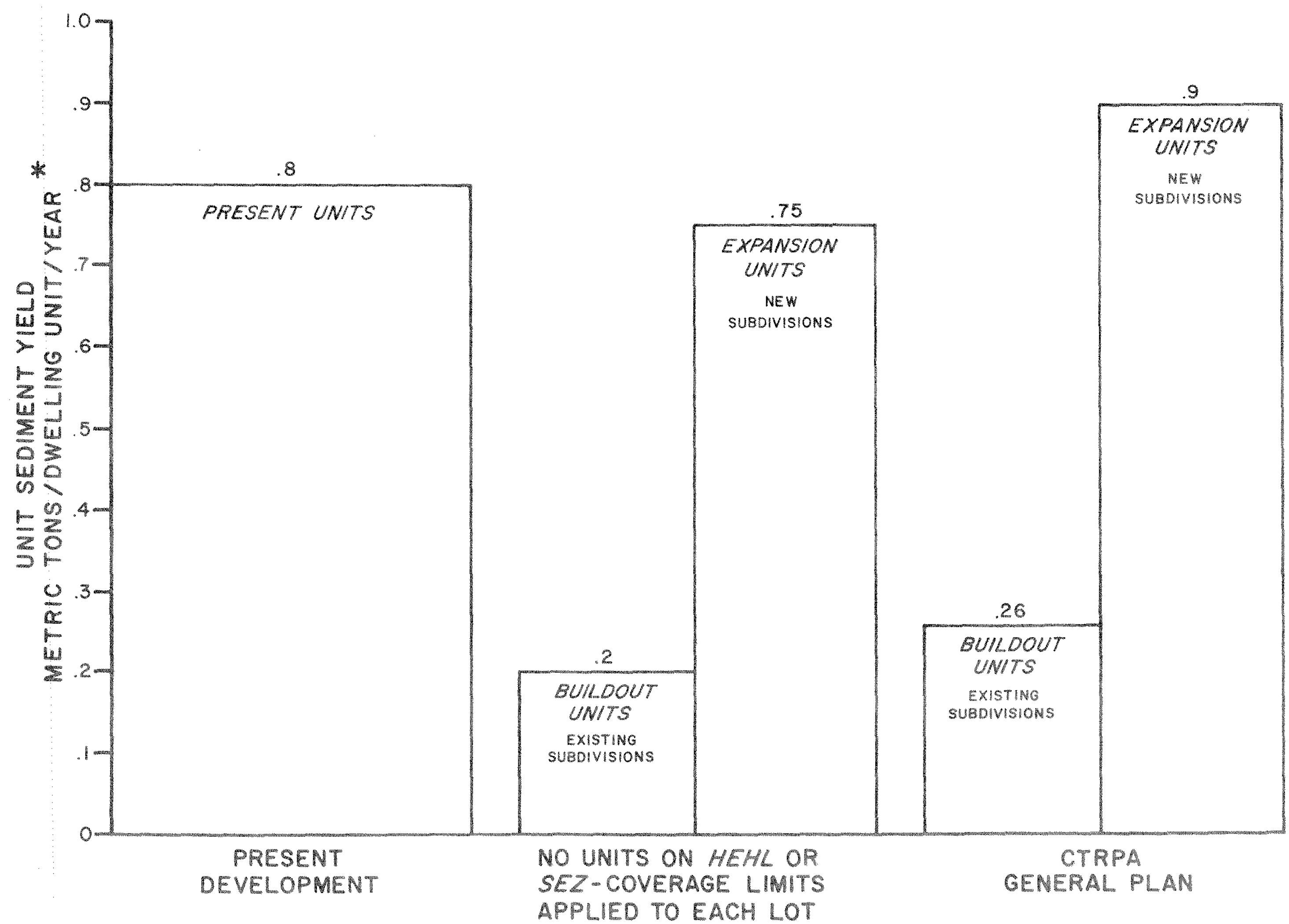
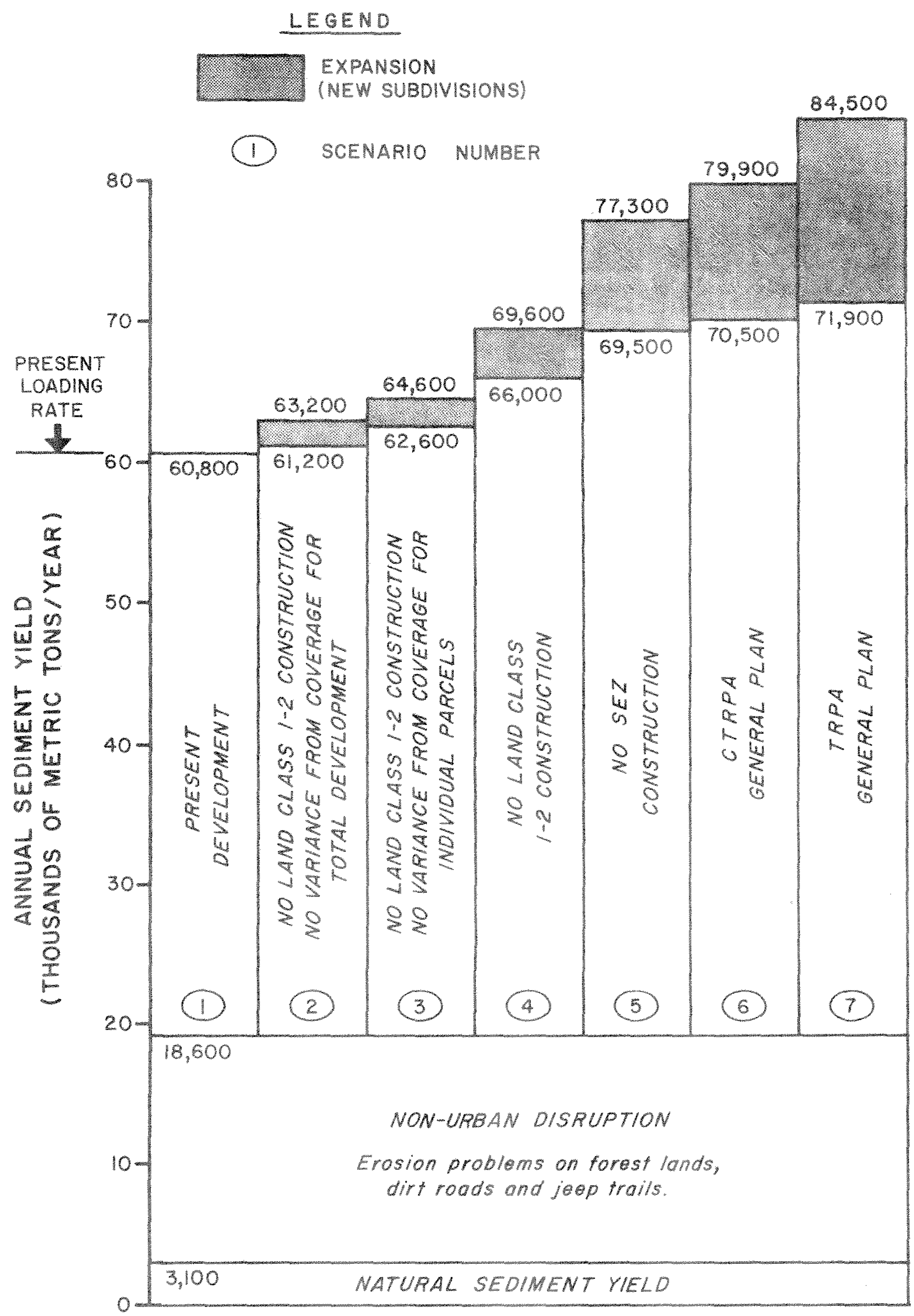


Figure III-5

Comparison of Unit Sediment Yield per Dwelling Unit in the California Portion of the Lake Tahoe Basin for Present Development and Future Potential Development

Figure III–6



TRENDS IN SEDIMENT PRODUCTION FOR VARIOUS LEVELS OF URBAN BUILDOUT AND EXPANSION

TABLE III–22

SCENARIO DESCRIPTIONS

1. PRESENT DEVELOPMENT – No change is allowed from present levels of development.
2. NO LAND CLASS 1–2 CONSTRUCTION WITH NO VARIANCE FROM COVERAGE FOR TOTAL DEVELOPMENT – No further development is allowed on high erosion hazard lands or in stream environment zones. On all other lands total development, including subdivision roads, utility disturbance, impervious surfaces and unvegetated areas is not allowed to exceed coverage limitations set by the land capability system. In most subdivisions these restrictions preclude further substantial development because existing disturbed areas already cover close to or in excess of allowable coverage.
3. NO LAND CLASS 1–2 CONSTRUCTION WITH NO VARIANCE FROM COVERAGE FOR INDIVIDUAL PARCELS – No further development is allowed on high erosion hazard lands or in stream environment zones. On all other lands impervious surfaces and unvegetated areas on each individual lot or parcel may not exceed coverage limitations. Roads in existing subdivisions are not counted against permissible coverage, but in new subdivisions the coverage attributable to roads is counted.
4. NO LAND CLASS 1–2 CONSTRUCTION – No further development is allowed on high erosion hazard lands or in stream environment zones. Variance from land coverage limitations is permitted as allowed by existing California Tahoe Regional Planning Agency ordinances.
5. NO SEZ DEVELOPMENT – No further development of stream environment zones is allowed. Variance from land coverage limitations is permitted as allowed by California Tahoe Regional Planning Agency ordinances.
6. CTRPA GENERAL PLAN – Development proceeds in both California and Nevada according to California Tahoe Regional Planning Agency plans and ordinances.
7. TRPA GENERAL PLAN – Development proceeds in both California and Nevada according to Tahoe Regional Planning Agency plans and ordinances.

(b) High Erosion Hazard Lands

Development of high erosion hazard lands is impossible without major increases in erosion. Erosion rates more than 1000 times natural background levels have been experienced in the Basin. In Figure III-6 the difference between sediment yields under scenario 4 and scenario 5 reflects the additional sediment yields that would result if development is allowed on high erosion hazard lands. Construction on high erosion hazard lands would cause a very large increase in sediment yields, even though the amount of construction would be relatively small.

(c) Coverage Limits

All development results in some increase in erosion and surface runoff, even when construction is limited to high capability lands. Impervious surfaces, disturbed terrain and unvegetated areas all contribute to erosion and surface runoff. These problems are most serious when the disturbed area exceeds the coverage limits set by the land capability system. The allowable coverage for each land capability classification is shown in Table III-3.

As depicted in Figure III-6, only scenario 1, which allows no new construction, and scenarios 2 and 3, under which coverage limits are enforced, prevent major increases in erosion. Construction in excess of land capability constraints greatly increases the sediment yield.

In scenario 2, coverage constraints are applied to each subdivision as a whole. Road and utility disturbance are included in determining the total coverage caused by development. In scenario 3, land coverage constraints are applied to individual parcels; coverage attributable to road and utility construction is not counted in determining whether total coverage exceeds that allowed by the land capability system. Scenario 2 more closely follows the land capability system. When applied to lots in subdivisions where the roads are already built, however, applying coverage restrictions to the area within each lot, as under scenario 3, will still prevent any major increases in erosion. The erosion from additional development under scenario 3 will be held to a very low level. If controls on existing sources of pollution are implemented, adoption of the coverage limits set by scenario 3 will not prevent attainment of the reduction in sediment and nutrient loadings needed to protect Lake Tahoe.

The coverage limits must be strictly enforced. Scenario 4 sets the same coverage limits as scenario 3, except that a variance is granted whenever the coverage limits would make it impossible to build on an individual lot. As can be seen from Figure III-6, allowing the variances causes a major increase in erosion.

(d) Stream Environment Zones

The estimated suspended sediment yields in Figure III-6 do not reflect the increased erosion hazard from disturbing areas subject to periodic inundation by streams. Nor does Figure III-6 reflect the impact of eliminating the capacity of stream environment zones to remove sediment and nutrients. To protect the natural treatment capacity of stream environment zones, and to prevent channelized flows from causing additional erosion, encroachment of stream environment zones must not be allowed.

The areas currently classified as stream environment zones include land which historically has been subject to stream flows but which has been altered by development. Most partially developed stream environment zones still are subject to the influence of streams. Further development would aggravate the erosion problems and loss of natural treatment capacity caused by encroachment of stream environment zones. In a few cases, however, the stream zone may have been so completely altered that an area is no longer influenced by stream flows or near surface groundwater, and further development would not cause any further restriction of drainage patterns. The determination of whether these areas should still be classified as stream environment zones should be made on a case by case basis. Reclassification clearly would not be appropriate where further development would exacerbate the water quality problems created by alteration of the stream environment zone. The possibility of restoring the stream environment zone should also be considered. Finally, reclassification should not be approved without mitigation measures to make up for the loss of natural treatment capacity caused by the alteration of the stream environment zone.

(e) Offset Policy

While the restrictions set above will hold down the level of erosion caused by development, further development will still cause some increase in sediment and nutrient loads. With the quality of Lake Tahoe presently deteriorating no new development can be tolerated unless it can be proven that water quality will not be affected.

No new development should be allowed without offsetting remedial measures to control pollution from existing sources. While projects proposed in this chapter provide a means of offsetting pollution from additional development, there is no guarantee these projects will be carried out. Therefore no new residential or commercial structure should be allowed until erosion and urban runoff control projects to offset the increase in erosion are implemented.

Because protection of Lake Tahoe requires a reduction in nutrient loads -- simply preventing any increases is not enough -- the offset schedule proposed here is based on completion of all erosion and urban runoff control projects. Development can be phased in as projects are implemented, however, so long as the level of development permitted is related to the number of projects which have been completed.

Accordingly, it is proposed that the level of development within each city or county in the Lake Tahoe Basin be tied to the five-year increments set for implementation of the erosion and urban runoff control projects. The first 25 percent of the development allowed under this plan within each jurisdiction will not be permitted until the city or county makes a commitment to implement the Level I (priorities 1-4) projects within its jurisdiction. The second 25 percent of development will require completion of the Level I projects and commitment to implement Level II (priorities 5-8) projects. Each additional increment of development will require commitment to implement the next level of projects, and completion of the erosion and urban runoff control projects for which commitments were made earlier. Table III-23 provides a simplified illustration of how the schedule would operate in California.

Alternative, more complex offset schedules are possible. A sliding scale could be adopted, allowing more development in earlier years, but the use of a sliding scale may not provide adequate assurance that erosion and surface runoff control projects scheduled for later years will be implemented.

The offset schedule will be applied separately to each city and county, allowing development within each jurisdiction when it makes the necessary implementation commitments. Most erosion and urban runoff control projects in the Basin are needed to correct problems on city and county roads. Applying the offset schedule separately to each jurisdiction provides an incentive for each city and county to correct the erosion and urban runoff problems for which it is responsible. Correction

TABLE III–23

DEVELOPMENT CONTROL OFFSET STRATEGY

for CALIFORNIA PORTION of the LAKE TAHOE BASIN

	YEAR	0	1 2 3 4 5	6 7 8 9 10	11 12 13 14 15	16 17 18 19 20	21 22 23 24 25
		1st Five Years		2nd Five Years	3rd Five Years	4th Five Years	5th Five Years
Development Prerequisites	Priority Commitment	I (1–4)	II (5–8)	III (9–10)	IV (11–12)		
	Priority Completion		I	II	III	IV	
Permitted Development Levels	Incremental Dwelling Units A/		1,475	1,475	1,475	1,475	0
	Cumulative Incremental Units		1,475	2,950	4,425	5,900	5,900
	Percent of Total Buildout Increment		1st 25%	2nd 25%	3rd 25%	4th 25%	--
	Total Units	B/	34,475	35,950	37,425	38,900 C/	38,900

A/ Based on average annual increment of 295 units/year in California.

B/ 33,000 total units estimate as of 1980 in California portion of the Basin.

C/ 38,900 units represents an 18% increase above present development levels.

of erosion problems within each locality would also help control turbidity and sedimentation problems in tributaries and nearshore waters, and the growth of attached algae in nearshore waters, within the area.

If the city or county has not made the commitments necessary to allow development, an individual lot owner should still be allowed to begin construction after paying a share of the cost of offsetting remedial measures. Accordingly, it is proposed that in addition to the basic offset schedule based on commitments from local government, a mechanism be adopted to allow individual offsets by property owners. The property owner's share of the cost of remedial measures will be based on the total cost of erosion and urban runoff projects, divided by the number of units which may be built, for each phase of the offset schedule. By way of illustration, the cost of Level I projects in California is about $9.8 million, and about 1,475 new units could be built when commitments are made to implement these projects. Thus, the share per unit would be about $6,650 during the first five-year period set by the offset schedule. An individual lot owner who paid this share to a fund committed to construction of erosion and urban runoff control projects would no longer be subject to any restrictions imposed by the offset schedule. Payment for offsetting remedial measures would not allow new subdivision construction, construction on high erosion hazard lands, in stream environment zones, or in excess of permissible coverage.

There are numerous variations on the basic offset schedule and the individual offset mechanism proposed here which would still meet the objective of preventing new development unless offsetting remedial measures are implemented. As part of the individual offset mechanism, for example, factors relating to the particular lot to be developed might be considered in determining the lot owner's share of the cost of offsetting remedial measures. The amount of land to be developed, or whether a residential or commercial structure will be built, might be considered. Depending on the implementing agency, the basic offset schedule could take into account other social and environmental factors besides water quality, setting priorities for which lots could be developed first. The offset schedule and individual offset mechanism proposed here are set forth to illustrate how the offset policy could be carried out, and are not intended to preclude adoption of alternative measures. This draft therefore sets forth only the broad outlines of how the offset policy could be applied. The final water quality plan, on the other hand, will have to decide which of the many possible variations of the proposed measures will be carried out. Based on public comments on this draft, and the preferences of agencies interested in implementing the offset policy, the final water quality plan will specify how the offset policy will be carried out.

ii. Best Management Practices

For construction allowed under this plan, the structures or facilities built must incorporate best management practices to control erosion and surface runoff. Best management practices include:

- Slope stabilization
- Protective surface cover or vegetation
- Adequate drainage facilities

Specific controls are cited in the Handbook of Best Management Practices (Tahoe Regional Planning Agency, 1978).

d. Forest Practices

i. Tree Removal

Tree removal should follow practices to protect vegetation not being removed, prevent damage to riparian vegetation, and provide for prompt soil stabilization and revegetation where necessary to prevent erosion.

Statewide best management practices for timber harvesting are being prepared in California under the authority of Section 208 of the Clean Water Act. These statewide best management practices are being prepared without consideration of the unique conditions in the Lake Tahoe Basin, however. The statewide best management practices therefore should be considered as minimum standards only. They will not be certified as the best management practices applicable to timber harvest in the Tahoe Basin. The Handbook of Best Management Practices (Tahoe Regional Planning Agency, 1978) sets best management practices for logging in the Tahoe Basin. In addition, the following controls are needed to protect water quality:

- No soil disturbance shall be permitted in stream environment zones, high erosion hazard lands, soils with low productivity, or soils with low revegetation potential.

- Tree removal from high erosion hazard lands shall be solely by means of helicopter, balloon, or over snow techniques which will not result in any soil disturbance.

- No vegetation shall be disturbed or removed from stream environment zones.

- All tree cutting shall be limited to thinning operations with the exception of removal of diseased trees. No clear cut swaths shall be permitted.

A thorough evaluation of the potential water quality impacts should be conducted when any large-scale commerical timber harvesting is proposed.

Prescribed burning and mechanical brush and timber thinning, if carefully conducted, may help control erosion by reducing the threat of wildfire.

ii. Dirt Roads

Except where roads are essential for fire control for emergency access, erosion from forest dirt roads should be controlled through:

- Closure;

- Stabilization and drainage control; and

- Revegetation

Wherever possible, roads must be eliminated from high erosion hazard lands and stream environment zones. For some of the roads which are not closed, protective surfacing, relocation, or installation of drainage facilities will be necessary. These controls can eliminate about 4,100 metric tons of suspended sediment per year, or about 75 percent of the suspended sediment load from forest dirt roads.

iii. Off-Road Vehicles

Off-road vehicle use must be restricted to designated areas where high erosion hazard lands, stream environment zones and sensitive vegetation are not threatened. The Handbook of Best Management Practices sets guidelines for off-road vehicle use.

To assure that vehicles stay out of areas where off-road vehicle use is not permitted, some old roads must be closed or blocked off. The Forest Service is conducting a program of blocking off roads and trails used in violation of its Off-Road Vehicle Plan.

iv. Livestock Confinement Areas and Grazing

Existing stables and corrals in stream environment zones should be relocated outside of stream environment zones on low erosion hazard lands with surface slopes of five percent or less. Livestock confinement areas should have runoff management systems designed to prevent drainage from flowing through these areas or through manure storage sites. All surface runoff from the facility should be contained and disposed of through an infiltration system. Control measures for livestock confinement facilities are set forth in the Handbook of Best Management Practices. The intensity of grazing on private lands should be monitored and controlled to prevent water quality problems, and the Forest Service should continue to observe best management practices to prevent over-grazing on National Forest lands.

v. Campgrounds

Dirt roads in developed campgrounds should be surfaced or closed and revegetated. Other control measures may be required at specific sites including:

- Stabilization of cut and fill slopes
- Installation of drainage, infiltration and sediment control facilities
- Modification or relocation of facilities in stream environment zones to minimize surface disturbance and interference with natural drainage.

The measures required will depend on the specific characteristics of the campground site.

Construction of new campgrounds should be subject to the same restrictions as apply to other development in the Basin including:

- Development shall not be permitted on high erosion hazard lands or in stream environment zones.
- Coverage shall conform to the land capability system.
- Drainage, infiltration, and sediment control facilities must be installed wherever water is concentrated by compacted or impervious surfaces.
- Best management practices for construction sites and for temporary runoff management must be followed.

vi. Ski Resorts

Some ski resorts have already begun efforts to correct water pollution problems. Each ski area should prepare a plan of action defining all surface water management problems and setting a schedule for installing necessary improvements. Necessary improvements may include:

- Slope stabilization
- Revegetation
- Installation of water bars, cross drains, and other runoff control systems

The Handbook of Best Management Practices sets standards for ski resorts.

Ski run and trail maintenance vehicles and equipment must not be operated in a manner that disturbs the soil. Snow moving, packing, and grooming must not be conducted when the snow cover is insufficient to protect the underlying soil from disruption.

Proposals for ski resort expansion must be carefully reviewed to prevent increases in erosion and surface runoff. New road construction must be kept to an absolute minimum, and prohibited on high erosion lands or in stream environment zones. Modern lift construction techniques permit tower installation without road construction. Guidelines recently prepared by the California Tahoe Regional Planning Agency, "Criteria for the Expansion of Ski Areas," define mitigation measures and control actions which must be implemented for ski area expansion (California Tahoe Regional Planning Agency, 1977). In addition, the following controls are needed to protect water quality:

- There shall be no soil disturbance on high erosion hazard lands, soils with low productivity, or soils with low vegetation potential.
- No vehicular, pedestrian, or ski traffic shall be allowed in stream environment zones except on stream crossing structures which are elevated to minimize disturbance of the area. Stream crossings shall not affect more than five percent of the total stream environment zone acreage within the ski area boundary. No permanent cutting and filling shall be permitted within any stream environment zone, and there shall be no relocation of stream environment zones. The original natural grade shall be maintained at all stream crossing sites.

- There shall be no soil disruption within stream environment zones except for installation of stream crossings.

- All areas from which vegetation is removed shall be revegetated with native plants and rhizomatous grasses. No bare, unvegetated soils shall be allowed on ski runs.

2. Other Water Quality Problems

a. Groundwater

To prevent the loss of vegetation which acts to intercept nutrients percolating into the ground, existing vegetation should be maintained wherever possible. Areas stripped of vegetation should be restored.

Because groundwater tables are often very near the surface in stream environment zones, further encroachment on these areas must be prohibited.

Many of the control measures needed to control erosion and surface runoff are also needed to protect groundwater. In addition some of the best management practices set by the Handbook of Best Management Practices are specifically directed to preventing discharges to groundwater. For example, the best management practices for livestock confinement facilities prohibit location of facilities on land which is less than four vertical feet above the groundwater table. The surface and groundwater systems of the Lake Tahoe Basin are interconnected, and the control measures adopted in this chapter are directed towards protecting both.

b. Atmospheric Sources

A study should be conducted to determine the importance of automobile exhaust and other atmospheric emissions as a source of nutrients to Lake Tahoe. If this source is significant, controls will have to be adopted.

Prevention of the destruction of vegetation which intercepts the nutrients which fall in precipitation, and restoration of areas stripped of vegetation, will also help control the amount of nutrients reaching the Lake from atmospheric sources.

c. Municipal Sewage

i. Unlined Sewer Pond

The use of an unlined oxidation pond inside the Basin by the Douglas County Sewer Improvement District No. 1 must cease. Lining the pond would cost about $500,000.

ii. Raw Sewage Overflows

Raw sewage overflows can be prevented by maintenance and surveillance programs. The Tahoe City Public Utility District conducts an intensive preventative maintenance program. Sewerlines are cleaned frequently using high pressure water jets. The program also includes television inspection of key gravity lines, surveillance at key manholes to observe sewage flows, and monitoring of pump station status through at least daily visits. All sewerage agencies in the Basin should have preventative maintenance and spill response programs modeled after those of the Tahoe City Public Utility District.

Another corrective measure would be to install an electronic system capable of continuously monitoring the status of all pump stations and capable of sensing high water levels at key manholes in gravity collection lines. The Tahoe City Public Utility District has proposed to install the first phase of such a system that would continuously monitor pumping station status for abnormal conditions. This proposal should be carried out as a demonstration project. If successful, it should be applied in the other utility districts in the Basin.

If a sewerline has a series of overflows due to design deficiencies, it should be reconstructed. Bolted down, sealed manhole covers should be added to sewerlines that parallel the Lake Tahoe shoreline or are located in stream environment zones to prevent spills from exiting via loose manhole covers. In other areas, sewerlines in or adjacent to stream channels should be relocated to high ground and fitted with sealed manhole covers.

iii. Exfiltration from Sewerlines

Further study of the problem of exfiltration from sewerlines is needed to determine the extent of the problem. Tracer studies of sewerlines would provide the most effective way of determining the extent of exfiltration losses. If investigations demonstrate that exfiltration is significant, control measures will have to be developed to seal the sewerlines. Sealing sewerlines could require a major public works project.

iv. Domestic Wastewater Not Connected to the Export Systems

A survey should be conducted to find those units which are not connected with sewerage systems. Utility records should be checked for documentary evidence that structures have been connected. Where there is no proof of connection, a dye test should be conducted. Structures which are not connected or exempted should be connected to the sewerage system. Except for existing structures in remote areas where waste disposal does not threaten water quality and sewerage system installation would damage the environment, no structure should be exempt from the requirement that all domestic waste be exported from the Basin.

Structures which have been exempted should be surveyed for compliance with conditions requiring use of bifurcated systems, export of toilet wastes, and other restrictions which have been set as a condition of the exemptions. The exemptions should also be reconsidered in light of advances in sewer technology that permit installation of low pressure community sewers in environmentally sensitive areas.

d. Miscellaneous Water Quality Problems

i. Industrial Discharges

No discharge of industrial waste within the Lake Tahoe Basin should be allowed.

ii. Solid Waste

No solid waste disposal in the Basin should be allowed. The facilities which now handle solid waste from the Basin have sufficient capacity to accept wastes from the Basin for the next several years. Because of capacity limitations and political considerations, the long-term availability of solid waste disposal sites for wastes for the Basin is uncertain. Planning should be conducted to assure the long-term availability of solid waste disposal sites.

iii. Construction and Dredging in Lake Tahoe

When piers or other structures are placed in the Lake they should be surrounded by vertical barriers to contain any disturbed sediment.

Methods of dredging which stir up bottom sediments, as when back hoes or drag lines are used, should not be permitted. Only suction dredging should be allowed, and disposal of dredged material must follow practices to prevent sediments from being discharged into the Lake.

Piers and jetties should not be allowed to block currents. They must be constructed so as to allow currents to pass through.

iv. Vessels Wastes

The discharge of vessel toilet wastes into Lake Tahoe should not be allowed. There are four pumpout facilities at commercial marinas and harbors on the Lake. Vessels can use these facilities instead of discharging into the Lake in violation of water quality regulations. To make it easier for vessels to comply with these standards, all twelve commercial marinas and harbors on the Lake should have pumpout facilities. An inspection program should also be adopted to ensure compliance.

v. Toxic and Hazardous Substance Spills

An interagency toxic and hazardous substance spill contingency plan should be developed for the Lake Tahoe Basin. The plan should include:

- incident reporting and lines of communication
- areas of responsibility and chain of command
- response, cleanup, and disposal procedures

The plan should be addressed to all lands and waters in the Lake Tahoe Basin.

CHAPTER IV

IMPLEMENTATION

The objective of planning under section 208 of the Clean Water Act is the adoption and implementation of a plan to carry out the control measures needed to protect water quality. Full implementation of the control measures called for in Chapter III will require both regulatory programs and a major commitment of public funds.

This plan calls for control measures to be implemented to the fullest extent possible using existing authority and funding. Controls can be enforced in California by the State Water Resources Control Board. If control measures are not being enforced in Nevada, they should still be carried out in California to keep the deterioration of water quality to a minimum, as well as to meet California's responsibilities under the Clean Water Act. Measures which can be carried out using existing authority and funding sources should be initiated as soon as possible while efforts to provide for complete implementation continue.

Other agencies, particularly local and regional agencies, are encouraged to take part in carrying out this plan. This chapter sets forth how other agencies can help implement the plan, as well as how the State Board will implement the plan, pursuant to state water quality programs, if other agencies do not make implementation commitments. Where another agency makes an implementation commitment, it can be designated in the final water quality plan as the agency responsible for implementing controls. Where no implementation commitment is obtained from other agencies before the final water quality plan is adopted, the State Board will assume implementation responsibility. The final plan will be legally binding on the State Board and the Lahontan Regional Water Quality Control Board. In adopting the final water quality plan, the State Board will be accepting responsibility to implement the plan, and to review decisions of the Lahontan Regional Board to ensure that they conform to the plan.

A. SURFACE WATER RUNOFF

Implementation of the controls needed to prevent pollution from surface water runoff will require both regulatory programs and a financial program. Regulatory programs will require property owners to correct existing erosion problems and to follow best management practices to control surface runoff. Regulatory programs will also be used to prevent erosion from future development. A financial program is needed to provide adequate funding for erosion and urban runoff control projects. Table IV-1 summarizes how the measures needed to control erosion and surface runoff will be implemented.

TABLE IV-1

IMPLEMENTATION OF SURFACE RUNOFF CONTROLS

PROGRAM AUTHORITY

(Agencies with authority to control problems caused by their own practices or which require construction of erosion or runoff control projects.)

LOCAL GOVERNMENT	STATE TRANSPORTATION DEPTS. (problems on state highways)	FOREST SERVICE (problems on National Forest lands)

REGULATORY AUTHORITY

(Agencies with authority to require implementation where agency with program authority does not make implementation commitment, or where problem is on private land)

LOCAL GOVERNMENT	TAHOE REGIONAL PLANNING AGENCY CALIFORNIA TAHOE REGIONAL PLANNING AGENCY	FOREST SERVICE (private activities permitted on National Forest Lands)

WATER QUALITY PROGRAMS

(Program setting general standards, or providing for enforcement in specific cases if other agencies do not make implementation commitments)

WASTE DISCHARGE REQUIREMENTS and CLEANUP ORDERS (requiring correction or prevention of problems at particular sites)	STORM SEWER PERMITS (setting general requirements, requiring correction or prevention of problems at particular sites, and requiring local governments to adopt regulatory programs)	PROHIBITIONS (setting development restrictions)	SEWER CONNECTION LIMITS (setting development restrictions)

FINANCIAL PROGRAM

(Means of providing funds and program assistance for projects which are the responsibility of local government)

STATE and FEDERAL GRANTS	STATE and FEDERAL PROGRAM ASSISTANCE	LOCAL PROGRAMS and FUNDS	PROPOSALS for LEGISLATION

1. Erosion Control Projects

a. Institutional and Regulatory Program

i. Projects on Public Roads and Highways

The state transportation departments have authority to carry out the projects needed to control erosion and runoff from state highways and rights-of-way. The cities and counties have authority to carry out projects on public streets and roads. If these agencies make a commitment to carry out erosion control projects, they can be designated as the implementing agencies in the final water quality plan. Their responsibilities would include detailed facilities planning, design, construction and maintenance. The technical and advisory services of the resource conservation districts could be used to help meet these responsibilities.

Local governments may also establish special assessment districts for the purpose of carrying out erosion and urban runoff control projects.

ii. Regulatory Programs

If the state transportation departments or local agencies fail to make commitments to carry out erosion and urban runoff control projects, regulatory programs must be adopted to require them to carry out the projects. These agencies own the roads causing erosion; they can be held responsible for correcting the problem.

The Tahoe Regional Planning Agency and the California Tahoe Regional Planning Agency have authority to require landowners to correct erosion problems on their property. These regional planning agencies have authority to adopt regulations for erosion control and watershed and water quality protection. Regulations should be adopted requiring the correction of existing erosion problems. The Tahoe Regional Planning Agency may not have authority to require state transportation departments to correct existing erosion problems. The Tahoe Regional Planning Compact provides that state public works projects may be constructed as proposed even if they are not approved by the bi-state agency. The California Tahoe Regional Planning Agency, on the other hand, clearly has authority over state highway projects. Both regional planning agencies have authority to require correction of erosion problems on city and county roads.

Some state highways are on National Forest lands, and are subject to special use permits issued by the Forest Service. The Forest Service can require correction of erosion problems as part of these special use permits.

For erosion and drainage problems on private lands, regulations should be adopted by the regional agencies or by local government requiring property owners to carry out control projects.

iii. State Water Quality Programs

State water quality programs can require landowners to carry out erosion and urban runoff control projects. The authority of the state water quality agencies applies to all property owners, including private parties, local government, state government, and the United States. Where other agencies fail to implement controls, state water quality agencies will require correction of erosion problems.

(a) Waste Discharge Requirements and Cleanup Orders

The Lahontan Regional Water Quality Control Board can issue waste discharge requirements and other orders requiring correction of any erosion problem on the California side of the Basin. If other agencies accept responsibility for implementation, it should not be necessary for the Regional Board to issue these orders. If commitments from other agencies cannot be obtained, the Regional Board will order correction of erosion problems.

In California, waste discharge requirements, issued by the Regional Water Quality Control Board, are required for any discharge which may affect water quality unless the Regional Board waives requirements. Erosion constitutes a discharge of silt. Erosion problems are threating the quality of Lake Tahoe. The Regional Board therefore may issue waste discharge requirements to any person or agency who owns property where erosion occurs. It is possible to consolidate the hearings for erosion control problems, a step that could simplify the task of issuing waste discharge requirements.

Waste discharge requirements shall require a reduction in erosion to the levels which could be achieved through implementation of erosion and urban runoff projects. The

Regional Board will require the person or public agency responsible for the erosion problem to submit a schedule of compliance, detailing the specific actions to be taken. Pursuant to these schedules of compliance, financial arrangements can be made including grant proposals for projects by local government, and detailed facilities planning can be conducted.

In some cases an oversteepened roadway slope or other erosion problem is not entirely within public ownership. The parties dedicating a public road to a city or county may have failed to dedicate the entire right-of-way. Waste discharge requirements can be issued to the individual property owner at the same time they are issued to the city or county, making the property owner responsible for those measures required on his property. The city or county could also accept a dedication of the area from the landowner, or establish a special assessment district for the project.

Where erosion problems are entirely on private land, and no other agency requires controls, waste discharge requirements shall be issued to the landowner. As in the case of erosion from public roads, schedules of compliance can be adopted.

If any person or public agency fails to comply with waste discharge requirements or a schedule of compliance, the Regional Board can issue a cease and desist order. The Regional Board may also seek an injunction or monetary penalties. The Regional Board can also issue a cleanup or abatement order to require correction of an erosion problem. If the cleanup or abatement order is not complied with, the Regional Board may obtain an injunction. The Regional Board can also undertake to perform the work itself, in cooperation with other government agencies, or by contract, and charge the property owner for the cost of the project.

Amendments to the Nevada Water Pollution Control Law in 1979 give the Division of Environmental Protection authority over "diffuse sources" including erosion and surface runoff problems. The amendments give the Division authority to issue orders requiring corrective action to control diffuse sources which violate water quality standards or threaten degradation of high quality waters. This authority could be used to require completion of erosion and urban runoff projects in Nevada. The program can be delegated to the cities and counties.

(b) Storm Sewer Permits

The federal Clean Water Act will require National Pollutant Discharge Elimination System permits for storm sewer discharges to surface waters. Environmental Protection Agency regulations provide that in most states, including California and Nevada, storm sewer permits are required whenever the state water quality agency determines that storm sewers are a major contributor of pollution. Storm sewer discharges are a source of much of the sediment and nutrients being discharged into Lake Tahoe, and are contributing to the deterioration of the Lake. In approving this plan, the State Water Resources Control Board will make a determination that storm sewer discharges are a major source of pollution to Lake Tahoe. The Environmental Protection Agency regulations also provide that the state water quality agency may require storm sewer permits when a water quality plan prepared under section 208 of the Clean Water Act sets requirements for storm sewers. This plan sets requirements for storm sewers, as is discussed below. The Lahontan Regional Water Quality Control Board shall issue storm sewer permits in California; the Nevada Division of Environmental Protection has responsibility in Nevada.

A storm sewer permit applies to all conveyances which are part of the storm sewer system, even though there may be several owners of the conveyances. If a landowner has a pipe or ditch leading to a county storm sewer which joins a state transportation department storm sewer before emptying into a stream, the landowner, county and transportation department are all subject to the permit.

A general permit may be issued for all storm sewers in the area. Six general permits should be issued, one for each city or county in the Lake Tahoe Basin, covering the discharges within the areas covered by the permits. Individual permits may be issued upon request of individual dischargers or where a separate permit would help enforce water quality controls.

Storm sewer permits will set conditions to protect water quality. The permits shall include conditions requiring persons subject to the permits, including the state transportation departments and local governments responsible for most of the storm sewers, to correct existing erosion problems. The conditions shall require the submission of proposals detailing the specific actions to be taken for the control of each of the erosion problems identified as requiring an erosion or urban runoff control project. These proposals must be submitted in time to allow implementation of the projects in accordance with the schedule of priorities set in Chapter III. The storm sewer permits shall set the dates by which the proposals must be submitted. In California, the proposals can serve as schedules of compliance for waste discharge requirements. The proposals shall be reviewed, modified as necessary, and approved by the Lahontan Regional Board, or by the Nevada Division of Environmental Protection for projects required by the Nevada storm sewer permits.

b. Financial Program

For erosion control projects required on private lands, the landowner will be responsible for the costs. Technical and advisory services of the resource conservation districts and the Soil Conservation Service are available to landowners in the Lake Tahoe Basin.

State transportation departments will be responsible for erosion control projects on state highways. Gas tax revenues, federal highway and state highway funds may be used to pay for these projects. Both states are now undertaking erosion control projects on state highways in the Lake Tahoe Basin.

For correction of erosion problems on city and county roads, additional sources of funding not currently being used by local agencies will be needed.

i. Funding Sources

Table IV-2 summarizes the funding sources which may be used for the erosion and urban runoff control projects which are the responsibility of local government.

(a) Existing Programs

(1) Federal Grants

Federal grants can provide much of the money needed for erosion control projects on public property. The ability of local government in the Lake Tahoe Basin to use federal grants has been limited because of difficulties in raising the non-federal share of project costs. Federal grants often cover half of the cost of a project, with the recipient required to produce the other half. The problem can be alleviated by using state funds to pay for part of the non-federal share. The State Water Resources

TABLE IV-2

FUNDING SOURCES

EXISTING SOURCES

GRANTS

	ADMINISTERING AGENCY	PERCENTAGE OF PROJECT COSTS WHICH MAY BE ELIGIBLE
Clean Lakes	Environmental Protection Agency	50%
Research and Development	Environmental Protection Agency	up to 75%
Resource Conservation and Development	Soil Conservation Service	50 to 80%
Small Watershed	Soil Conservation Service	50 to 80%
Bond Funds	State Water Resources Control Board	50 to 100%

PROGRAMS

AGENCY	COMMENTS
Soil Conservation Service	Technical assistance
California Conservation Corps	May provide labor for project construction
Resources Agency	May use Environmental Protection Program Fund for special projects to control erosion
Cities and Counties	Can carry out erosion and runoff control projects

PROPOSALS REQUIRING LEGISLATION

PROPOSAL	COMMENTS
Road Use and Parking Fees (Basin User Fee)	May be adopted for entire Basin or for California only. Has potential to raise $10 million to $17 million annually.
Transient Occupancy Tax	Would raise less than $1 million annually
Recreation Fees	Could raise over $1 million annually
Gas Tax Revenues	Legislation could authorize use of gas tax revenues to correct erosion and runoff problems on roads and streets in the Lake Tahoe Basin. Could provide enough funds for all such projects listed in this plan.
Appropriations	State or Federal Appropriations could provide funding for erosion and urban runoff control.

Control Board will seek sources of federal funding, assist other agencies in making grant proposals, and coordinate proposals for federal grants with proposals for state funding to help pay the non-federal share.

aa. Clean Lakes Grants

The Environmental Protection Agency's Clean Lakes program provides grants for protection of freshwater lakes. These grants may be used for sediment and nutrient control projects on public roads, including slope stabilization and revegetation projects. The Environmental Protection Agency's budget includes about $15 million each year for Clean Lakes grants, a large part of which should be available for projects in the Lake Tahoe Basin. Because relatively few grants are applied for, less than half of the amount budgeted for Clean Lakes grants has been awarded in recent years.

Proposed regulations by the Environmental Protection Agency provide that grants will be made to the states, which set project priorities. Grants are provided for 50 percent of the cost of erosion control projects. Arrangements may be made by which local government pays for all or part of the remaining costs, but the states are ultimately responsible for assuring that funds are raised for the non-federal share.

The proposed regulations contemplate grants for programs which include all the projects needed to protect a lake, rather than separate grants for each project. A Clean Lakes grant has been awarded for a separate erosion control project in Washoe County, but this grant should not preclude Nevada from receiving another Clean Lakes grant. The grant was issued to a county, not the state, for only $200,000, before the proposed regulations were issued, and does not purport to provide the comprehensive program envisioned by the policy of awarding a single grant for each lake. The single grant policy clearly cannot preclude California from receiving a grant. Because grants are issued to the states, which set project priorities, a separate grant to each state is required for interstate lakes.

bb. Research and Development Grants

Research and development grants from the Environmental Protection Agency may be available for individual projects. These grants to state or local agencies may provide up to 75 percent of project costs.

cc. Resource Conservation and Development Grants

The Soil Conservation Service's Resource Conservation and Development program offers grants for 50 to 80 percent of project costs. Project priorities are set by councils comprised of local governments and resource conservation districts. Before a grant may be awarded, the Department of Agriculture must designate the area as a Resource Conservation and Development Area. An application for designation of the Lake Tahoe Basin has been submitted by the local governments and resource conservation districts in the Basin. Approval of the application is clearly warranted by the need for conservation projects to protect the resources of the Lake Tahoe Basin.

dd. Small Watershed Program

The Small Watershed Program offers grants from the Soil Conservation Service for projects within small watersheds. A Small Watershed grant could be sought for a project or group of projects in any of the 63 watersheds which drain into Lake Tahoe. Proposals are submitted through the Resource Conservation Districts, but approval of the Basin as a Resource Conservation and Development Area is not required. Grants cover 50 to 80 percent of project costs.

(2) State Grants -- Bond Funds

The Clean Water and Water Conservation Bond Law of 1978 provides a source of money for erosion control projects. Up to $50 million from the bond fund may be used for reclamation, water conservation, and pollution control projects which are not eligible for federal sewage treatment facility grants. Grants may be awarded to state or local agencies for 50 percent, or in special situations up to 100 percent, of the non-federal share of erosion control projects. The bond fund is administered by the California State Water Resources Control Board, which will commit $10 million from the fund for projects in the Lake Tahoe Basin.

(3) State and Federal Programs

Several state and federal programs can help reduce the cost of erosion control projects. The Soil Conservation Service also offers technical assistance. The California Conservation Corps could help carry out erosion control projects.

The Environmental Protection Program Fund, administered by California's Secretary for Resources, could be used for special projects by state agencies to control erosion problems in the Lake Tahoe Basin.

(4) Local Funds

The ability of local government to provide funds for erosion control is limited. The limited ability of local government to raise additional taxes, especially after the adoption of Proposition 13 in California, means that money for erosion control projects will come largely at the expense of other programs. Carrying out erosion control projects will provide some savings to local government, however, by reducing regrading and other maintenance costs. State and federal highway funds allocated to local government in the Basin may be used to help pay for erosion control projects on public roads.

Before the Tahoe Regional Planning Agency adopted its 208 plan in 1978, the cities and counties expressed a willingness to spend between $50,000 and $200,000 apiece, per year, on erosion control. When these estimates were made, however, the local governments were given little incentive, either in the offer of matching state grants or in the threat of enforcement actions, to spend money on erosion control projects.

(b) New Programs

(1) Visitor Fees

Basin visitors, as well as Basin residents, benefit from measures to protect water quality at Lake Tahoe. Fees can be set which raise funds needed for erosion and surface runoff control while requiring visitors to pay an equitable share of the costs.

aa. Road Use and Parking Fees

The existing transportation system including streets and roads, parking lots, and adjacent roadway slopes is the major source of sediment and nutrients to Lake Tahoe. Federal or state legislation should be enacted to establish a means of charging a fee to users of the transportation system.

The 1977 Draft 208 Plan proposed a Basin user fee based on permits issued to Basin visitors. Because there is limited highway access into the Basin, vehicle use provides a simple means of issuing permits. Color-coded permits to be displayed on the vehicle could be purchased at collection booths at entrances to the Basin or at commercial establishments. Permanent resident property owners, persons employed in the Basin, commercial and through-traffic would be exempt.

Assuming a charge of $2 per vehicle for a weekly permit and $10 per vehicle for an annual permit, the fee could raise $6 million annually by 1985, and $10 million annually by 1995.

The Regional Transportation Plan prepared by the California Tahoe Regional Planning Agency in 1978 calls for fees based on parking on the California side of the Basin. The California Air Resources Board, in adopting an air quality plan for the Lake Tahoe basin, approved of the fee as part of a basinwide public transportation system. The fee would take the form of a parking permit. Through traffic, commercial vehicles, and vehicles parked at the owner's residence would be exempt. Permits could be purchased through the State Department of Motor Vehicles, at ticket agencies, banks, automobile clubs, Basin entrances, and recreation facilities. A transportation agency would be created to administer the fee. Projected yearly revenues, based on a fee of $5 for a three-day permit, $10 for a weekly permit, and $20 for an annual permit, would generate $17 million in excess of administration costs by 1985. Most of the revenue would be used for a regional transportation system, but a major portion would be used for erosion control.

The Regional Transportation Plan calls for an expenditure of $20 million for erosion and surface runoff control projects over the first nine years the fee is in effect. In addition, $25 million could be allocated to the California Tahoe Conservancy Agency over the same period for the purchase of property in the Basin.

bb. Transient Occupancy Tax

Each of the cities and counties in the Basin has a transient occupancy tax. The tax is six percent of rental receipts, except in El Dorado County where the tax is five percent. State legislation could establish an additional transient occupancy tax to help pay for erosion control projects. The state tax could be collected at little cost if it is collected by the local agencies which collect the existing tax. An additional tax of one percent of rental receipts would raise approximately $650,000 annually by 1985 and $850,000 by 1995.

cc. Recreation Fees

State or federal legislation could provide for recreation fees charged to campground users, state park visitors, skiers, and casino visitors. The legislation could provide for collection of the fees by the agency or individual operating the recreation facility. Projected revenues from recreation charges, set for both sides of the Basin, are shown in Table IV-3.

TABLE IV–3

POTENTIAL REVENUES from RECREATION FEES

Recreation	FEE: Present Rate	FEE: Potential Increase		Estimated Annual Revenue*: 1985	Estimated Annual Revenue*: 1995
Campgrounds	$3-$4/night	$0.50/night		$157,000	$229,000
State Park Visitors	$1/car	0.50/car		200,000	279,000
Skiing	$10–16/lift ticket	0.50/lift ticket		434,000	454,000
Gaming		1/2% on gross revenues		821,000	1,121,000
			TOTAL	$1,612,000	$2,083,000

* Based on McDonald & Smart, Inc. (1974)

(2) Gas Tax Revenues

The California Constitution provides that revenues from gasoline taxes may be spent on mitigation of the environmental effects of public streets and highways. This provision allows the Legislature to appropriate gasoline tax revenues for erosion control projects on all public roads, not just state highways.

State legislation should be enacted authorizing the use of gasoline tax revenues for erosion control on city and county roads, and appropriating money for projects in the Lake Tahoe Basin. Public roads are the largest source of existing erosion problems in the Lake Tahoe Basin. As these problems were created by construction undertaken to provide for automobile use, it is appropriate to use money raised by gasoline taxes to pay for corrective measures.

(3) Appropriations

State and federal funds, in addition to those available through existing programs, could be provided through legislation appropriating money for erosion control.

Federal funds could be appropriated for grants administered by the Environmental Protection Agency or the Soil Conservation Service. Legislation could establish a separate program for erosion control at Lake Tahoe, or funds could be channelled through the Resource Conservation and Development and Clean Lakes programs.

Federal legislation could also provide authorization and funds for the Forest Service to carry out erosion control projects throughout the Lake Tahoe Basin, in addition to the projects now being carried out on National Forest lands. Funding and authority to carry out erosion control projects could be included as part of legislation establishing a Lake Tahoe National Scenic Area. The creation of a National Scenic Area has been proposed as a means of protecting the extraordinary scenic and environmental resources of the Basin. Legislation creating the National Scenic Area would authorize the Secretary of Agriculture to purchase land within the Basin to protect these resources. In keeping with the purposes of the National Scenic Area, the legislation could provide for erosion control.

In California, additional funding could be provided by appropriations to the Clean Water and Water Conservation Bond Law of 1978, earmarked for erosion control in the Basin, or by legislation creating a new program.

(4) Offset Funds

Some funds for erosion control projects will be raised as a result of the individual offset mechanism proposed as part of the offset policy discussed on pages 123 through 127. Unless local government makes the necessary commitments to carry out erosion and urban runoff control projects, lot owners will be allowed to build only upon payment of a sum to be used for construction of erosion and urban runoff control projects. If the State Water Resources Control Board implements the offset policy, the payments shall be made to the State

Water Pollution Cleanup and Abatement Account, with the funds received earmarked for erosion control projects in the Lake Tahoe Basin. The Cleanup and Abatement Account could also be used if another agency implements the offset policy, or a new fund could be established specifically for the purpose of paying for erosion and urban runoff control projects in the Tahoe Basin.

ii. Financial Strategy

The strategy to raise funds for erosion and urban runoff control projects should include the following:

- Greatest possible use of existing sources of revenue. Existing programs may not provide adequate funding for all projects. If funds are spent on the highest priority projects, however, a major reduction in pollution is possible. New programs needed to fund the remaining projects may not be readily forthcoming. This financial program seeks to do what can be done now while new programs are being sought.

- Proposals to provide for all priority list projects. Completion of these projects is essential to maintaining the quality of the Lake.

- Provision to maintain a proper level of local responsibility. Most priority list projects are on city and county roads. Local residents share responsibility for erosion problems in the Lake Tahoe Basin, and share in the benefits of erosion control. While local government should not be required to pay all of the erosion control costs, it should bear a fair share. The financial strategy should provide an incentive for local participation in erosion control projects. At the same time, difficulties in raising the local share of construction costs must not delay implementation.

(a) A Strategy for California

It is proposed as part of this water quality plan that the California State Water Resources Control Board commit $10 million from the Clean Water and Water Conservation Bond Law of 1978 for erosion and urban runoff control projects at Lake Tahoe.

Commitment of these bond funds can guarantee that the projects in priorities 1-4, the projects to be carried out during the first five years of the schedule adopted in Chapter III, can be carried out in California. Completion of these projects, which involve revegetation and slope stabilization, will achieve over two-thirds of the reduction in soil loss which can be achieved by completion of all projects.

Bond funds can be stretched further if they are used to match federal grants. The Federal Policy for the Lake Tahoe Basin calls upon the Environmental Protection Agency and the Soil Conservation Service to provide financing for implementation of this plan.

A commitment by the California Department of Transportation to pay for the cost of projects on state highways -- $7.8 million -- and commitments by local government could also be used to match federal grants. With the complete cooperation of local, state and federal agencies, existing programs could be used to finance most of the priority list projects. Some projects are eligible for 75 to 80 percent grants from the Soil Conservation Service or the Environmental Protection Agency. Others are eligible for 50 percent funding under the Environmental Protection Agency's Clean Lakes program. Table IV-4 illustrates how funding commitments from state and local government, covering the 20 year period set for implementing erosion and urban runoff control projects, could be used to match federal grants. Together, the federal, state and local funds would be sufficient for over four-fifths of the projects on the California side of the Basin.

TABLE IV–4

POSSIBLE USE of STATE and LOCAL COMMITMENTS
to MATCH FEDERAL GRANTS

COMMITMENTS

State Water Resources Control Board		$10 million (bond funds)
California Department of Transportation		7.8 million
Cities and Counties		5–10 million
	TOTAL	$22.8–27.8 million

USE OF COMMITMENTS TO MATCH GRANTS

	GRANTS		COMMITMENTS		TOTAL
	$7.5 million in 75% grants (research and development, Resource Conservation and Development, and Small Watershed grants)	+	$2.5 million (state and local share)	=	$10 million
	$20.3–25.3 million in 50% grants (Clean Lakes grants)	+	$20.3–25.3 million (state and local share)	=	$40.6–50.6 million
TOTAL	$27.8–32.8 million in federal grants	+	$22.8–27.8 million (state and local share)	=	$50.6–60.6 million

Cost of erosion and runoff control projects in California in priority groups 1–11, including design and administration is $52.5 million.

Total cost of all projects is $62.7 million (1979 dollars).

At least $5 million of the funds received as Clean Lakes grants will be used to purchase land or development rights to lots where construction would cause water quality problems.

Federal programs providing 75 to 80 percent grants should be used as much as possible, but Clean Lakes grants probably will be used for most projects. While proposed Environmental Protection Agency regulations call for submission of a single program to protect each lake, the regulations also state that the project period usually will not exceed four years. The schedule set in Chapter III provides twenty years to complete the erosion and urban runoff control projects. Consistent with the purposes of the Clean Lakes program, the State Water Resources Control Board's initial application will include a list of all projects. Funding should then be broken down into a series of more manageable grants, with one grant for each priority group.

A commitment of $10 million in bond funds can ensure implementation of the projects according to schedule for at least the first five years after the final 208 plan is adopted. With the assistance of other local, state and federal agencies, it may be possible to carry out the projects scheduled for a much longer period. In the meantime, new sources of funding will be sought to pay for the remaining projects. The most promising new sources are road user charges, funds from gas tax revenues, and appropriations as part of National Scenic Area legislation. The State Water Resources Control Board will pursue all possible funding sources until sufficient funds are available to carry out all erosion and urban runoff projects.

(b) Local Share

The State and Regional Boards will use their enforcement authority to make sure that local government bears its fair share of the cost of erosion and urban runoff control projects. Local government is legally responsible for correcting problems on public streets and roads. If local government fails to correct these problems, the Lahontan Regional Water Quality Control Board shall order cleanup. If the local agency does not comply with the order, the Regional Board can act to have the problem corrected. State law authorizes the Regional Board to use bond funds or other available sources of money to pay for the project, and collect the costs later from the local agency. The State and Regional Boards can proceed to have priority list projects completed promptly without relieving local government of responsibility for paying its share of the costs.

Local government will be required to bear the entire cost of a project where it fails to comply with a cleanup order, but should pay only part of the cost if it complies. The local share should also be reduced on projects for which federal grants are obtained.

The local share of project costs will be determined on a case-by-case basis, depending in large measure upon the availability of funds for the project from other sources. The total level of expenditure to be expected from local government on the California side of the Basin will be about $500,000 per year, for a total of $10 million over the twenty year implementation period. The local share could be lower if legislation is enacted providing sufficient funding to carry out the erosion and urban runoff control projects.

2. On-Site Surface Runoff Control Measures

a. Local and Regional Regulation

Local government or the regional agencies should adopt programs to require property owners to carry out the measures needed to control on-site runoff problems. For some practices, such as surfacing private driveways, general ordinances may set adequate controls. Requiring surfacing of dirt roads and driveways as a condition of sale of the property would help ensure compliance. For most problems, the effectiveness of controls will depend on how they are adapted to each site. Best management practices can serve as a guide, but their application must be tailored to individual cases. An ordinance implementing controls over on-site runoff problems should require review and permitting of individual sites. The permits would require installation of surface runoff management systems for these sites.

A Tahoe Regional Planning Agency ordinance requires consideration of surface runoff management systems whenever development or use permits are issued by local government or the bi-state agency. The ordinance needs to be strengthened, so that runoff management systems and other appropriate best management practices are required wherever on-site runoff problems are found. The ordinance also needs to be amended to require review of sites which would not otherwise come up for development or use permits. As one of the conditions of approval of the Tahoe Regional Planning Agency's 208 plan, Nevada required adoption of a provision to implement on-site runoff management systems without waiting for construction or use permit applications. The Tahoe Regional Planning Agency has not met this condition.

b. Forest Service Permits

Some of the areas which need surface runoff management systems are on federal land. The sites are operated under special use permits from the Forest Service. The Forest Service requires compliance with best management practices as a condition of these special use permits. A commitment by the Forest Service to continue its program could assure implementation.

c. State Water Quality Programs

Water quality reglatory programs may be carried out in the absence of, or in addition to, regulation by local and regional agencies. Where review of individual projects is required, and adequate programs are adopted by local or regional agencies, review by water quality agencies can be waived to prevent duplication. State water quality programs setting general standards will be used in combination with programs by local and regional government, to provide backup enforcement.

i. Waste Discharge Requirements and Cleanup Orders

The Lahontan Regional Water Quality Control Board can require correction of on-site surface runoff problems by issuing waste discharge requirements for any problem site. The requirements shall require a reduction in pollution equivalent to that which can be achieved by following the control measures called for in Chapter III.

To avoid duplication of other regulatory programs, the Regional Board can waive discharge requirements for any site adequately regulated by a permit from another agency. The Regional Board can terminate the waiver for a particular site if it determines that issuance of waste discharge requirements would help protect water quality.

Schedules of compliance shall be issued with waste discharge requirements. The requirements will be enforced through cease and desist orders, injunctions, monetary penalties, and cleanup and abatement measures where necessary.

The Nevada Division of Environmental Protection also has authority to require correction of on-site runoff problems. The Division has authority to designate sites where best management practices to control runoff are necessary and to order site owners to follow best management practices. This authority may be delegated to cities and counties.

ii. Storm Sewer Permits

The National Pollutant Discharge Elimination System permits issued for storm sewers shall be used to require compliance with the measures needed to control on-site runoff problems. All persons subject to the storm sewer permits shall be required to comply with the control measures called for in Chapter III. Where the control measures specify best management practices to control on-site runoff problems, the landowner may propose alternative practices. These practices may be followed, instead of the specific best management practices called for in Chapter III, if the state water quality agency determines that they will yield an equivalent reduction in pollution. This determination shall be made on an individual basis with the issuance of a separate permit, which will apply to the site instead of the general storm sewer permit issued for all sites in the city or county. The separate permit will incorporate the practices to be followed. In California, the separate permit will also serve as the waste discharge requirements for the site.

Exceptions to the conditions required by the general storm sewer permits can also be coordinated with the issuance of waivers of waste discharge requirements. The storm sewer permits will provide that when waste discharge requirements are waived because best management practices are required by a permit from another agency, compliance with the other permit constitutes compliance with the storm sewer permit.

3. Development Controls

a. Zoning

Control of future development should be enforced by local and regional government, through land use ordinances and through review of individual projects.

The existing land use ordinances should be amended to prohibit development in stream environment zones or on high erosion hazard lands, or in excess of land capability.

Future subdivisions should be prevented by rezoning unsubdivided lands now zoned for urban use as general forest land, or by adopting a prohibition against any new subdivisions.

The California Tahoe Regional Planning Agency has proposed a growth management ordinance which would limit the number of construction permits allowed each year acording to environmental constraints. Such a mechanism, adopted by local or regional government, could be used to prevent construction until offsetting erosion and urban runoff control projects are carried out. Because the offset policy (discussed on pages 123 through 127) will prevent issuance of permits in any one year to all projects where development would otherwise be permissible, the ordinance should also include a means for allocating the limited number of permits. Similarly, a growth management ordinance could be used to implement the program of individual offsets. Priority for development permits would be given to individual lot owners who pay their share of the cost of offsetting erosion control projects, as calculated under the individual offset mechanism discussed on page 126.

Permits for the development which is allowed should require compliance with best management practices to prevent excessive erosion and surface runoff.

b. Land Purchase and Exchange

Land purchase programs should also be used to prevent development which threatens the quality of Lake Tahoe. The State Water Resources Control Board strongly supports creation of a land purchase program to purchase lots in stream environment zones, on high erosion hazard lands, or which cannot be used for residential or commercial construction without excessive coverage.

Purchase of land or development rights will be included as part of the program submitted by the State Board to the Environmental Protection Agency for a 50 percent grant under the Clean Lakes program, discussed on page 143. Clean Lakes grants may be used to purchase property for the purpose of preventing pollution of freshwater lakes. Depending on the size of the grant awarded by the Environmental Protection Agency, the State Water Resources Control Board proposes to use at least $5 million from the Clean Lakes grant for purchase of land and development rights. While far more money will be needed to buy all the lots unsuited for development, use of these funds will be a start towards establishing the property acquisition program needed to protect Lake Tahoe. The Forest Service's land acquisition plan has served to prevent the subdivision of several large parcels in the Basin. The Forest Service's Land Management Plan calls for the purchase of an additional 33,000 acres in the Basin, which will further reduce the threat of new subdivision development. It is important that the Forest Service continue to receive adequate funding to carry out the land acquisition program. The Forest Service could also buy individual lots in existing subdivisions which cannot be developed without causing excessive erosion or encroaching on stream environment zones. The Forest Service has authority to purchase individual lots, but as a matter of policy does not buy small, isolated urban parcels which are not suitable for public recreation. In the interest of protecting the water quality of Lake Tahoe -- the Forest Service's top priority in the Basin -- the Forest Service should reassess its land acquisition policies. Much of the urbanized area on the south shore is outside National Forest boundaries, although the entire north shore is included. While the Forest Service can acquire land outside the National Forest boundaries, there are limitations on the acreage and types of parcels it can buy. Federal legislation should be enacted to expand the National Forest Boundaries to include the entire Lake Tahoe Basin.

Establishment of a Lake Tahoe National Scenic Area would create a program to buy land in the Basin, including individual lots. The United States Secretary of Agriculture would be authorized to acquire property through purchase or exchange, or to purchase development rights. A similar proposal would have the Bureau of Land Management purchase lots in the Basin, using funds raised by sale of federal lands surrounding urban areas in Nevada, outside the Tahoe Basin.

California has established a state agency, the California Tahoe Conservancy Agency, to acquire property in the Lake Tahoe Basin. To date, the Legislature has not appropriated any funds to the agency. Funds should be provided. A bi-state conservancy agency would be created if Nevada and the United States would ratify the Tahoe Conservancy Agency Compact approved by the California Legislature.

A recently enacted City of South Lake Tahoe ordinance provides for the expenditure of up to five percent of the city's general revenues for purchase of open space and community parks. In implementing the ordinance the City is emphasizing purchase and preservation of fragile lands, especially stream environment zones. Funds the city commits to buy fragile lands may be counted as part of the commitment of non-federal funds used to match a Clean Lakes grant, thus increasing the size of the grant which may be awarded and making more funds available for land purchase.

Land conservancy programs by private nonprofit agencies may also help protect the Lake Tahoe Basin. The League to Save Lake Tahoe is planning to establish a separate land trust to acquire property in the Lake Tahoe Basin.

Land purchase is not required to impose development controls in the Lake Tahoe Basin. Some landowners will contend that the state and federal constitutions prohibit regulation unless compensation is paid for any loss in property values. The courts have stated there is no "set formula" for deciding when regulation is invalid, and the validity of development restrictions to protect Lake Tahoe water quality therefore may ultimately have to be decided by the courts. But the courts have held that a decline in property values, standing alone, does not invalidate regulation, even in cases where the value of the property after regulation is relatively small if not minimal. The courts have upheld regulation where they find it reasonably relates to the protection of the public welfare, including protection of the environment. Because further development would pollute Lake Tahoe, government agencies may prohibit development without paying for the land.

Regulatory programs needed to protect Lake Tahoe water quality should not be delayed while legislation for property acquisition programs is sought. Even so, establishment of a property acquisition program would be the best long-term solution to the problems threatened by future development in the Basin. Property acquisition provides a means of reducing or eliminating the financial impact on individual lot owners who will be unable to build homes. Land purchase also brings the property into public ownership, so that it may be managed to prevent water quality problems.

Based on current market values, the cost of purchasing all of the lots on the California side of the Lake Tahoe Basin where development would be prohibited under this plan may well exceed $200 million.

c. Water Quality Programs

Controls on development needed to protect water quality can be enforced by state and federal water quality agencies. The State Water Resources Control Board will adopt the necessary controls as part of the final water quality plan.

i. Prohibitions

State law authorizes the California State Water Resources Control Board to set prohibitions against the discharge of waste in certain areas or under certain conditions. These prohibitions may apply to discharges to groundwater or surface water. In adopting the final water quality plan, the State Water Resources Control Board will adopt the prohibitions discussed below. These prohibitions shall be enforced by the Lahontan Regional Board through administrative orders, injunctions, and monetary penalties.

This plan sets prohibitions directed against any new subdivision development, and any new development in high erosion hazard lands, in excess of allowable coverage, or which is not in accordance with the offset policy set by the plan. Because any development will result in some discharge, these prohibitions should prevent any new development in violation of the development restrictions called for in this water quality plan. Because groundwater as well as surface water carries nutrients into the Lake, the prohibitions address discharges to both groundwater and surface water. All discharges or placement of building or fill material in stream environment zones for the purposes of new development are prohibited. The prohibitions do not apply to repair or replacement of an existing structure. For example, if a building or residence is destroyed by fire, a new building or residence could be built on the same lot. These prohibitions shall apply in addition to the prohibitions currently set by the Water Quality Control Plan for the North Lahontan Region (State Water Resources Control Board and Lahontan Regional Water Quality Control Board, 1975). These prohibitions shall be strictly enforced. In contrast to actions enforcing the current prohibition against the discharge of silt to surface waters, where absolute attainment has not been required so long as controls keep sediment generation to a minimum, no discharge shall be permitted in violation of the prohibitions in Table IV-5.

Similar discharge prohibitions could be set in Nevada if they are adopted by the State Environmental Commission. Prohibitions adopted by the Commission can be enforced by the Division of Environmental Protection.

ii. Review of Individual Projects

(a) Waste Discharge Requirements

The Lahontan Regional Board may issue waste discharge requirements for construction projects in the Lake Tahoe Basin. Conditions shall be imposed to insure that any new development is in accordance with this plan. The prohibitions set by this plan can be enforced without issuing waste discharge requirements to individual projects, but waste discharge requirements can be used to apply the prohibitions. The Lahontan Regional Board shall issue waste discharge requirements as appropriate to enforce the prohibitions. The Regional Board shall also issue waste discharge requirements when development does not violate the prohibitions, but control measures still are needed to prevent erosion and surface runoff problems. Waste discharge requirements shall require new development to comply with the discharge prohibitions and to incorporate measures which limit erosion and surface runoff to the levels which can be achieved by following best management practices. The Regional Board may waive waste discharge requirements when a permit issued by another agency sets adequate controls.

TABLE IV-5

PROHIBITIONS

1. ***AGAINST DISCHARGE FROM ANY NEW SUBDIVISION:***

   The discharge or threatened discharge, attributable to development of any new subdivision, of solid or liquid waste, including soil, silt, sand, clay, or other organic or earthen material, to ground or surface waters in the Lake Tahoe Basin is prohibited.

2. ***AGAINST DISCHARGE FROM DEVELOPMENT ON HIGH EROSION HAZARD LANDS, IN STREAM ENVIRONMENT ZONES, OR WHICH IS NOT IN ACCORDANCE WITH LAND CAPABILITY:***

   The discharge or threatened discharge, attributable to new development on high erosion hazard lands, in stream environment zones, or which is not in accordance with land capability, of solid or liquid waste, including soil, silt, sand, clay, or other organic or earthen material, to ground or surface waters in the Lake Tahoe Basin is prohibited.

3. ***AGAINST DISCHARGE TO STREAM ENVIRONMENT ZONES:***

   The discharge or threatened discharge, attributable to new development in stream environment zones, of solid or liquid waste, including soil, silt, sand, clay, rock, metal, plastic, or other organic, mineral, or earthen materials, to stream environment zones in the Lake Tahoe Basin is prohibited.

4. ***AGAINST DISCHARGE FROM ANY NEW DEVELOPMENT NOT OFFSET BY IMPLEMENTATION OF REMEDIAL EROSION CONTROL MEASURES:***

   The discharge or threatened discharge attributable to new development not in accordance with the offset policy set by the Lake Tahoe Basin water quality plan, of solid or liquid waste, including soil, silt, sand, clay, or other organic or earthen material, to ground or surface waters in the Lake Tahoe Basin is prohibited.

AS USED IN THESE PROHIBITIONS:

"HIGH EROSION HAZARD LANDS" means any land which can be classified on the basis of soil type, slope or geomorphic setting as capability class 1 or 2 land, according to the combined capability rating system set forth in R. Bailey, Land Capability Classification of the Lake Tahoe Basin, California-Nevada (1974).

"NEW DEVELOPMENT" means the construction of any structure, including any commercial or residential building, road, driveway or other impervious surface, which was not under construction or which had not received all necessary permit approvals before adoption of these prohibitions. "New Development" does not include maintenance or repair of any existing structure, the replacement of any existing structure with another structure on the same parcel of no greater land coverage, any structure approved by the Regional Board as reasonably necessary to control existing sources of erosion or water pollution, or any structure approved by the Regional Board as reasonably necessary to carry out the Lake Tahoe Basin Non-Attainment Plan adopted by the California Air Resources Board.

"NEW DEVELOPMENT NOT IN ACCORDANCE WITH LAND CAPABILITY" means new development which results in an impervious surface or other land disturbance on any lot or parcel in excess of the allowable percentage of impervious cover set forth in R. Bailey, Land Capability Classification of the Lake Tahoe Basin, California-Nevada (1974).

"NEW DEVELOPMENT NOT IN ACCORDANCE WITH THE OFFSET POLICY SET BY THE LAKE TAHOE BASIN 208 PLAN" means any new development which is not in accordance with the offset policy set in Chapter III of the Lake Tahoe Basin water quality plan approved by the State Water Resources Control Board. If any of the erosion or urban runoff control projects called for in Chapter III of the Plan have not been implemented, no new development shall be considered in accordance with the offset policy unless it has been approved by the Regional Board or by a management agency designated by the State Board to implement the offset policy.

"NEW SUBDIVISION" means any development involving the division of any lot or parcel into two or more lots or condominiums which: (1) results in impervious surface or other soil disturbance in excess of that which would be allowable under these prohibitions or any applicable land use ordinance if the lot or parcel were not divided; or (2) divides the lot or parcel into five or more lots or condominiums.

"STREAM ENVIRONMENT ZONE" means any areas which can be identified as a stream environment and related hydrologic zones using the procedure set forth in the Handbook of Best Management Practices, (Tahoe Regional Planning Agency, Lake Tahoe Basin Water Quality Management Plan, Volume II, 1978). "Stream Environment Zone" includes that region: (1) which surrounds a stream, including major streams, minor streams and drainageways, (2) which owes its biological and physical characteristics to the presence of water, (3) which may be inundated by a stream; or (4) in which actions of man or nature may directly or indirectly affect the stream. A stream includes small lakes, ponds, and marshy areas through which the stream flows.

The Nevada Water Pollution Control Law, as amended in 1979, allows the Division of Environmental Protection to review practices which threaten to degrade high quality waters. Unless local government makes a commitment to enforce the controls set by this plan, the Division should review all proposals for development at Lake Tahoe. After review, the Division should issue orders prohibiting development which is inconsistent with this plan and requiring permitted development to follow best management practices to control erosion and surface runoff.

(b) 404 Permits

Section 404 of the Clean Water Act requires a permit from the United States Army Corps of Engineers for any project involving the placement of fill or earthen material in wetlands. These "404 permits" cannot be issued if the state water quality agency denies certification that the discharge is in compliance with state water quality standards. The permit requirement can be enforced by the Corps or by citizen suits. As wetlands are part of the stream environment zone, the Corps can help protect stream environment zones by denying 404 permits for activities in Basin streams and wetlands and by taking enforcement action against unlawful filling.

The Corps has authority to issue general permits which cover a class of projects. The Corps has issued a general permit, applicable nationwide, which authorizes filling in wetlands adjacent to smaller streams, including most streams in the Lake Tahoe Basin. As applied to the Lake Tahoe Basin, this general permit is inconsistent with section 404 of the Clean Water Act, which authorizes general permits only when the permitted discharges have minimal adverse environmental effects. The Corps has authority to determine that the general permit should not apply in the Lake Tahoe Basin and require individual permits for all projects. Because many of the projects authorized by the general permit will violate state water quality standards -- indeed all will be in violation of the prohibition against development in stream environment zones -- the Corps should require individual permits. If the Corps does not require individual permits, the state water quality agencies should issue orders denying certification that the permitted discharges are in compliance with state standards. If the Corps renews the general permit when it expires in 1982 it should be revised so as not to apply to the Lake Tahoe Basin.

iii. Storm Sewer Permits

The National Pollutant Discharge Elimination System storm sewer permits shall prohibit any person subject to the permits from carrying out any new subdivision development. The permits shall also prohibit any new development on high erosion hazard lands, in stream environment zones, in excess of land capability, or which has not been offset by implementation of erosion and urban runoff control projects. Permits shall require any new development to follow the best management practices set forth in Chapter III of this plan.

iv. Sewer Connection Limits

The sewerage agencies serving the Lake Tahoe Basin are subject to National Pollutant Discharge Elimination System permits and waste discharge requirements issued by the state water quality agencies. The sewerage agencies may also receive grants from state water quality agencies and the Environmental Protection Agency for sewage treatment facility construction. These permits and grants set conditions to protect water quality.

Conditions shall be set in these grants or permits to prohibit the sewerage agencies from providing any connection serving new development which is not in accordance with this plan. These conditions shall prohibit any connection serving new subdivisions. These conditions shall also prohibit any connections serving new development on high erosion hazard lands, in stream environment zones, in excess of land capability, or which has not been offset by implementation of erosion and urban runoff control projects.

d. Application of Development Restrictions

The development restrictions called for in this plan may be implemented through zoning, land purchase, or water quality programs. By whatever means the controls are implemented, however, and regardless of the implementing agency, implementation will require a procedure to apply the controls on a lot-by-lot basis.

Figure IV-1 outlines how the development restrictions can be applied, based on review and approval of applications submitted by landowners proposing to build on their property. Where part of the land is in a stream environment zone, or the land includes areas in more than one land capability class, the application and approval would include a map or diagram showing these areas. The applications and approvals would also specify the coverage permissible within each land capability class. Such a procedure could be required as part of several of the implementing mechanisms proposed here. For example:

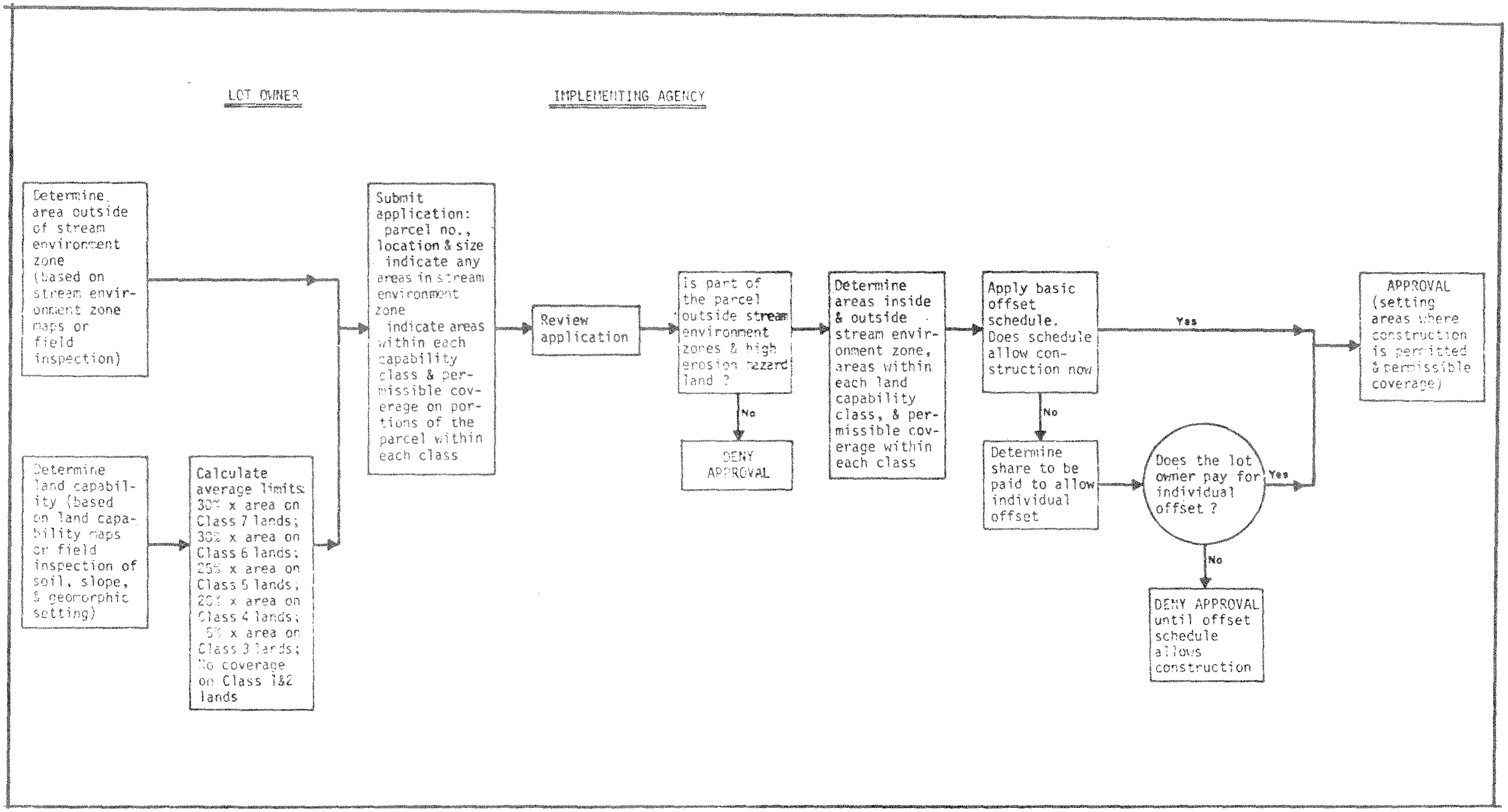


FIGURE IV-I

APPLICATION OF DEVELOPMENT RESTRICTIONS

- Land use ordinances could require approval of areas where development is permitted and establishment of coverage limits before permits are issued.

- Conditions in the waste discharge requirements issued to sewerage agencies shall require that such a procedure be followed before connection permits are issued.

- Water quality agencies shall require that the necessary information be submitted in reports for waste discharge requirements, which will apply the development restrictions.

Ideally, the development restrictions should be applied before sewer allocations and building permits are issued, so that landowners are not put to the expense of preparing building plans before they know exactly how the restrictions will be applied. The implementing agency should still require that the building plans be submitted when they are prepared, so that it can make sure construction stays within the restrictions it has set.

Because development shall be permitted only outside stream environment zones, application of the development restrictions requires a determination of how much of a lot or parcel is in the stream environment zone. This plan adopts the criteria for identifying stream environment zones set forth in the Handbook of Best Management Practices. Stream environment zones include:

- Streams, small lakes, and ponds

- A buffer strip, 25 to 100 feet on either side of the stream, depending on the magnitude of the stream

- Wetlands and areas of riparian vegetation

- Areas with alluvial soils

- The 100-year flood plain

This plan also prohibits development on high erosion hazard lands (capability classes 1 and 2) and requires that development on land of capability classes 3 through 7 stay within the coverage limits set by the land capability system. This plan adopts the combined capability rating system, developed by the Forest Service in cooperation with the Tahoe Regional Planning Agency, to define land capability classes. The land capability system classifies land into seven capability classes, depending on soil type, slope and geomorphic setting (Bailey, 1974).

Maps of stream environment zones and land capability are available at the Tahoe Regional Planning Agency and California Tahoe Regional Planning Agency offices. This plan adopts the procedures used to identify stream environment zones and land capability, not the maps themselves. Nevertheless, the maps may be useful. A landowner can use the maps to provide an initial indication of how a lot or parcel will be affected by the development restrictions, without having to conduct a detailed field investigation. The landowner may also use the maps to prepare an application for a determination of how the development restrictions apply to his property. While the maps may be used as evidence of land capability or stream environment zone boundaries, however, the maps are not entitled to any special weight if other information is available. In many cases either the landowner or the reviewing agency may want to rely on more specific or more complete information about soils, geomorphic setting, vegetation or other factors, as may be provided by a detailed site investigation.

So long as the development restrictions are applied and enforced, the procedures to be followed are largely a matter within the discretion of the implementing agency. This discussion is intended only to illustrate how the restrictions may be applied.

4. Forest Practices

Regulation by local government and state water quality agencies can be used to implement measures to control erosion and surface runoff from forest lands. In addition, the Forest Service can be expected to play a major role in implementing controls on forest lands. Approximately 72 percent of the forest lands in the Basin are managed by the Forest Service. Private holdings account for about 21 percent of the forest lands in the Basin, and 7 percent are in state parks.

The federal Clean Water Act requires the Forest Service to comply with all state, interstate, and local water pollution control laws. If necessary, the state water quality agencies will issue orders requiring the Forest Service to correct existing erosion and drainage problems on National Forest lands and to prevent threatened problems. Enforcement action by the state water quality agencies should not be necessary, however. The Forest Service has adopted programs for watershed protection and watershed restoration. If the Forest Service makes an implementation commitment, it can be designated in the final water quality plan as the agency responsible for implementing controls on National Forest lands. So long as the Forest Service continues to receive adequate funding, its programs should be adequate to control water quality problems on National Forest lands.

Regulatory programs adopted by local or regional government, or enforcement by state water quality agencies, will be necessary to enforce controls on private lands.

a. Timber Removal

On National Forest lands, measures to prevent water quality problems from timber removal are being followed by the Forest Service. Conditions to protect water quality are included in the special use permits required for other persons to remove timber from National Forests.

The Tahoe Regional Planning Agency's Tree Conservation Ordinance and the California Tahoe Regional Planning Agency's Vegetation and Soil Protection Ordinance set standards for tree removal. Conditions should be set in the permits required by these ordinances to implement the control measures needed to protect water quality.

Commercial timber harvests are subject to the Tahoe Regional Planning Agency's Timber Harvesting Ordinance. In California, timber harvest plans will also be subject to review by the California Tahoe Regional Planning agency and the Department of Forestry. If any large-scale commercial timber harvest plans are submitted, these agencies should conduct a thorough review to set the conditions needed to protect water quality. Unless conditions can be set which will adequately protect water quality, the timber harvest should not be permitted.

If other agencies fail to enforce the controls on timber harvesting called for in the plan, the Lahontan Regional Water Quality Control Board shall issue waste discharge requirements enforcing controls.

b. Dirt Roads

The Forest Service is conducting a restoration needs inventory of National Forest lands in the Basin. The inventory, which is scheduled for completion by 1980, will identify roads causing erosion problems. The Forest Service already is carrying out some of the projects needed to correct these problems. These projects include closing and revegetating some roads, construction of bridges to prevent erosion at stream crossings, and installation of roadside drainage.

The restoration needs inventory is not limited to old roads. The inventory parallels the problem inventory conducted in the preparation of the Tahoe Regional Planning Agency's 1977 Draft 208 Plan which identified erosion and drainage problems outside National Forests. Among the projects now being carried out by the Forest Service is a project to control leaching from an old landfill in Meyers and a project to restore parts of the Blackwood Creek watershed altered by an old quarry.

Revegetation, resurfacing, or other measures to control erosion from dirt roads on private forest lands should be enforced through regulatory programs adopted by local or regional agencies. If these agencies do not make a commitment to implement controls, waste discharge requirements and cleanup orders issued by the Lahontan Regional Board shall require landowners to correct erosion problems from dirt roads. The Nevada Division of Environmental Protection should also issue orders requiring correction of erosion from dirt roads. The inventory of unsurfaced roads taken as part of the 1977 Draft 208 Plan did not include roads on the large land holdings which make up the bulk of the private forest land in the Basin. Regulatory programs adopted to implement controls on old forest roads should include an inventory to identify the problems needing correction. Other kinds of erosion problems on private lands, such as gravel operations, were identified in the inventory for the 1977 Draft 208 Plan. The erosion control projects set forth in Chapter III of this plan include some projects on private forest lands. The programs used to implement the erosion control projects, discussed on pages 141 through 145 will apply to private forest lands.

c. Off-Road Vehicles

Controls on off-road vehicle use on National Forest lands can be implemented through enforcement of the Forest Service's Off-Road Vehicle Plan.

Erosion from off-road vehicle use on private lands should be controlled through enforcement of local or regional ordinances. The California Tahoe Regional Planning Agency's Soil Conservation Ordinance sets restrictions on off-road vehicle use. More vigorous enforcement is required, however. The Ordinance should also be strengthened, and enforcement made more effective, by prohibiting all off-road vehicle use outside of designated areas and trails, except with a permit from the agency.

Adoption and enforcement of ordinances to control off-road vehicle use are also needed in Nevada. An environmental assessment prepared by the Forest Service for its Off-Road Vehicle Plan states that the eastern part of the Basin is highly sensitive to disturbance and cannot tolerate cross-country vehicle travel.

Direct enforcement of state water quality laws against off-road vehicle users would not be very effective. In some cases waste discharge requirements and cleanup orders may be issued to property owners requiring them to prevent or correct water quality problems caused by off-road vehicle use on their property.

d. Livestock Confinement and Grazing

A special use permit from the Forest Service is required to use National Forest lands for stables or livestock grazing. These permits can require compliance with the best management practices needed to control erosion and runoff from livestock confinement areas or to prevent overgrazing.

Programs adopted by local or regional government to control on-site surface runoff problems should also set controls on grazing and livestock confinement. Waste discharge requirements and cleanup orders by state water quality agencies shall be issued where local government fails to set adequate controls.

e. Campgrounds

Measures to control erosion and runoff from campgrounds in National Forests should be carried out by the Forest Service. One of the watershed restoration projects now being carried out by the Forest Service will correct erosion problems at a recently purchased campground.

Local or regional ordinances adopted to require surfacing or revegetation of private driveways or forest roads should also apply to dirt roads in campgrounds. Other control measures for existing campgrounds would require review of individual sites.

Construction of a developed campground in the Lake Tahoe Basin requires a permit from the city or county where the campground is built. The permit is subject to review by the Tahoe Regional Planning Agency. In California, approval by the California Tahoe Regional Planning Agency is also required. Permits should prohibit development on high erosion hazard lands, in stream environment zones, or in excess of land capability, and should enforce the best management practices needed to prevent water pollution.

Prohibitions, waste discharge requirements and cleanup orders issued by state water quality agencies will be used where necessary to control erosion and surface runoff from existing and proposed campgrounds.

f. Ski Resorts

Special use permits set erosion control requirements for ski resorts on National Forest lands, and should require compliance with the control measures adopted in Chapter III of this plan.

Ski resort expansion requires a permit from the Tahoe Regional Planning Agency. In California, a permit from the California Tahoe Regional Planning Agency is required. These agencies should not issue any permits for ski area expansion or new ski area development which is not in conformity with this plan. Any permits issued to ski areas by these agencies should also require the areas to adhere to the control measures called for in Chapter III. Local or regional ordinances could also be adopted to require existing ski areas to follow control measures.

The Lahontan Regional Water Quality Control Board shall continue to enforce controls, issuing waste discharge requirements for each ski resort on the California side of the Basin. The 1979 amendments to the Nevada Water Pollution Control Law will enable the Division of Environmental Protection to require control measures in Nevada.

B. OTHER WATER QUALITY PROBLEMS

1. Groundwater

Programs used to control surface runoff will incorporate measures to protect groundwater. The prohibitions adopted to prevent development which threatens water quality include prohibitions against discharges to groundwater. The limitations on vegetation removal set to prevent erosion from timber harvesting, ski areas and other sources will also help protect groundwater. Programs to enforce best management practices at sites with on-site surface runoff problems will also incorporate those best management practices adopted to protect groundwater.

2. Atmospheric Sources

The studies needed to determine the importance of atmospheric emissions on water quality in the Lake Tahoe Basin should be carried out through a cooperative effort among state and federal air and water quality control agencies.

Although emissions of oxides of nitrogen are expected to increase significantly in the Basin, no specific program to control oxides of nitrogen is underway. If the studies indicate that atmospheric emissions of oxides of nitrogen contribute significant quantities of nutrients to the Lake, preparation of a plan for the Prevention of Significant Deterioration of Air Quality, as authorized by the Clean Air Act, is essential. The plan would determine the control measures necessary and adopt a program for implementation.

Implementation measures adopted in this plan to control removal of vegetation and to restore areas stripped of vegetation will also help control the nutrients reaching the Lake from atmospheric sources.

3. Municipal Sewage

Measures needed to control pollution of Lake Tahoe from municipal sewage will be carried out by sewerage agencies. Control measures shall be enforced by the state water quality agencies and the Environmental Protection Agency.

a. Unlined Sewage Pond

A suit filed by the Environmental Protection Agency, joined in by the Natural Resources Defense Council and the Lahontan Regional Board, would require the Douglas County Sewer Improvement District No. 1 to stop discharge of sewage within the Basin by ceasing use of its unlined oxidation pond.

b. Raw Sewage Overflows

All sewerage agencies in the Basin shall develop preventive maintenance and spill response programs. Development of these programs shall be required as a condition of the grants, National Pollutant Discharge Elimination System permits, and waste discharge requirements issued to the sewerage agencies.

Raw sewage overflows constitute a violation of state and federal water quality laws. When overflows occur, enforcement action should be taken by the Lahontan Regional Board, the Nevada Division of Environmental Protection, or the Environmental Protection Agency. Enforcement actions provide an incentive for better spill prevention and containment.

Enforcement orders and conditions in grants, permits and waste discharge requirements will also require measures such as installation of monitoring equipment and any necessary reconstruction or relocation of sewerlines. These projects may be eligible for state and federal grants. Grants from the Environmental Protection Agency may cover up to 75 percent of project costs in most cases and grants from the California State Water Resources Control Board may cover an additional 12-1/2 percent. If a project uses innovative technology, grants may cover up to 97 1/2 percent of project costs.

c. Exfiltration from Sewerlines

A study of sewerline exfiltration should be carried out under a joint powers agreement among the sewerage agencies, with financial assistance from the state water quality agencies and the Environmental Protection Agency. All grants, permits, and waste discharge requirements issued to the sewerage agencies shall require study of possible exfiltration.

Sewage exfiltration would constitute a violation of state law in both California and Nevada, and could lead to enforcement action to require correction of the problem. Projects to correct exfiltration may be eligible for grants from the State Water Resources Control Board and the Environmental Protection Agency.

d. Domestic Wastewater Not Connected to the Export System

Grants, permits and waste discharge requirements issued to the sewerage agencies should also require them to determine which structures in their districts are not connected to the export system. Sewerage agencies will be required to review their records for documentary evidence that structures are connected, and use dye tests to determine if structures lacking documentary evidence are connected. Where necessary, the state water quality agencies will bring enforcement actions to prevent discharges from structures not connected to the export system.

The El Dorado County Public Health Department should conduct the survey needed to determine if structures exempt from the septic tank prohibition are complying with conditions requiring use of bifurcated systems and export of toilet wastes. The exemptions are scheduled for review by the Lahontan Regional Board in 1981. The Regional Board shall make sure that the conditions of the exemptions are complied with before extending the exemptions. The Regional Board will also reconsider the exemptions in light of technical advances permitting installation of low pressure sewers in environmentally sensitive areas.

4. Miscellaneous Water Quality Problems

a. Industrial Wastes

Current prohibitions against a discharge of industrial waste in the Lake Tahoe Basin shall be continued.

b. Solid Waste Disposal

To require continuation of the current practice of exporting all solid waste from the Basin, the California State Water Resources Control Board will adopt the following prohibition in approving this plan:

> "The discharge of garbage or other solid waste to lands within the Lake Tahoe Basin is prohibited."

Local government should assume responsibility for planning to assure continued availability of disposal sites with adequate capacity to handle solid waste from the Basin.

c. Construction and Dredging in Lake Tahoe

Conditions in permits issued by the United States Army Corps of Engineers should require construction practices to contain any sediment disturbed by placing structures in the Lake. The permits should also prohibit any construction which will alter the flow of currents in the Lake. Similar conditions should be set in the permits issued by state lands agencies, the Tahoe Regional Planning Agency, and the California Tahoe Regional Planning Agency. If necessary, state water quality agencies shall issue permits to require compliance with practices to prevent water pollution.

State water quality agencies should review all dredging and not permit the dredging unless the practices called for in this plan are followed.

d. Vessel Wastes

Regulations by the States of California and Nevada, approved by the Environmental Protection Agency, prohibit the discharge of vessel sewage to Lake Tahoe. The United States Coast Guard is primarily responsible for enforcing these prohibitions, and should include an inspection program as part of its enforcement effort. Other federal and state agencies should assist the Coast Guard. Permits issued by the Army Corps of Engineers, state lands agencies, and regional planning agencies for marinas, buoys, and other facilities serving vessels on Lake Tahoe should require compliance with the prohibitions against discharge of vessel wastes. These agencies should also assist in the inspection program. State water quality agencies shall assist the Coast guard in its program to enforce the discharge prohibitions, and shall bring their own enforcement actions where necessary.

In California, the Harbors and Navigation Code authorizes the California State Water Resources Control Board to require marinas or other marine terminals to install pumpout facilities. The State Board has adopted procedures by which the Regional Water Quality Control Boards determine the need for pumpout facilities, and request the State Board to require specific terminals to install facilities. As provided by these procedures, the Lahontan Regional Board shall determine the need for additionl pumpout facilities at Lake Tahoe, and request the State Board to require installation where additional pumpout facilities are necessary.

e. Toxic and Hazardous Substance Spills

The Lahontan Regional Water Quality Control Board shall take the lead in developing a contingency plan for toxic and hazardous substance spills in the Lake Tahoe Basin. The plan should be prepared in cooperation with the following agencies:

- California Office of Emergency Services
- Nevada Civil Defense and Disaster Agency
- California Department of Health Services
- Nevada Division of Environmental Protection
- United States Forest Service
- United States Environmental Protection Agency
- California Department of Fish and Game
- State Transportation Departments
- County Health Departments
- California Highway Patrol
- City Police and County Sheriffs
- any other agency which may become involved in emergency response or cleanup of toxic and hazardous spills.

To the greatest extent possible, the contingency plan should be coordinated with the existing plan prepared by the Forest Service.

C. ADMINISTRATIVE COSTS

The public agencies responsible for implementation of this plan will have to devote a significant amount of staff time to administration and enforcement. As this Chapter sets forth, a number of government agencies may assume responsibility for implementing elements of the Lake Tahoe Basin Water Quality Plan. These agencies can best determine the resources they need to implement the plan. Agencies making implementation commitments should indicate their staffing and funding requirements so that this information can be included in the final plan.

This section estimates the administrative costs to the State Water Resources Control Board and the Lahontan Regional Quality Control Board, assuming they are responsible for implementing all elements of the plan in California. The administrative costs to the State and Regional Board will be reduced to the extent that other agencies assume implementation responsibilities. Therefore, the staffing and cost estimates given here may help indicate the total costs to the agencies making implementation commitments.

The administrative responsibilities set by this plan include:

- Regulation and enforcement;
- Program administration; and
- Studies of water pollution problems.

Table IV-6 summarizes the staffing which would be needed if these responsibilities were carried out entirely by the State and Regional Boards.

1. Regulation and Enforcement

Where no other agency assumes responsibility for implementation, administrative orders and enforcement actions by the Lahontan Regional Board shall be used to require compliance with the control measures called for by this plan. Waste discharge requirements and National Pollutant Discharge Elimination System permits will be used to require completion of erosion control projects and adherence to best management practices to control erosion and surface runoff. While administration can be simplified by consolidating hearings on waste discharge requirements and by relying on general permits, review of the controls needed at particular sites will be required in many cases. Review of the controls to be carried out at individual sites may well be required for each of the sites needing an erosion or urban runoff control project, and for each area of intensive vehicular use, ski resort, stable and golf course. For other projects, review of a few selected sites should be adequate to ensure general adherence to the control measures called for by this plan. Issuing waste discharge requirements and National Pollutant Discharge Elimination System Permits, and reviewing compliance at individual sites, will require about 4.0 person years per year in staff time by the Lahontan Regional Board. State Board review will require an additional 0.2 person years per year.

Waste discharge requirements and permits issued to sewerage agencies will be amended to require that no new development in violation of the development restrictions set by this plan be issued a sewerage connection permit. Deciding whether development on any particular lot is prohibited will require a determination of how much of the lot is on high erosion hazard lands or in stream environment zones, calculation of permissible coverage, and application of the offset policy. Assuming these decisions are made by the Lahontan Regional Board -- the sewerage agencies, local government, or regional land use planning agencies could also accept responsibility -- about 1.5 person years per year of staff time will be required. A procedure for administrative review of initial staff determinations could require an additional 0.5 person years per year of staff time from the Regional and State Boards.

TABLE IV–6

STAFFING REQUIREMENTS for IMPLEMENTATION
of the LAKE TAHOE BASIN 208 PLAN
by the STATE WATER RESOURCES CONTROL BOARD
and the LAHONTAN REGIONAL WATER QUALITY CONTROL BOARD

ACTIVITY	STAFF REQUIRED (Person years/year)	
	STATE BOARD	REGIONAL BOARD
Issuing and revising permits and waste discharge requirements (including review of schedules of compliance for individual erosion, urban runoff, and on-site runoff control projects)	0.2	4.0
Review of Proposals for Development for Compliance with 208 plan	0.2	1.8
Enforcement Activities	0.3	4.0
Program Administration (administration and coordination of grants and contracts)	4.0	–
TOTAL	4.7	9.8

In a few cases, additional enforcement actions, including cease and desist orders, cleanup orders, and actions for injunctions or civil penalties may be required. Most of these enforcement actions will involve erosion control projects, on-site controls, or development restrictions, but actions may be necessary for any of the control measures required by the plan. Enforcement actions will require about 4.0 person years per year of staff time from the Regional Board, and about 0.3 person years per year from the State Board.

2. Program Administration

This plan proposes the use of $10 million instate bond funds, as well as use of federal grants, to pay for erosion and urban runoff control projects. In addition to administering state bond funds, the State Board will need a continuing effort to review the progress of plan implementation and to coordinate the various regulatory and funding programs used to implement the plan. These program administration measures will require about 4.0 person years per year of staff time.

3. Studies

This draft 208 plan calls for studies of atmospheric inputs of nitrogen and of sewage exfiltration, to identify water pollution problems and develop corrective measures. The total cost of study of atmospheric sources study, and an initial study of sewage exfilitration is estimated at $150 thousand. If the initial study of sewage exfiltration indicates there is significant amount of sewage exfiltration in the Basin, a more extensive follow-up study will be required. Staff time needed to review the contracts issued for these studies is included in the estimate of program administration requirements.

CHAPTER V

SOCIAL, ECONOMIC AND ENVIRONMENTAL IMPACTS OF THE PROPOSED PLAN AND ALTERNATIVES

A. ALTERNATIVES

The effect of carrying out a water quality plan can be illustrated by focusing on five basic alternatives:

- No Growth (Alternative A).
- Strict Adherence to Land Capability (Alternative B).
- Proposed Alternative (Alternative C).
- Control Worst Problems (Alternative D).
- No Action (Alternative E).

1. Alternative A -- No Growth

Many of the environmental resources of the Lake Tahoe Basin, not just water quality, have been affected by development of the Basin. Further development may adversely affect air quality, wildlife habitat, and Basin scenery. The State Board is required to consider these environmental impacts before adopting a water quality plan. The California Environmental Quality Act authorizes the State Board to include measures in the plan which are directed at controlling these environmental problems, in addition to the controls needed to protect water quality. Alternative A proposes a no growth policy aimed at preventing additional environmental problems, as well as the measures needed to control water pollution caused by existing development.

Alternative A proposes implementation of the erosion and urban runoff control projects, on-site runoff controls, forest practices, and control measures for other water quality problems set forth in Chapter III. To prevent future environmental problems, development restrictions would be set allowing no new development in new subdivisions or on lots in existing subdivisions. Both the development controls and the controls for existing sources of water pollution would be implemented pursuant to the programs set forth in Chapter IV.

2. Alternative B -- Strict Adherence to Land Capability

The federal Clean Water Act and the State Board's nondegradation policy require the maintenance of existing water quality, however, a water quality plan may set further controls aimed at providing additional water quality protection. Additional controls may be directed towards achieving a partial restoration of natural water quality, or simply to provide additional assurance that existing water quality will be maintained. Alternative B proposes to keep erosion and surface runoff problems from future development to a minimum by requiring strict adherence to land capability. Controls on existing sources of water pollution would also be implemented.

Strict adherence to land capability requires that development restrictions enforcing coverage limitations on construction in existing subdivisions take into account the existing land diturbance from subdivision roads. Under Alternative B, coverage attributable to subdivision roads, as well as coverage within each lot, would be counted against the percent coverage allowed under the land capability system. Additional development restrictions against new subdivisions, development on high erosion hazard lands, stream environment zone encroachment, and development not offset by erosion and urban runoff control projects, would also be enforced. Permitted development would have to follow best management practices, and the erosion and urban runoff control projects, on-site runoff controls, forest practices, and controls on other water quality problems set forth in Chapter III would be carried out. Controls would be implemented pursuant to the programs set forth in Chapter IV.

3. Alternative C -- the Proposed Alternative

Alternative C proposes implementation of the control measures needed to protect Lake Tahoe water quality, but does not propose development restrictions beyond those needed to preserve existing water quality. As detailed in Chapter III, the necessary control measures include:

- Erosion and Urban Runoff Control Projects

- On-site Runoff Controls

- Development Restrictions Prohibiting: 1) new subdivisions; 2) construction on high erosion hazard lands; 3) stream environment zone encroachment; 4) excess coverage on individual lots; and 5) development before offsetting erosion and urban runoff control projects are implemented.

- Best Management Practices for Permitted Development

- Forest Practices

- Controls on Other Water Quality Problems: 1) groundwater; 2) atmospheric sources; and 3) municipal sewage.

In contrast to Alternative B (Strict Adherence to Land Capability), development restrictions setting coverage limits for lots in existing subdivisions would consider only the coverage within each lot. Coverage attributable to subdivision roads would not reduce the amount of coverage allowed. Chapter IV sets forth the programs to be used to implement the Proposed Alternative. Other agencies are encouraged to help implement the plan, but where no other agency makes an implementation commitment the State Water Resources Control Board will implement the plan.

4. Alternative D -- Control Worst Problems

Maintaining the water quality of Lake Tahoe will require costly control measures, and cause economic hardships. It will be difficult to raise the funds needed for erosion and urban runoff control projects. Development controls will affect property values. Alternative D proposes, on the basis of social and economic considerations, that only some of the erosion and urban runoff control projects be constructed, and only those development restrictions aimed at the most extreme water quality problems be imposed. Only the projects aimed at the worst erosion problems, the revegetation and slope stabilization projects making up priorities 1-4, would be implemented. New development in existing subdivisions would be allowed so long as best management practices are followed, and development is outside high erosion hazard lands and stream environment zones. In all other respects Alternative D would follow the control measures set under the Proposed Alternative (Alternative C) and detailed in Chapter III. Implementation would be pursuant to the programs set forth in Chapter IV.

Alternative D cannot be adopted consistent with the Clean Water Act unless the federal nondegradation policy is changed.

5. Alternative E -- No Action

Alternative E illustrates the consequences if no 208 plan is adopted, and none of the control measures called for under the other alternatives are implemented. New development would proceed in accordance with the rules of the Tahoe Regional Planning Agency, except that stricter rules of the California Tahoe Regional Planning Agency would apply in California.

B. EFFECTS OF ALTERNATIVES ON WATER QUALITY

The most outstanding feature of the Lake Tahoe Basin is the clarity and purity of the Lake, and the most important difference between the five alternatives is the extent to which they protect the Lake. The Proposed Alternative (C), is designed to maintain the quality of the Lake, and Alternatives A (No Growth) and B (Strict Adherence to Land Capability) would provide additional protection beyond the controls set by the Proposed Alternative. Alternative D (Control Worst Problems) will provide far more protection than Alternative E (No Action), but will still allow water quality to deteriorate.

As set forth in Chapter II, the water quality of the Lake has deteriorated as a result of development in the Basin. Algal growth rates have increased, roughly doubling over the past two decades, and algal growth rates are increasing at an accelerating rate. There has been an increase in attached algae in nearshore waters. Algal growth has been stimulated by the addition of nutrients to the Lake, the most important source of these nutrients being erosion from developed areas of the Basin. Current nutrient loadings are several times natural levels. To halt the trend towards deteriorating water quality, a major reduction in nutrient loadings is required. If erosion rates and the corresponding nutrient loadings continue at or near current levels, nutrient concentrations and algal growth rates in the Lake will continue to increase over a long period.

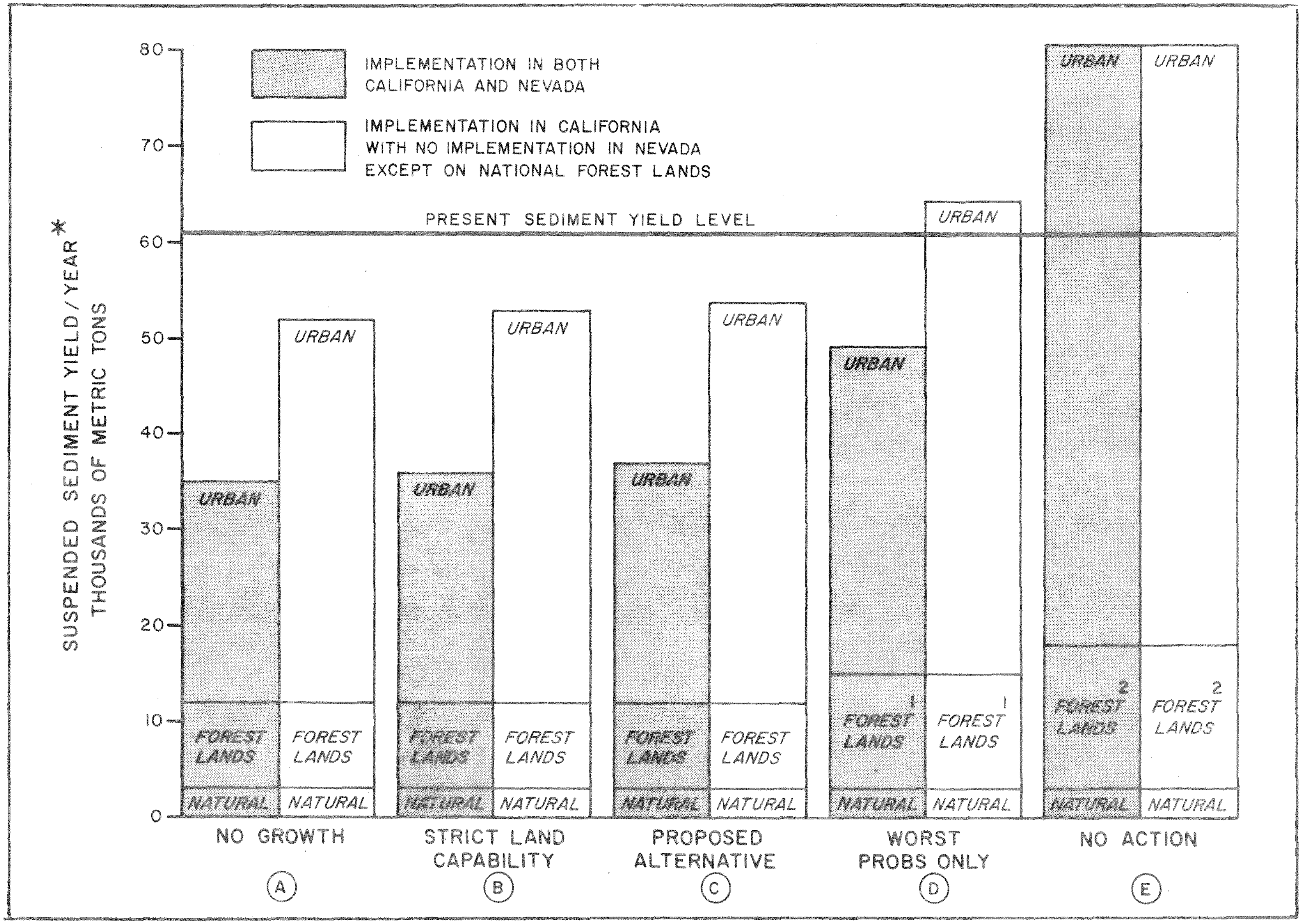
The impact of the five alternatives on water quality can be compared by looking at the sediment yields projected under each alternative. Sediment affects the clarity of tributary and nearshore waters, as well as their suitability for fish and aquatic invertebrates. More important, sediment yields provide an indication of the nutrient loadings from erosion and surface runoff. Changes in sediment yields indicate corresponding changes in nutrient loadings.

Figure V-1 depicts the sediment yields projected for each of the five alternatives. The projections assume implementation of all controls proposed under each alternative, as well as construction of all development the alternative would allow. Because it may not be possible to enforce controls on both sides of the Lake, Figure V-1 shows for each alternative the effect of enforcing controls on the California side only, as well as the impact of basinwide implementation. The projections assume that the Forest Service will voluntarily implement controls on both sides of the Lake, even if Nevada adopts no enforcement program. Thus, the different projections for basinwide implementation and enforcement in California only reflect differences in sediment yields from privately owned lands.

Implementation of the erosion control projects, on-site surface runoff controls, development restrictions and forest practices set by the Proposed Alternative (C) will result in a major reduction in sediment yields. Sediment yields will be reduced from the current level of about 61,000 metric tons per year to about 38,000 metric tons. The stricter controls on development set by the Strict Adherence to Land Capability Alternative (B), will reduce sediment yields by an additional 1,500 metric tons per year. The No Growth Alternative (A) would hold sediment yields down to 36,000 metric tons per year.

Alternative D (Control Worst Problems) will provide much less protection, with sediment yields of about 49,000 metric tons per year. Alternative E (No Action) would allow sediment yields to increase to about 82,000 metric tons per year.

Figure V-1



1. Assumes Forest Service will carry out only the highest priority projects for erosion control on dirt roads and other problem sites on National Forest lands.
2. Assumes Forest Service will carry out no erosion control projects.
* Sediment yield estimates based on relation among land capability, percent disturbance, and sediment generation set forth in Appendix B.

Comparison of Estimated Sediment Yield Under Different Alternative Plans if Implemented by Both States or Only by California

It is not possible to determine precisely what reduction in nutrient loads, and therefore what corresponding reduction in sediment loads, is required to reverse the current trend towards eutrophication of the Lake. Considering the rapid increase in algal growth rates which has been observed, in spite of the long lead time before increased loadings exhibit their full effect, the reduction under Alternative D is not sufficient. If alternative D is implemented on the California side only, with no implementation in Nevada, nutrient loadings will increase.

The reduction in pollution resulting from implementation on the Proposed Alternative (C) on the other hand, appears to be sufficient to prevent further deterioration of the Lake beyond that which already has occurred. In combination with the reduction resulting from export of municipal sewage, implementation of the Proposed Alternative would reduce the total nitrogen reaching Lake Tahoe to levels closer to natural conditions than to current conditions. While enforcing Strict Adherence to Land Capability (B) or No Growth (A) would achieve somewhat greater reductions in sediment and nutrient loadings than the proposed alternative, the difference is slight. The difference does not appear to be large enough to prevent attainment of the federal nondegradation standard. State and federal laws do not require this plan to adopt water quality control measures beyond those necessary to prevent degradation of Lake Tahoe.

Adopting Alternative A or B would provide an additional margin of safety. There is a possibility that further research and monitoring may indicate that the reductions in nutrient and sediment loads required to preserve water quality are somewhat greater than that achieved by implementation of any of the alternatives. Even if implementation of Alternative A, B, or C does not prove sufficient, however, it will reduce pollutant loads to the point where it is possible, with additional controls, to prevent a deterioration of water quality. Increases in algal growth, if not reversed, at least will be slowed down to where any additional controls which are required can be identified and implemented before there is any extensive change in the character of the Lake.

Additional control measures could include projects designed to achieve a greater reduction in erosion from oversteepened roadway slopes and similar sites than is achieved by the projects proposed here. Greater reductions in erosion would require considerably higher expenditures than those estimated in Chapter III. Other projects could restore certain areas, such as subdivisions where only a few of the lots have been built on, to their natural state. Restoration of stream environment zones appears to be the most promising measure. The Forest Service is restoring one such area, Osgood swamp, which had been altered before the Forest Service acquired the property.

As the Proposed Alternative (C) appears at this time to be adequate to maintain water quality, the principal benefit of adopting Alternative A or B would be the greater flexibility provided in case additional controls later prove necessary. Once additional development is allowed, there is little that can be done to reduce the increased erosion and surface runoff short of removing the structures. Best management practices will already be employed in any new development. Thus, a conservative approach would be to prevent any new development until it can be determined, on the basis of later monitoring, that the other controls adopted in fact are adequate. Preventing futher development in subdivisions which now have only a few units would also help preserve the possibility of restoring these areas later.

Stricter controls than those set by the Proposed Alternative would have to be adopted if it is decided to go beyond preserving existing water quality and partially restore the natural quality of the Lake. The controls set by Alternative A or B would be enforced while studies are conducted to find additional measures to further reduce nutrient loadings.

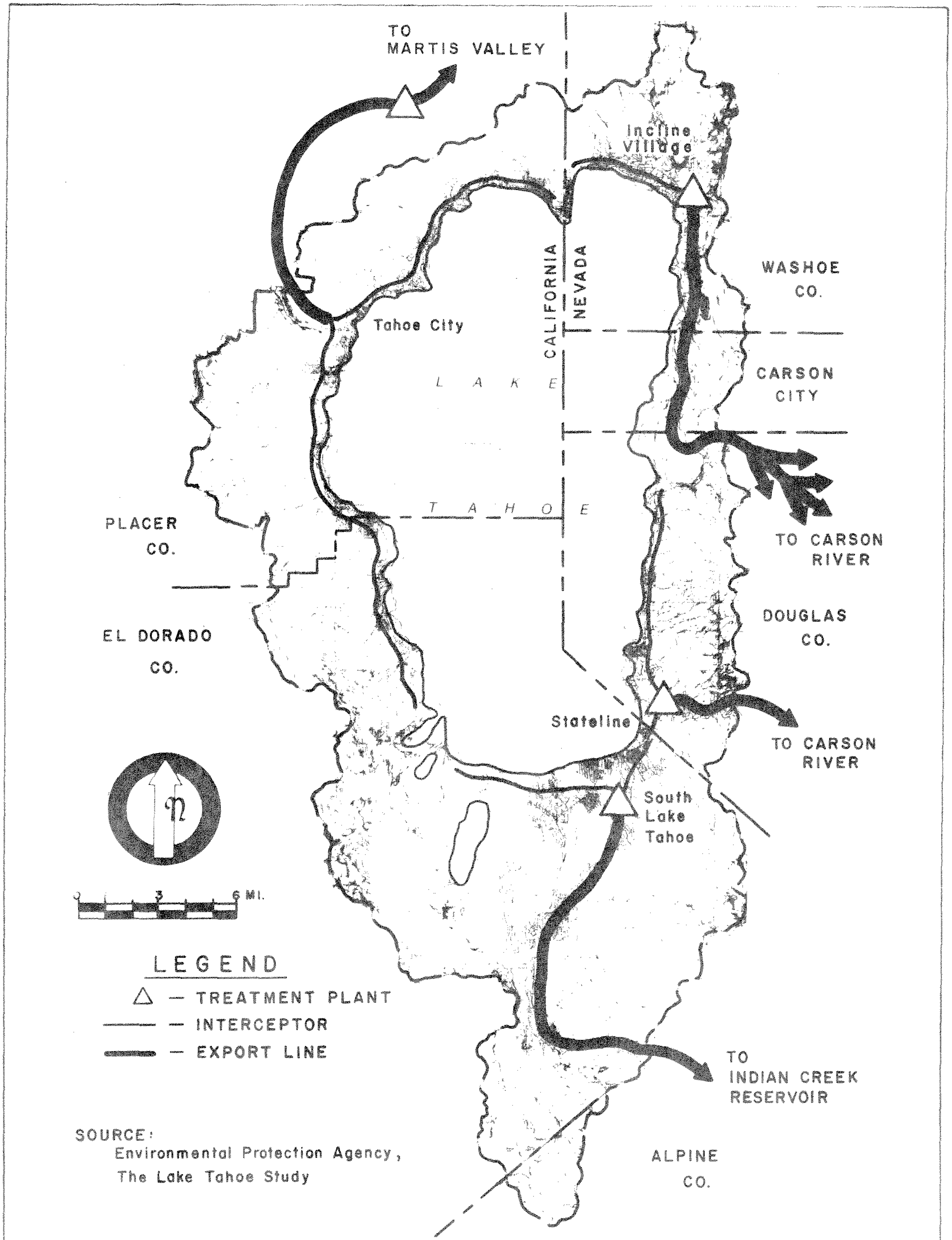
By reducing the annual sediment and nutrient loadings, all of the alternatives except No Action (E) will provide for partial restoration of the natural water quality of streams draining disturbed areas in the Basin. The declines which have been observed in the abundance of aquatic organisms and in the aesthetic appearance of these streams will be reversed. The improvement in water quality will be significantly greater under Alternative A, B, or C than under Alternative D (Control Worst Problems), but under none of the alternatives will the quality of these streams approach natural conditions. Under Alternative E there would be a further decline in the water quality of tributary streams. The extent of the sediment plumes observed where tributaries enter the Lake will also increase under Alternative E. Alternative D will reduce sediment plumes slightly, while a greater improvement can be expected under the other three alternatives.

Because nutrients entering the Lake remain over long periods, merely reducing the annual loadings will not be sufficient to prevent further declines in water quality. A major reduction in nutrient loadings is required. Under Alternative D, and to a far greater extent under Alternative E, nutrient concentrations in the Lake would increase, leading to a violation of the water quality standards set under state and federal law. As nutrient levels increased, so would algal productivity and algal densities, slowly changing the color of the Lake. In nearshore waters, increased growth of attached algae could be expected. The reductions in nutrient and sediment loadings under the Proposed Alternative (C), on the other hand, should hold algal productivity to the levels observed in recent years. The clarity and deep blue color of Lake Tahoe will be maintained.

C. Municipal Wastewater Treatment

1. Treatment and Export Systems

Four major systems provide treatment and export of sewage from the Lake Tahoe Basin. These systems are shown in Figure V-2. The South Tahoe Public Utility District provides service on California's south



SEWAGE TREATMENT PLANTS AND EXPORT LINES shore. The Tahoe-Truckee Sanitation Agency and two of its member entities, the North Tahoe and Tahoe City Public Utility Districts, serve the north and west shore. Incline Village General Improvement District provides service for north shore Nevada. Douglas County Sewer Improvement District No. 1 serves Nevada's south shore.

(A) South Tahoe Public Utility District

The South Tahoe Public Utility District serves virtually all of the South Lake Tahoe area extending from the Nevada state line to Emerald Bay. The treatment plant provides tertiary treatment with nitrogen and phosphorus removal. Treated effluent is exported 27 miles to Indian Creek Reservoir in Alpine County. Designed for a theoretical capacity of 7.5 million gallons per day (mgd), maximum day, the treatment facility was completed in 1965. The export system was completed in 1968.

Effluent from the treatment facility accounts for over 85 percent of the water in Indian Creek Reservoir. The reservoir stores water for irrigation. During the growing season, water is released into Diamond Ditch for use on agricultural lands in Alpine County. The Reservoir also provides recreation opportunities including a trout fishery.

Numerical limitations on the chemical constituents of the discharge to Indian Creek Reservoir are set by the Lahontan Regional Board. Beginning in 1975, these limitations were violated intermittently, due to increases in the amount of sewage being treated by the plant and deterioration of plant equipment. The discharge contained high concentrations of nutrients and ammonia. The nutrients have caused eutrophication of the Reservoir, with yearly algal blooms and growths of noxious weeds along the shoreline. The high ammonia concentrations also caused fish kills.

In response to enforcement action initiated in 1977 by the Lahontan Regional Board, the South Tahoe Public Utility District has spent approximately $700,000 for interim improvements. The district's panel of consultants has set the effective capacity of the treatment and export system at 7.0 mgd. Further improvements may be necessary, however. The district is preparing facilities plans and has requested grant assistance for treatment plant modifications needed to improve plant reliability, as well as for treatment plant expansion.

(B) Tahoe-Truckee Sanitation Agency: North Tahoe and Tahoe City Public Utility Districts

The North Tahoe Public Utility District and Tahoe City Public Utility District provide wastewater collection service along the north and west shores of Lake Tahoe. Interceptors extend to the Nevada state line on the north shore, and to Bliss Park, north of Emerald Bay, on the west shore. The sewage is treated at the Tahoe-Truckee Sanitation Agency treatment facilities near Truckee.

The Tahoe-Truckee Sanitation Agency is a five-district joint powers agency. It operates a 15-mile interceptor sewer that parallels the Truckee River, beginning at Tahoe City and terminating at the regional treatment plant one mile below Truckee. The interceptor transports raw wastewater from the North Tahoe and Tahoe City Public Utility Districts and from three districts located outside the Lake Tahoe Basin.

The regional treatment plant operated by the Tahoe-Truckee Sanitation Agency provides advanced wastewater treatment including nitrogen and phosphorus removal. Treated effluent is discharged into subsurface trenches in Martis Valley. Ultimately, the treated effluent migrates with the naturally occurring groundwater in the area into Martis Creek and the Truckee River. Waste discharge requirements set by the Lahontan Regional Board set a 4.83 mgd capacity, 7 day average, allocating 2.94 mgd to the Tahoe Basin districts.

(C) Incline Village General Improvement District

The Incline Village General Improvement District treats and exports sewage collected on the Nevada side of the north shore, including the sewage collected by the Crystal Bay General Improvement District. Designed for a 3.0 mgd capacity, the treatment plant currently provides secondary treatment. A 19-mile export line transports the effluent to the Carson River. In summer, effluent is diverted for irrigation outside the Basin. The discharge is in compliance with effluent limitations. The current interim limitations expire on June 1, 1982, after which any direct discharge to the Carson River must meet more stringent tertiary treatment standards.

(D) Douglas County Sewer Improvement District No. 1

Wastewater collected in the five sewerage districts on Nevada's south shore is treated and exported by facilities operated by the Douglas County Sewer Improvement District No. 1. Casinos account for approximately 70 percent of the sewage handled by the facilities.

After secondary treatment, effluent is exported over Daggett Pass (Kingsbury Grade). Between October and April, effluent is discharged directly to the East Fork of the Carson River. For the rest of the year, the effluent is used for irrigation on a ranch in the Carson Valley.

The treatment facilities are inadequate. Because of design deficiencies, the treatment plant, originally planned for 3.0 mgd, has an effective capacity of less than 1.8 mgd. Effluent limitations set by the Nevada Division of Environmental Protection were violated for nine months in 1977 and ten months in 1978. The effluent produces a visible foam when it is discharged directly to the Carson River, and there is clear evidence of adverse impacts on aquatic life below the discharge point. Due to the inability of the activated sludge unit to meet effluent limitations, the district has used an oxidation pond to provide additional treatment. Some of the sewage in the unlined pond percolates into the groundwater and ultimately will flow into Lake Tahoe.

2. Available Capacity

The capacity of the treatment and export systems to handle future development without expansion or modification can be determined on the basis of the effective capacity of the systems and current high flows. Effective capacity is the ability of the system to collect, treat, export and dispose of wastewater in compliance with standards set by state and federal water quality agencies. Effective capacity may be less than design capacity, as the limiting component of the system may not prove capable of adequately treating flows for which the system was originally designed.

The current high flow for each of the four systems is estimated here based on historic flows or on projections based on known commitments. Actual flows may be different because of new connections made after the historic high flows, changes in occupancy, water conservation, and reductions in infiltration and inflow.

Unless estimates of available capacity are regularly updated, unplanned building moritoria may result when commitments meet or exceed the effective capacity of the treatment systems. If flows exceed effective capacity, violations of effluent limitations and water quality standards result. The sewerage agencies are best equipped to provide the information needed to regularly update estimates of available capacity.

It is proposed that as part of any water quality plan approved for the Lake Tahoe Basin, the permits and waste discharge requirements issued to sewerage agencies require them to submit annual reports providing the information needed to update the estimates of available capacity made here. The reports shall state:

- The effective capacity of each key element of the collection, treatment, export and disposal system

- Current high flows

- An allocation of capacity among: 1) current users; 2) projects for which connection permits have been issued; 3) capacity currently used or to be reserved for public agencies; 4) projects for which will-serve letters or similar commitments have been issued; and 5) additional capacity, listed in terms of total flow and single family dwelling unit equivalents.

- The number of additional connection permits or service commitments to be issued in the following year, and the flow projected from these units.

- Any proposed actions, including time schedules and financial plans, which will provide increases in effective capacity.

The reports shall be reviewed by the Lahontan Regional Board or the Nevada Division of Environmental Protection, and will be made available to other public agencies and interested individuals.

Before a subdivision lot can be offered for sale or lease in California, the Real Estate Commissioner must issue a final public report. Where, as in the Lake Tahoe Basin, a sewer connection is needed for residential or commercial construction, a lack of available sewerage capacity constitutes grounds for the Commissioner to deny issuance of the report. In addition, the Subdivision Map Act requires cities and counties to determine whether the discharge of sewage from a proposed subdivision to a community sewer system will result in a violation of waste discharge requirements set by the Regional Water Quality Control Board. If the new subdivision would cause or add to a violation of waste discharge requirements, the city or county may disapprove of the subdivision. Sewage treatment capacity on the California side of the Basin currently is not adequate to serve all of the lots in existing subdivisions. Therefore, no new subdivisions should be approved by the Real Estate Commissioner or by local government unless treatment facilities are expanded.

Current estimates of available capacity for each of the four sewerage systems in the Basin are set forth below.

(A) South Tahoe Public Utility District

The capacities of the major components of the South Tahoe Public Utility District treatment and export system and estimated high flows are shown in Table V-1.

Indian Creek Reservoir cannot hold all of the water discharged into it without some release before the start of the irrigation season. Based on the ratio between peak and average flows, the capacity of the reservoir works out to the equivalent of 5.8 mgd, maximum day. The permit for the discharge to Indian Creek Reservoir does not prohibit releases before the irrigation season, however. The capacity estimates in Table V-1 assume an effective capacity of 7.0 mgd for the treatment and export systems, based on the capacity rating set by the South Tahoe Public Utility District's panel of consultants.

TABLE V–1

ESTIMATED AVAILABLE CAPACITY
of the SOUTH TAHOE PUBLIC UTILITY DISTRICT

EFFECTIVE CAPACITY

COMPONENT	CAPACITY	REMARKS
Collection System	Varies	No known capacity problems
Treatment Plant	7.0 mgd, maximum day	Below design capacity of 7.5 mgd
Export Pumping	8.6 mgd, maximum day	Limited in high lift section*
Indian Creek Reservoir	5.8 mgd, maximum day	Cannot store all effluent without discharge before irrigation season

FLOWS

Projected flows from all units connected as of August 1, 1979	6.2 mgd	
Contractural obligations to public agencies not yet exercised	0.33 mgd	Total allocation for Forest Service and State Parks is 0.47 mgd
Potential high flows	6.53 mgd	
Estimated Available Capacity	(7.0 mgd – 6.53 mgd): 0.47 mgd	

* The District is currently testing the capacity of the export line between the treatment plant and the Luther Pass pump station. The District indicates capacity is probably between 7.5 and 9.0 mgd.

Flows are estimated on the basis of data developed by the South Tahoe Public Utility District. When all existing connections and contractural obligations are taken into account, the remaining capacity is estimated at 0.47 mgd.

(B) North Tahoe and Tahoe City Public Utility Districts

Table V-2 estimates the available capacity of the North Tahoe and Tahoe City Public Utility Districts. The capacity of the Tahoe-Truckee Sanitation Agency treatment facilities has been apportioned among the five member entities. The total allocated to the two districts within the Lake Tahoe Basin is 2.94 mgd.

The high flow estimate is based upon 11,696 equivalent single family dwelling units connected or issued connection permits as of August 1, 1979. Flow per unit is derived from occupancy rates, persons per single family unit, and per capita wastewater generation data from the 1974 Tahoe Regional Transportation Study.

After contractual obligations to public agencies are fulfilled, only 0.05 mgd are estimated to be available for new development beyond the units for which connection permits already have been issued.

Based on a recommendation made by the State Water Resources Control Board in response to questions presented by a court reviewing the current flow allocations for the Tahoe-Truckee Sanitation Agency, those allocations may be changed. The allocations would remain the same for the summer months, but higher flows would be allowed for the rest of the year. The change would not increase the available capacity estimated here, however, as the high flow estimate is based on population and per capita wastewater generation during the summer months.

(C) Incline Village General Improvement District

Estimated available capacity of the Incline Village General Improvement District facilities is summarized in Table V-3. Flow estimates are based on flows observed in the treatment plant in August 1978, plus flows observed from the Washoe County Sewer Improvement District No. 1. Before completion in 1979 of an interceptor leading to the Incline Village general Improvement District plant, Washoe County Sewer Improvement District No. 1 contracted with the North Tahoe Public Utility District to handle its sewage. Since completion of the interceptor, the Washoe County Sewer Improvement District No. 1 has merged into the Incline Village General Improvement District.

The available capacity of the Incline Village General Improvement District facilities is estimated at 1.67 mgd.

TABLE V–2

ESTIMATED AVAILABLE CAPACITY

of the NORTH TAHOE and TAHOE CITY PUBLIC UTILITY DISTRICTS

EFFECTIVE CAPACITY

COMPONENT	CAPACITY	REMARKS
Collection System	Varies	No known capacity problems
Export Interceptor	3.89 mgd	All gravity flow
Treatment Plant	2.94 mgd, 7–day average	Allocation of Tahoe-Truckee Sanitation Agency facilities to flows from Tahoe Basin

FLOWS

Projected high flow from all connected units and private units with sewer permits	2.82 mgd	Includes 0.046 mgd from Forest Service
Contractual obligations to public agencies not yet exercised	0.072 mgd	A total of 0.118 mgd is reserved for Forest Service through 1985
Estimated Available Capacity	0.05 mgd	

TABLE V–3

ESTIMATED AVAILABLE CAPACITY

of the INCLINE VILLAGE GENERAL IMPROVEMENT DISTRICT

EFFECTIVE CAPACITY

COMPONENT	CAPACITY	REMARKS
Collection System	Varies	
Treatment Plant	3.0 mgd, 30-day average	
Export System	3.0 mgd	

FLOWS

Historic Flows	1.33 mgd	1.05 mgd treated in August 1978 plus 0.28 mgd from former Washoe County Improvement District No. 1
Reserved for Public Agencies	0	
Estimated Available Capacity	1.67 mgd	

(D) Douglas County Sewer Improvement District No. 1

The Douglas County Sewer Improvement District No. 1 has made commitments far in excess of the available capacity of its treatment and export system. Table V-4 summarizes the capacity and demands upon the system.

The effective capacity of the district's treatment plant is 1.8 mgd. Flows in excess of this capacity are not adequately treated. The district has proposed substantial interim modifications which will raise the treatment facility capacity to between 2.3 and 2.5 mgd.

If all the new casinos and casino expansions with will-serve letters from the Douglas County Sewer Improvement District No. 1 are built, average flows in the system will increase to an estimated 3.97 mgd. This figure includes only those projects which have received all necessary approvals from the Tahoe Regional Planning Agency, and does not include approximately 650 proposed dwelling units granted building permits as of February 1979.

3. Flows from Projected Growth

Sewage flows can be projected for the level of development allowed under each of the five alternatives. These flow projections, shown in Table V-5, are based on the population projected for each alternative.

The population projections are shown in Table V-10 and their derivation is explained in the accompanying text. The population projections, and hence the flow projections in Table V-5, reflect conditions when all development allowed under each alternative is completed. Under the Strict Adherence to Land Capability (B) and Proposed Alternative (C), where development is phased in over a 20-year period, the projected flows would be reached by the year 2000. For Alternative D (Control Worst Problems) and E (No Action) the ultimate level of development would be reached by 1995 in California. The year when development would be complete in Nevada is not determined. The land use and land capability data used to project populations does not take into account any development for which sewer permits have been issued since 1977, but which would not have been allowed under the controls set under one or more of the alternatives. Hence, the flows projected in Table V-5 under the No Growth Alternative may be somewhat lower than flows estimated on the basis of current commitments.

The population figures were multiplied by estimates of per capita flow to yield summer average flows, which in turn were converted to peak flows. Per capita flow estimates, based on 1974 summer average population estimates derived from Tahoe Regional Transportation Study data and summer seasonal sewer flows for the same year, are shown in Table V-6. The population figures used to determine per capita flows, like the population projections, do not include day users. The higher per capita flows shown for the Douglas County Sewer Improvement

TABLE V-4

ESTIMATED AVAILABLE CAPACITY

of DOUGLAS COUNTY SEWER IMPROVEMENT DISTRICT NO. 1

EFFECTIVE CAPACITY

COMPONENT	CAPACITY	REMARKS
Collection System	Varies	No known capacity problems
Treatment Plant	1.8 mgd	2.5 mgd after completion of interim improvements
Export Pumping	2.88 mgd	
	FLOW	
Historic High Flow	2.05 mgd	August 1978
Reserved for Public Agencies	0	
Estimated Available Capacity:	0.45 mgd	Available only after completion of interim improvements

TABLE V-5

PROJECTED FLOWS (MGD)

SERVICE AREA	EFFECTIVE TREATMENT CAPACITY	ALTERNATIVE				
		A	B	C	D	E
		No Growth	Strict Adherence To Land Capability	Proposed Alternative	Control Worst Problems	No Action
South Tahoe PUD	7.0 mgd maximum day	6.5	6.7	7.5	9.4	11.0
North Tahoe PUD Tahoe City PUD	2.94 mgd 7-day avg.	2.4	2.5	3.1	4.0	4.7
Incline Village G.I.D.	3.0 mgd, 30-day avg.	1.1	1.2	1.5	1.9	4.8
Douglas County S.I.D.	1.8 (2.5) mgd, 30-day avg.	1.9	1.9	1.9	2.3	8.1

TABLE V-6

PER CAPITA WASTEWATER GENERATION

SERVICE AREA	GALLONS PER CAPITA PER DAY 1/
South Tahoe Public Utility District	75 2/
North Tahoe and Tahoe City Public Utility Districts	85 3/
Incline Village General Improvement District	110 4/
Douglas County Sewer Improvement District No. 1	140

1/ All estimates are based on 1974 summer average population, derived from Tahoe Regional Transportation Study data, and summer seasonal sewage flow observed in 1974. The population served and sewage collected by the former Washoe County Improvement District No. 1 are taken into account in the Incline Village General Improvement District estimate.

2/ Using the 1975 mid-census population estimate by the State Department of Finance and seasonal sewage flows for summer 1975, sewage flows compute to 76 gallons per capita per day.

3/ The 1974 final environmental impact statement for the Tahoe-Truckee Sanitation Agency facilities estimated current flows at 80 to 85 gallons per capita per day.

4/ The 1979 facilities plan for the Incline Village General Improvement District computes August 1978 peak flows at 110 gallons per capita per day.

District No. 1 are the result of higher day use in the casino core area than in other parts of the Basin. The conversion factors set forth in Table V-7 were used to convert average flows into high flow estimates, which are expressed in the units by which effective capacity is rated for each district. The conversion factor used for the North Tahoe and Tahoe City Public Utility Districts is taken from a draft Environmental Impact Report on expansion of the Tahoe-Truckee Sanitation Agency facilities. The conversion factor for the other systems is derived from flow data in their facilities plans.

Numerous factors could result in flows different than those projected in Table V-5. Populations could be different because of changes in occupancy rates or persons per household. If increases in day use are not proportional to increases in resident, seasonal, and overnight visitors, the flows could also be different. Finally, changes in water use habits or in the amount of infiltration and inflow could affect total flows. Even so, the flow projections provide a basis for determining when detailed facilities planning will be necessary. More refined flow estimates may be made as part of these detailed plans. Different flow projections than those used here can be accepted if they are based on growth which can be expected under applicable land use ordinances and the restrictions on development called for by the water quality plan ultimately approved for the Lake Tahoe Basin.

4. Facilities Needs

Projects needed to upgrade or expand waste treatment and export systems can be divided into three groups:

Type I - Immediate improvements, including temporary or interim measures to correct existing violations of effluent limitations.

Type II - Projects needed for long-term compliance with effluent limitations.

Type III - Expansion of capacity needed for projected growth.

Table V-11 lists the projects needed in each of these three groups, and estimates the cost for each project.

The Type III projects listed in Table V-11 are those needed to accommodate the growth projected under the Proposed Alternative (C). No expansion of capacity will be required under the No Growth (A) or Strict Adherence to Land Capability (B) Alternatives, although Type I and Type II projects will be needed to bring effective capacity up to current flows.

Only the two systems on the California side will have to be expanded to treat the increased flows projected under the Proposed Alternative.

TABLE V–7

CONVERSION FACTORS

SERVICE AREA	TERMS OF CAPACITY DESIGNATION	CONVERSION FACTOR
South Tahoe Public Utility District	Maximum day	1.35 $\left[\frac{\text{maximum day}}{\text{summer average}}\right]$
North Tahoe and Tahoe City Public Utility Districts	Peak 7-day average	1.19 $\left[\frac{\text{peak 7-day avg.}}{\text{summer average}}\right]$
Incline Village General Improvement District	Maximum 30-day average	1.16 $\left[\frac{\text{maximum mo. avg.}}{\text{summer average}}\right]$
Douglas County Sewer Improvement District No. 1	Maximum 30-day average	1.13 $\left[\frac{\text{maximum mo. avg.}}{\text{summer average}}\right]$

If Alternative D (Control Worst Problems) is adopted, all of the treatment plants except the Incline Village General Improvement District plant will have to be expanded to handle the projected flows. Much larger projects than those listed in Table V-8 would be required for the two California plants. The export pumping capacity of the South Tahoe Public Utility District would also have to be increased.

Under the No Action Alternative (E), all treatment plants and all export systems serving the Lake Tahoe Basin would have to be expanded.

5. Energy Use

The energy used to treat and export sewage from the Basin, based on flows projected for the Proposed Alternative (C), is estimated in Table V-9. The estimates assume the projects listed in Table V-8 are carried out. The estimates include primary energy consumption, that consumed at the treatment and export facilities, and secondary consumption, the energy used to manufacture chemicals and other materials used at the treatment plants. The primary energy figures include only energy used for treatment and export, not for collection.

South Tahoe Public Utility District and Douglas County Sewer Improvement District No. 1 have the highest rates of energy use because of the distance and elevation sewage must be pumped for export. The Tahoe-Truckee Sanitation Agency uses more energy intensive waste treatment processes than the other three plants. Because the sewage is exported by gravity flow, however, the North Tahoe and Tahoe City Public Utility Districts have lower energy use rates than the two south shore districts.

Both primary and secondary energy consumption are a function of the amount of sewage treated and exported. The larger flows projected for the Control Worst Problems (D) and No Action (E) Alternatives will yield corresponding increases in total energy consumption.

D. Social Impacts

1. Population

a. Population Projections

The summer average population projected under each of the alternatives, after construction of all units which may be built under each alternative, is shown in Table V-10.

The population in the Carson City portion of the Lake Tahoe basin is small, and the number of dwelling units is projected to decrease from fourteen to nine.

TABLE V–8

PROJECT LIST of WASTEWATER FACILITIES NEEDS

TYPE I PROJECTS – IMMEDIATE NEEDS

SERVICE AREA	PROBLEM DESCRIPTION	FACILITIES DESCRIPTION	COST (Millions)
South Tahoe Public Utility District	Lack of storage reservoir capacity	New reservoir (Heise Site)	1.6 (1980 dollars)
South Tahoe Public Utility District	Discharge of waste within Basin due to ruptures of export line	Repair export pipeline	1.4 (1979)
South Tahoe Public Utility District	Improve plant reliability	Treatment plant modifications 1/	7.2 (1979)
Douglas County Sewer Improvement District No. 1	Discharge of waste into Tahoe Basin	Line emergency reservoir	0.5 (1979)
Douglas County Sewer Improvement District No.1	Reduce violations of effluent limitations, improve effective capacity	Dissolved air flotation unit, secondary clarifier, diffused air system	1.8 (1979)
Tahoe City Public Utility District	Periodic raw sewage overflows from collection system	Pump station telemetry system	0.2 (1979)
TYPE I FACILITIES (1979 dollars)		SUBTOTAL –	12.7

1/ Head Start Program

TABLE V–8 (continued)

PROJECT LIST of WASTEWATER FACILITIES NEEDS

TYPE II PROJECTS – LONG-TERM COMPLIANCE

SERVICE AREA	PROBLEM DESCRIPTION	FACILITIES DESCRIPTION	COST (Millions)	IMPLEMENTATION DATE
South Tahoe Public Utility District	Violation of effluent limitations, retain effective capacity of 7.0 mgd	New secondary treatment facilities, new reservoir, irrigation system 2/	8.4 (1982)	1982
Douglas County Sewer Improvement District No. 1	Meet more stringent effluent limitations	Treatment plant modifications, new effluent disposal for 1.9 mgd 3/	18.4 (1982)	1982
Incline Village General General Improvement	Meet more stringent effluent limitations	Treatment plant modifications, new effluent disposal for 1.5 mgd 4/	4.5 (1982)	1982
TYPE II FACILITIES (1982 dollars)		SUBTOTAL – 31.3		

2/ Assumes secondary treatment, export to new reservoir in Alpine County, land disposal by irrigation.

3/ Assumes secondary treatment, storage reservoirs, flood irrigation in Carson Valley on leased land.

4/ Assumes effluent will be used for wetlands enhancement.

TABLE V–8 (continued)

PROJECT LIST of WASTEWATER FACILITIES NEEDS

TYPE III FACILITIES – EXPANSION UNDER PROPOSED ALTERNATIVE

SERVICE AREA	PROBLEM DESCRIPTION	FACILITIES DESCRIPTION	COST (Millions)	IMPLEMENTATION DATE
South Tahoe Public Utility District	0.5 mgd expansion (7.0 mgd to 7.5 mgd)	Included in Type II facilities 5/	0.5 (1982)	1982
North Tahoe and Tahoe City Public Utility Districts	0.2 mgd expansion at Tahoe-Truckee Sanitation Agency plant	Additional facilities, expand disposal 6/	1.8 (1982)	1982
TYPE III FACILITIES (1982 dollars) SUBTOTAL – 2.3				
ALL TYPES (1979 dollars) TOTAL – 32.9				

5/ Assumes 7.5 mgd plant will be constructed in one stage; the cost cited represents the estimated incremental cost of a 7.5 mgd plant compared to a 7.0 mgd plant.

6/ Assumes that 0.2 mgd increment will be part of a larger expansion of the plant to serve all five member entities. Cost represents share of expansion costs allocated to 0.2 mgd increment.

TABLE V-9

ENERGY USE FOR SEWAGE TREATMENT AND EXPORT

SERVICE AREA	TOTAL PRIMARY ENERGY Millions of BTU/yr.	TOTAL SECONDARY ENERGY Millions of BTU/yr.	TOTAL ENERGY Millions of BTU/yr.	ENERGY USE RATE BTU Per Gallon Treated
South Tahoe Public Utility District	83,345	2,958	86,303	47.3
North Tahoe & Tahoe City Public Utility District	13,280	19,902	24,182	29.9
Incline Village General Improvement District	11,875	600	12,475	29.0
Douglas County Sewer Improvement District No.1	19,558	977	20,535	39.9

TABLE V-10

PROJECTED POPULATION AFTER COMPLETION
of ALL PERMITTED DEVELOPMENT

	A	B	C	D	E
	NO GROWTH (1977)	STRICT ADHERENCE to LAND CAPABILITY	PROPOSED ALTERNATIVE	CONTROL WORST PROBLEMS	NO ACTION
South Tahoe PUD	62,505	64,374	72,604	90,587	106,424
Tahoe-Truckee Sanitation Agency	23,985	24,408	30,332	39,484	46,712
CALIFORNIA - TOTAL	86,490	89,782	102,936	130,071	153,136
Douglas County	11,591	11,921	11,937	14,117	49,646
Washoe County	8,534	9,354	11,619	14,635	37,455
NEVADA - TOTAL	20,125	21,275	23,556	28,572	87,101
BASIN TOTAL	106,615	111,057	126,492	158,823	240,237

Population is projected on the basis of housing units to be built under each alternative. Housing units are projected using Tahoe Regional Planning Agency data showing developed and developable acreage, land capability, and zoning, and applying the restrictions on development set by each alternative. The housing unit projections make use of a 1974 lot count taken as part of the Tahoe Regional Transportation Study, and are adjusted on the California side to reflect a 1978 lot count by the California Tahoe Regional Planning Agency. The housing unit projections assume that the breakdown between single family units, multiple family units, hotel/motel units, mobile homes and campgrounds will follow current patterns. A California Tahoe Regional Planning Agency ordinance favoring construction of single family homes, until most of the existing vacant lots are built upon, could change current patterns in California.

b. Trends

The population on the California side of the Basin which may be expected if growth continues according to previous trends can be calculated using the Department of Finance's "E-150" formula. The formula assumes that previous birth rates and migration rates will continue as they have in the past. Table V-11 shows the projected populations in California using the "E-150" formula. The formula assumes no increase in occupancy rates.

Using the Department of Finance's formula, the California peak population, including day use, is about 25% higher than the California average summer population. The Department of Finance's 1976 population estimate of the present population was adjusted to the California Tahoe Regional Planning Agency's 1978 population estimates. From the 1978 population estimate, the year 2000 population projection was made.

As can be seen by comparing Table V-10 with Table V-11, if growth in California continued according to past trends, the population would soon reach the levels projected on the basis of construction of all housing units which may be built in the Basin. Under all five alternatives, the population would reach the buildout level, including buildout of all new subdivisions allowed under Alternative E (No Action), before the year 2000. Thus, under each alternative, rapid buildout can be expected unless growth is limited by a growth management ordinance or some other measure which prevents growth according to earlier trends.

The requirement in the Proposed Alternative (C) that any new development be offset by construction of measures to correct existing erosion and runoff problems would phase in growth.

TABLE V-11

CALIFORNIA E-150 POPULATION PROJECTIONS

PROJECTED POPULATION BASED ON PREVIOUS TRENDS

(Assuming No Limitations Are Imposed By Amount of Permitted Development)

SOUTH TAHOE PUBLIC UTILITY DISTRICT AVERAGE SUMMER POPULATION

	1978	1980	1985	1990	1995	2000
Res.	22,446	25,574	33,396	40,169	46,942	53,714
Non-Res.	18,233	20,775	27,130	32,631	38,133	43,637
Hotel/Motel	16,769	19,334	25,247	30,367	35,487	40,607
Campgrounds	4,609	5,249	6,842	8,236	9,616	11,010
E-150 Total	62,257	70,932	92,615	111,403	130,178	148,968

SOUTH TAHOE PUBLIC UTILITY DISTRICT PEAK POPULATION

	1978	1980	1985	1990	1995	2000
Res.	25,990	29,612	38,669	46,511	54,353	62,195
Non-Res.	21,658	24,677	32,226	38,761	45,296	51,834
Hotel/Motel	20,668	23,549	30,751	36,987	43,222	49,459
Campgrounds	4,264	4,540	7,230	8,704	10,162	11,635
E-150 Total	73,180	83,378	108,876	130,963	155,033	175,123

TAHOE-TRUCKEE SANITATION AGENCY AVERAGE SUMMER POPULATION

	1978	1980	1985	1990	1995	2000
Res.	9,004	9,787	11,743	13,977	16,211	18,445
Non-Res.	13,280	14,434	17,320	20,615	23,910	27,205
Hotel/Motel	3,643	3,960	4,751	5,655	6,559	7,463
Campgrounds	2,337	2,540	3,048	3,628	4,208	4,788
E-150 Total	28,264	30,721	36,862	43,875	50,888	57,901

TAHOE-TRUCKEE SANITATION AGENCY PEAK POPULATION

	1978	1980	1985	1990	1995	2000
Res.	12,522	13,610	16,331	19,438	22,545	25,652
Non-Res.	18,387	19,985	23,981	28,543	33,106	37,668
Hotel/Motel	4,439	4,825	5,789	6,891	7,992	9,093
Campgrounds	2,466	2,680	3,216	3,828	4,440	5,051
E-150 Total	37,814	41,100	49,317	58,700	68,083	77,464

CALIFORNIA AVERAGE SUMMER POPULATION

	1978	1980	1985	1990	1995	2000
Res.	31,450	35,361	45,039	54,146	63,153	72,159
Non-Res.	31,513	35,209	44,450	53,246	62,043	70,842
Hotel/Motel	20,612	23,294	29,998	36,022	42,046	48,070
Campgrounds	6,946	7,789	9,890	11,864	13,824	15,798
E-150 Total	90,521	101,653	129,377	155,278	181,066	206,869

CALIFORNIA PEAK POPULATION

	1978	1980	1985	1990	1995	2000
Res.	38,512	43,222	55,000	65,949	76,898	87,847
Non-Res.	40,045	44,662	56,207	67,304	78,402	89,502
Hotel/Motel	25,107	28,374	36,540	43,878	51,214	58,552
Campgrounds	7,330	8,220	10,446	12,532	14,502	16,686
E-150 Total	110,994	124,478	158,193	189,663	221,016	252,587

If the projects are constructed over a twenty-year period, growth will be phased in over a twenty-year period. Population projections in California by five-year increments under the Proposed Alternative (C) are shown in Table V-12.

c. Occupancy

Occupancy rates, the percentage of housing units occupied at any time, may increase as commercial development of Lake Tahoe, including Nevada casinos, leads to a greater permanent population to maintain and operate those facilities. Increased use of second homes in the Basin as retirement residences or rentals could also increase occupancy rates as would multiple ownership of vacation homes. Occupancy rates were 72 percent in California and 70 percent in Nevada in the summer of 1974. Occupancy rates are higher on the south shore.

At the same time, the number of persons per household may increase. A shortage of housing, especially low-cost housing for service employees, may lead more basin residents to share residences, increasing the population per housing unit.

The extent to which occupancy increases will depend largely on the amount of commercial development, especially casino expansion, but will also be affected by the amount of new housing constructed. Increases in occupancy, therefore, will be greatest under Alternative A (No Growth) and least under Alternative E (No Action) with the other alternatives having intermediate impacts. The higher occupancy rates to be expected as a result of setting controls which limit the number of housing units in the Basin could be prevented by limiting casino expansion.

The population projections in Table V-10 assume no change in occupancy. With increases in occupancy rates and in the number of persons per household, the Basin population could be significantly higher. Some increase in occupancy is likely, and a large increase is possible.

While increasing occupancy may yield an average population well over projected levels, it would not have a comparable effect on peak population. The difference between peak and average populations in the Basin reflects the number of housing units which are occupied on peak days but are vacant for part of the season. An increase in occupancy rates could increase average population without increasing peak population. The trend towards more housing units being occupied by permanent residents would increase occupancy rates, and thus increase average population, but might not affect the population on peak days, when a very high percentage of all units are occupied. In fact, the average number of persons per housing unit is slightly lower for units occupied by residents than for units occupied by non-residents.

TABLE V–12

SUMMER AVERAGE POPULATION PROJECTION in CALIFORNIA
UNDER the PROPOSED ALTERNATIVE (C) by 5-YEAR INCREMENTS

	1977	1985	1990	1995	2000
South Tahoe PUD	62,505	65,029	67,555	70,079	72,604
Tahoe-Truckee Sanitation Agency	23,985	25,572	27,159	28,745	30,332
California	86,490	90,601	94,714	98,824	102,936

d. Spillover

Increasing employment opportunities in the Lake Tahoe Basin, in combination with a shortage of housing, may cause some spillover of population to nearby areas. Spillover will stem largely from casino expansion on the south shore, which will generate jobs in the casinos and in hotels, motels, restaurants, shopping centers and gas stations serving casino visitors. Some employees who cannot find housing on the south shore may be willing to commute from outside the Basin. Most of the population spillover will occur in the Carson Valley in Douglas County, Nevada. There may also be increased growth pressure in Alpine County, California.

The greatest factor in determining the amount of spillover will be the extent of casino expansion. Spillover can be limited if casino expansion is limited. The availability of housing, as determined by the residential construction allowed under each of the alternatives, will also be a factor, with spillover being greatest under Alternative A (No Growth).

Limiting housing construction in the Lake Tahoe Basin may not generate large population increases outside the Basin. Increased employment opportunities in the Basin probably will be reflected more in increased occupancy than in an increase in the number of workers commuting from outside the Basin. The increased population, reflected either as increased occupancy or spillover, represents people who move to the Lake Tahoe Basin or the Carson Valley from other areas. These people may be attracted to the Basin as much by the opportunity to live at Lake Tahoe as by the availability of employment, and may not be willing to commute from outside the Basin. Indeed, to the extent that increased occupancy cannot accommodate additional population generated by casino expansion, the casinos may have difficulty in recruiting employees.

2. Housing

The number of housing units (single family dwellings, multiple family dwellings, motel/hotel rooms, and campground and mobile home spaces) at buildout under each alternative is shown in Table V-13. These projections assume that the current housing mix is maintained.

Roughly twenty-five percent of the housing units in the Lake Tahoe Basin are hotel and motel rooms. Five percent of the total housing units are campground units. In addition, about forty-five percent of the remaining, residential units are second homes. In the future, economic incentives may favor second home construction even more (Dornbusch, 1978).

TABLE V–13

HOUSING AVAILABILITY (TOTAL UNITS)

	A	B	C	D	E
	NO GROWTH (1977 LEVEL)	STRICT ADHERENCE to LAND CAPABILITY	PROPOSED ALTERNATIVE	CONTROL WORST PROBLEMS	NO ACTION
CALIFORNIA – TOTAL	37,530	38,516	43,288	53,646	66,272
NEVADA – TOTAL	10,098	10,687	11,875	14,508	43,725
BASIN – TOTAL	47,628	49,203	55,163	68,154	109,997

Low-income housing is in short supply in the Lake Tahoe Basin. This shortage is not expected to change under any alternative, as there is very little market incentive for construction of low-income housing in the Basin. Very little low-income housing is being built, or even proposed, despite a California ordinance favoring low-income housing. Low-income multiple family units are exempt from a California Tahoe Regional Planning Agency ordinance which limits residential construction to one unit per lot.

The State Water Resources Control Board must consider housing needs before adoption of water quality standards, but the State Board is not required to weaken water quality standards where there is a need to develop more housing within a region. In addition, under federal law, housing needs do not constitute a valid basis for weakening water quality standards for waters like Lake Tahoe which constitute an outstanding national resource. In the Lake Tahoe Basin, relaxing water quality standards would not be an effective means of meeting housing needs. Much of the additional housing would be second homes, and almost none would be low-income housing. Housing needs in the Lake Tahoe Basin should be addressed through more direct means than through modification of water quality controls. Strong incentives for low-income housing, in the form of subsidies or priority for building and sewer permits, are needed to overcome market conditions favoring higher-income and second home housing.

Except under Alternative A (No Growth), which bars any new development, the development restrictions set by the various alternatives still leave local and regional government some flexibility in deciding how much housing there should be. The restrictions are based on land capability and the extent of land disturbance. They do not specify how many units can be built. More units could be built if local and regional ordinances limiting the number of units allowed per lot are amended.

3. Land Use

a. Within the Lake Tahoe Basin

Within the Tahoe Basin, much of the land zoned for urban use has not been subdivided or otherwise committed to development. Table V-14 shows the amount of land currently being used for various purposes and the amount of land which will be devoted to those purposes if all areas zoned for urban use by the Tahoe Regional Planning Agency and the California Tahoe Regional Planning Agency General Plans are developed. The General Plans of the two agencies set the same land use district boundaries.

TABLE V–14

LAND USE and ZONING in LAKE TAHOE BASIN *

LAND USE DISTRICT	EXISTING LAND USE (Acres)	GENERAL PLAN (Acres)
Rural Estates	2,488	2,337
Low Density Residential	13,308	19,198
Medium Density Residential	1,626	1,504
High Density Residential	1,074	2,270
Medium Tourist Residential	3	3
Tourist Commercial	1,024	1,320
General Commercial	1,123	1,503
Recreation	2,207	4,328
Public Service	727	898
Conservation Reserve	–	1,753
General Forest	174,538	163,004
BASIN TOTAL	198,118	198,118

* Source: Tahoe Regional Planning Agency (1977).

The General Plans would allow development of a large area which is now forest. By prohibiting further subdivisions, all alternatives, except E (No Action), would preserve existing land uses instead of allowing the further urbanization called for by the General Plans. Limiting the extent of development is consistent with the Forest Service's Land Management Plan for the Basin, which calls for preservation of a larger area of forest lands than is provided for by the General Plans.

Restrictions on development would also preserve open space within areas already subdivided or otherwise committed to urban use. Alternative A (No Growth) would keep the largest amount of open space, while Alternatives B (Strict Adherence to Land Capability) and C (Proposed Alternative) would preserve somewhat less open space. Alternative D (Control Worst Problems) would preserve considerably less open space than the stricter alternatives, but would still prevent development on about 25 percent of the presently subdivided land which would be built upon under Alternative E (No Action).

A large part of the open space preserved under Alternative D (Control Worst Problems), including most of the open space preserved within existing urban areas, would be in stream environment zones. Alternative D would preserve over 1,000 acres of stream environment zone within existing subdivisions plus approximately 6,500 acres of stream environment zone in presently unsubdivided areas which would be developed under Alternative E (No Action). Alternatives A (No Growth), B (Strict Adherence to Land Capability) and C (Proposed Alternative) would also preserve this stream environment zone acreage as open space.

Restrictions on stream environment zone development would prevent development in the floodplain, reducing the hazard of flood loss. Financial assistance from the federal Department of Housing and Urban Development cannot be provided for housing in flood hazard areas unless the community is participating in the National Flood Insurance Program. Two areas of the Basin, Placer County and the parts of El Dorado County outside the City of South Lake Tahoe, do not have the development restrictions or building standards necessary to participate in the program.

b. Outside the Basin

If development restrictions cause a spillover of population from the south shore of Lake Tahoe to Alpine County, California or the Carson Valley in Douglas County, Nevada, development in these areas could cause a loss of range and forest land. The more spillover, which would be greater under the alternatives setting tighter controls on development, the more serious the possible land use problems outside the Tahoe Basin.

The extent of spillover may not be significant under any alternative, however, as a housing shortage within the Basin is more likely to cause an increase in occupancy than it would development outside the Basin. In any event, the area developed outside the Basin should be far less than the area preserved as forest land or open space within the Basin.

Mitigation measures should be adopted by the counties or the State of Nevada to prevent spillover from adversely affecting land use outside of the Lake Tahoe Basin. Limiting casino expansion, the principal cause of any population spillover into areas adjacent to the Lake Tahoe Basin, would prevent spillover and the land use changes it causes. Zoning to protect environmentally sensitive areas could also help prevent spillover from causing environmental problems.

4. Transportation

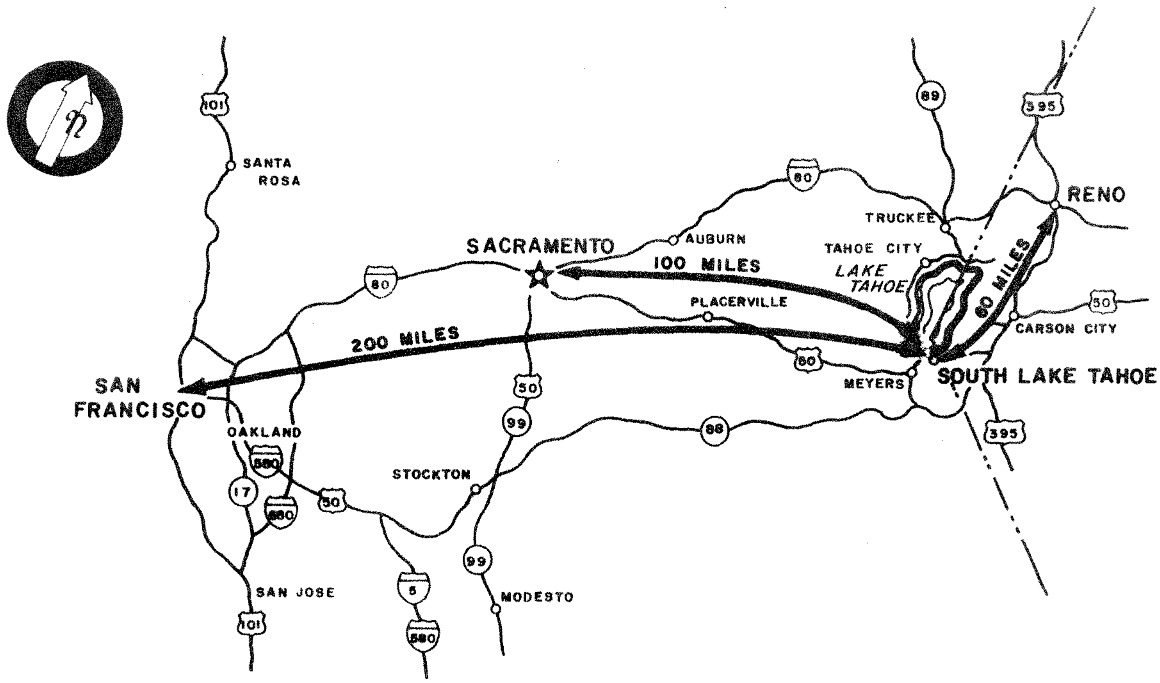
Transportation into and within the Lake Tahoe Basin is almost entirely by automobile. Commercial bus, train, and air service do not account for a significant portion of the trips to the Basin. The location of the Basin with respect to nearby population centers is shown in Figure V-3. Seven million people live within four hours' driving distance of the Basin. Access is provided primarily by two-lane California highways. About 70 percent of the trips to the Basin are from California; 30 percent are from Nevada.

Figure V-4 shows the major transportation corridor on the south and east shores of the Lake. Highways 89 and 28 are the major corridors on the west and north shore. Highway 50 is the major corridor on the south shore. Commercial flights use the South Lake Tahoe Airport and the Truckee-Tahoe Airport, near Truckee to the north of the Basin. Greyhound provides bus service to Basin destinations. One AMTRAK passenger train runs each day with a stop at Truckee. Public transit within the Basin is provided by two bus systems, one operated by the City of South Lake Tahoe and the other operated on the north shore by Placer County.

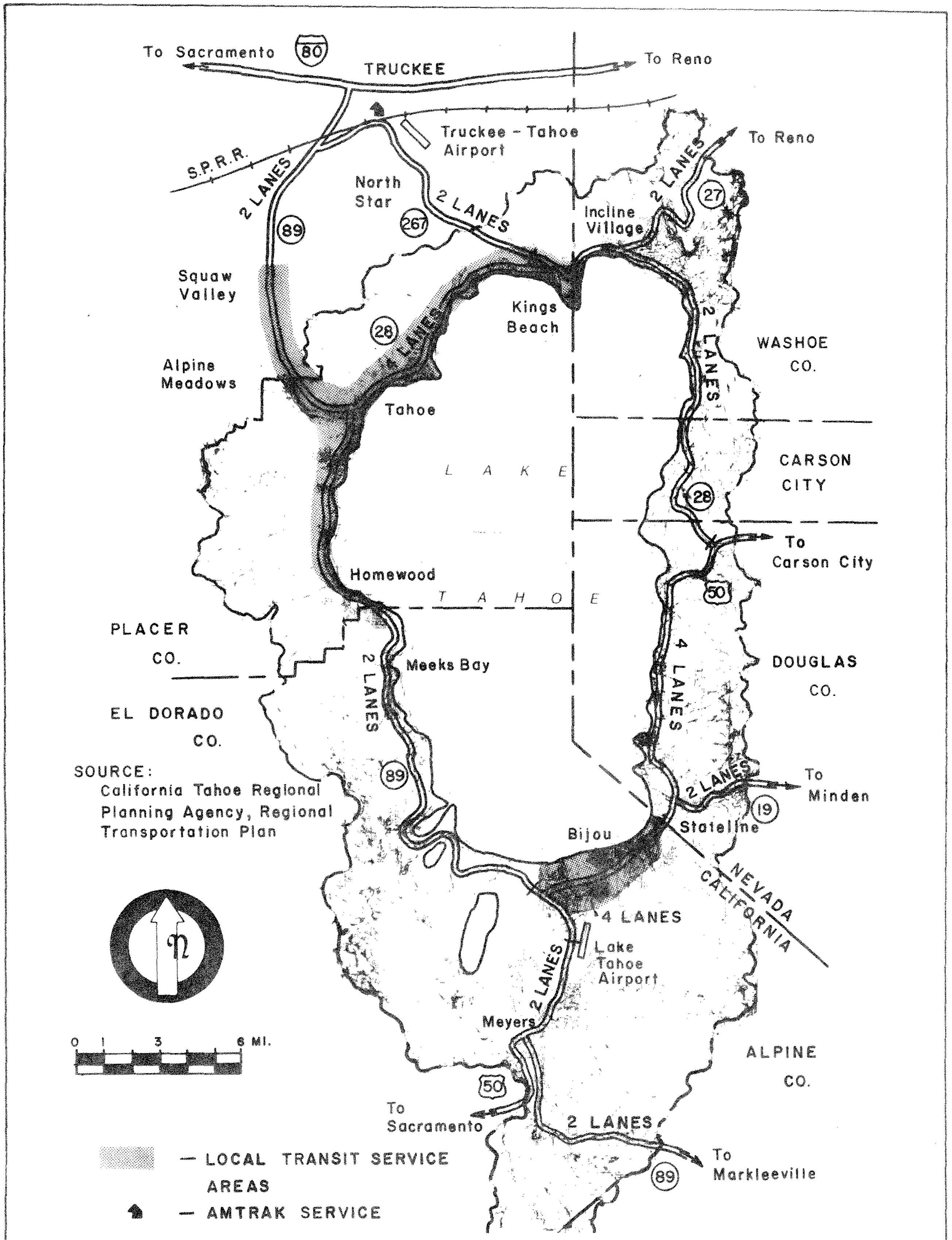
Traffic volumes are at or near the capacity of the roads entering the Basin and along major corridors within the Basin. Traffic congestion is greatest along Highway 50 near the state line where traffic volume is at capacity, with stop and go traffic at low speeds, for periods of eight hours or more. Traffic in the Tahoe City area also is congested in both summer and winter.

The Lake Tahoe Basin is well suited for public transportation. Most traffic occurs within a few narrow corridors. Most trips to the south shore casino area originate near the Highway 50 corridor. Most trips to the Tahoe City area on the north shore start in areas close to the Highway 89-Highway 28 corridor. Traffic demand is relatively uniform, spread out over a long portion of the day.

Figure V-3



Lake Tahoe Region in Relationship to Major Population Centers and Principal Routes between Lake Tahoe, Sacramento and San Francisco



SOURCE:
California Tahoe Regional Planning Agency, Regional Transportation Plan

EXISTING TRANSPORTATION FACILITIES

a. Traffic Volumes

Traffic volume will correspond to the level of development allowed under each of the alternatives. Basin residents account for about 60 percent of the automobile trips within the Basin, but because visitor trips are longer on the average -- 6.3 miles per trip as compared to 4.1 miles per trip for residents -- total miles traveled are about the same. Restrictions on development will limit the number of residents and visitors in the Basin, and thus also limit the amount of traffic.

Increases in traffic will cause congestion on roads where traffic is now near capacity, and extend the period over which traffic is backed-up at areas already at capacity. A Lake Tahoe Basin Highway Capacity Study, prepared by the California Tahoe Regional Planning Agency in 1979, indicates the effect of a 17 percent increase in traffic -- about the increase which may be expected under the Proposed Alternative (C). On peak days, traffic would exceed highway capacity for over ten hours at every critical location on the California side of the Basin. At the south shore state line, traffic would be at capacity for 18 consecutive hours. At the north shore, where peak traffic is still slightly below capacity, capacity volumes would be maintained for 13 straight hours. The much larger increase in traffic to be expected under Alternative D (Control Worst Problems) would cause even more severe traffic problems. Traffic under the No Action Alternative (E) would far exceed that which Basin highways conceivably could handle.

Expanded public transit could limit the increases in traffic, but the extent to which public transit can cut automobile use in the Basin remains to be seen. It is unlikely that public transit could handle even the moderate growth projected under the Proposed Alternative (C) without some increase in traffic congestion. A significant worsening of traffic conditions can be expected under Alternative D.

b. Transportation Facilities

Construction of new roads to handle the increased traffic projected for the Lake Tahoe Basin would cause serious water quality problems. Road construction adds large impervious surfaces, increasing surface runoff and erosion. Road cuts also add to erosion and runoff problems. The quality of runoff water from heavily used roads and highways is seriously degraded. The most serious water quality problems threatened by new highway construction in the Lake Tahoe Basin stem from encroachment of stream environment zones and construction in high erosion hazard lands.

The prohibitions against encroachment of stream environment zones and high erosion hazard lands, proposed under all but the No Action Alternative (E), will effectively prohibit new highway construction in the Basin. Only relatively short segments could be constructed without crossing stream environment zones or high erosion hazard lands. Adoption of the prohibitions, therefore, would preclude major new highway construction as a means of reducing traffic problems.

Variances are not provided for new highways designed to reduce traffic congestion, however. Construction of new roads in high erosion hazard lands or stream environment zones would cause water quality problems which far outweigh any benefits in traffic improvement. The Regional Transportation Plan in force for the California side of the Basin, where the most heavily congested areas are located, concludes that environmental considerations, especially air and water quality, preclude expansion of the Basin highway system.

Traffic problems can be mitigated by limiting the amount of additional development in the Basin or by providing expanded public transportation. The four alternatives which set prohibitions affecting highway construction also limit the amount of development in the Basin to varying degrees. If it is believed that the Proposed Alternative (C) allows too much traffic congestion, the stricter limitations set by the No Growth Alternative (A) could be adopted. Limitations on casino expansion, which draws more traffic into the most heavily congested road segments, could also be adopted by Nevada or by Douglas and Washoe Counties.

The Regional Transportation Plan for the California portion of the Basin, prepared by the California Tahoe Regional Planning Agency, calls for an extensive public transportation system. Major elements of the plan include:

- Greatly expanded transit service, with exclusive bus lanes and service at reduced fares

- Peripheral parking facilities and associated transportation systems to provide visitors with an alternative to automobile use in the Basin

- More bikeways

- Improved pedestrian facilities, and

- Road use or entry charges

Implementation of these measures would reduce automobile use in the Basin. The California Air Resources Board adopted these measures as part of a Lake Tahoe Basin Nonattainment Plan, required to meet the requirements of the federal Clean Air Act. In adopting the plan, the Air Resources Board resolved that the basinwide public transportation system provided by these measures is essential to attainment of federal air quality standards for carbon monoxide.

Implementation of a basinwide public transportation system may, in some cases, require construction in stream environment zones or high erosion hazard lands. For example, minimal road widening of up to five or six feet may be required for bus lanes or bikeways. In contrast to new highway construction which would affect large areas, the amount of land required for these public transportation facilities will be insignificant. Construction will be along existing transportation corridors, instead of in previously undeveloped areas. Wherever possible, existing structures or fills will be used when stream environment zones must be crossed.

Accordingly, the prohibitions on development proposed for Alternatives A through D make exception for measures required to implement the basinwide public transportation system. The public transportation system will mitigate traffic congestion, is essential to meeting federal air quality standards, and will have little effect on water quality. In fact, the public transportation system will help protect water quality. By reducing automobile traffic, the system will help cut surface runoff problems from areas of intensive vehicular use.

Controls will still be necessary to ensure that adverse impacts on water quality are kept to a minimum. In California, an exception to a prohibition will be made only when the Lahontan Regional Board finds:

- There is no reasonable alternative which avoids the need for the exception.

- The project incorporates measures which will ensure that any erosion and surface runoff problems caused by the project are kept to a minimum.

- Any encroachment of stream and environment zones or high erosion hazard lands is mitigated by restoration of presently disturbed areas in the Basin sufficient to offset the effect of the project.

One kind of mitigation project could be restoration of stream environment zones which have been altered by previous development. Ideally, mitigation measures should be in the same watershed, but mitigation could be provided on any stream in the Basin. Projects already required as part of this plan or other orders issued by water quality control agencies shall not be accepted as mitigation measures.

The prohibitions adopted under the Proposed Alternative (C) should not affect construction of transportation facilities other than highways and facilities part of the basinwide transportation system adopted by the Air Resources Board. The Regional Transportation Plan does not provide for additional runways or taxiways at the South Lake Tahoe Airport. Terminal facilities, which the Transportation Plan indicates may be expanded, can be constructed outside stream environment zones and high erosion hazard lands. The Regional Transportation Plan also proposes a waterborne transportation system, but docking facilities can be constructed without wetlands filling or any other violation of prohibitions. The No Growth Alternative (A) would prevent airport expansion and construction of docks needed for waterborne transportation unless exceptions are provided for when prohibitions are adopted.

5. Recreation

Lake Tahoe is a popular resort destination for residents of northern California and Nevada. On an average summer day, over 120,000 visitors can be expected in the Basin. Outdoor recreation includes fishing, hiking, and simply enjoying the scenery. The largest winter sport is skiing. According to the Tahoe Regional Planning Agency's Draft 208 Plan, approximately two-thirds of the visitors come primarily to enjoy the Lake, the mountain environment, and the outdoor recreation opportunities offered. The remainder come for gaming and entertainment at the casinos.

To the extent that the alternatives protect water quality and preserve open space, they will help protect the quality of outdoor recreation in the Lake Tahoe Basin.

Control measures adopted to prevent erosion from ski area expansion, set under all but the No Action Alternative (E), severely restrict the areas where additional ski resort development may take place. The California Tahoe Regional Planning Agency's Regional Plan provides, however, that no new large or major facilities shall be provided for alpine skiing. As part of its preparation of Part 2 of the Land Management Plan for the Lake Tahoe Basin, the Forest Service is considering several sites for possible ski resort expansion (Forest Service, 1979). One of the possibilities being considered involves expansion of Heavenly Valley by adding new ski slopes at sites outside the Lake Tahoe watershed. As these slopes are outside the area covered by this water quality plan, and erosion from these slopes would not affect Lake Tahoe, they are not subject to the controls set by this plan.

The control measures set for ski areas may also affect operation of existing facilities, especially at times of inadequate snow cover when operation could cause erosion problems.

There are several ski areas just outside the Lake Tahoe Basin which provide opportunities for alpine skiing to residents and visitors of the Lake Tahoe Basin. This plan does not apply to the operation of ski areas outside the Basin or limit the possibility for expansion of these areas.

Alternatives A, B, C, and D restrict the possibility for additional golf course construction in the Lake Tahoe Basin, although golf course construction is allowed so long as it is outside stream environment zones. The California Tahoe Regional Planning Agency's Regional Plan states that there shall be no new large or major facilities for golfing in the Lake Tahoe Basin.

The development restrictions set under Alternatives A, B, C, and D may also limit the possibilities for casino expansion. In addition, this Chapter suggests limits on casino expansion as a means of preventing a spillover of growth into areas adjacent to the Basin and as a means of controlling traffic problems.

E. Public Services and Utilities

1. Services

Most of the public services and utilities in the Tahoe Basin are at, or very near capacity. Only a few of the basic services could easily accommodate the population projected for the Proposed Alternative (C). Growth allowed by the No Action Alternative (E) would overwhelm all services in the near future. If development is slowed, excess capacity in services will be depleted much less rapidly. One public service, municipal wastewater treatment, is discussed on pages 189 through 208. Transportation is discussed on pages 220 through 226. Other public services are discussed in this section. This section focuses on the problems in the California portion of the Basin because the majority of the people live in California. In some cases, services located in California are also used by Nevada residents.

a. Schools

Schools on the California side of the Lake Tahoe Basin are provided by two districts.

The Lake Tahoe Unified School District serves the south lakeshore from Emerald Bay to the Nevada state line. It extends west to near Twin Bridges, outside the Lake Tahoe Basin. The maximum number of additional primary and secondary students which can be accommodated using existing facilities is 1,133.

The west and north shore areas, including parts of El Dorado County and Placer County, are served by the Tahoe-Truckee Unified School District. The maximum number of additional students which could be acommodated in the Tahoe Basin portion of the District is 953.

Based upon student permanent resident ratios of 1:7 and 1:9 for the Lake Tahoe and Tahoe-Truckee Unified School Districts, respectively, an additional permanent population of 7,931 in the south shore area and 8,577 in the west and north shore areas could be accommodated. The growth permitted under Alternative D (Control Worst Problems) could not be accommodated by the existing facilities in the Lake Tahoe School District. The growth permitted under Alternative E (No Growth) would exceed capacity in both districts.

b. Health Care Services

Two full-service hospitals serve the Lake Tahoe Basin: Barton Memorial Hospital, a private, nonprofit facility in South Lake Tahoe, and Tahoe Forest Hospital, a public facility in Truckee. These two hospitals serve the needs of both the California and Nevada sides of the Basin.

Barton Memorial Hospital can, on the average, adequately serve the existing permanent population. Capacity is exceeded for approximately 25 days out of the year during peak demand. The bed capacity will be increased by about 45 percent when 28 presently unlicensed beds are included.

Tahoe Forest Hospital serves a smaller population than Barton Hospital and does not provide specialized services. Capacity is well above the current demand.

Demands for skilled nursing and intermediate care beds exceed supply. A single skilled nursing facility is available. It is consistently full and patients often must be referred to facilities outside the area.

Emergency room care is provided for residents and visitors and is considered overcrowded.

El Dorado and Placer Counties provide mental health services in South Lake Tahoe and Kings Beach, respectively. These services do not have any in-patient facilities. Population growth will require expansion of services as demand increases.

Other services provided by county health departments include various primary-care detection and prevention clinics, rehabilitation services, educational programs, and drug abuse and alcoholism counseling. Other than the educational programs, which could handle a 35 percent increase, and the counseling programs, which could handle a 10 percent increase, the services are at or over capacity. Many health care needs remain unfulfilled for lack of funds.

c. Police

The staffing levels of the various police forces in the Basin are calculated from the permanent resident population. This results in understaffed services which are strained by the influx of summer and holiday visitors.

d. Fire Protection

Six separate fire protection jurisdictions serve the California side of the Tahoe Basin. Some fire protection districts do not have sufficient staff, facilities, equipment, or hydrant water pressure. Location of newer developments has, in some cases, created response time problems, while water pressure in hydrants varies with available water supply and with the size and length of the water lines.

Fire protection is not fully adequate in any area of the Basin. Fire insurance rates in the Tahoe Basin are among the highest in the State. Expansion of residential areas would further burden already overburdened services.

e. Road Maintenance

Ice control during the winter is a problem on Lake Tahoe roads. Erosion control projects would reduce the need for ice control measures. Runoff from snowmelt would be collected and conveyed in stable drainage systems rather than allowed to flow across roadways where it can freeze in thin layers which require ice control for public safety.

Erosion control projects will also reduce the amount of general road maintenance required throughout the year. There will be less mud flowing onto roads, less regrading of roadsides to maintain proper slopes, and fewer cases of roads being undermined by runoff.

These positive impacts on road maintenance would occur under either Alternative A (No Growth), Alternative B (Strict Adherence to Land Capability) or Alternative C (Proposed Alternative). Because Alternative D would only control some of the erosion and drainage problems, the magnitude of the improvement would be less than under the other alternatives. Alternative E (No Action) would allow present problems to continue.

f. Solid Waste

All solid wastes must be exported from the Basin. The western and northern shores of the Tahoe Basin, from Rubicon-Meeks Bay to Stateline, are serviced by the Tahoe City Disposal Company and the Kings Beach Disposal Company.

These companies dispose of the refuse in the North Tahoe Landfill, which is on Forest Service land 1.3 miles off Highway 89 aproximately 5 miles north of the entrance to Squaw Valley. This landfill is expected to reach capacity before 1985. The Forest Service is not willing to lease additional land for solid waste disposal.

The southern and eastern shores of the Basin are served by the South Tahoe Refuse Company which operates and maintains a landfill site east of Gardnerville in Douglas County, Nevada. The site is leased by the county from the Bureau of Land Management. The fill receives solid waste from the El Dorado County portion of the Basin, including the City of South Lake Tahoe, Douglas County and the Carson City area. Approximately 85 percent of the refuse comes from the Tahoe Basin. The physical capacity of the landfill is adequate. In 1980, the Douglas County Commissioners will review the landfill operation and decide if the South Tahoe Refuse Company can continue as the fill operator. The Commissioners' decision could seriously affect solid waste removal service on the southern and eastern shore of Lake Tahoe.

Reducing the volume of waste generated and recycling wastes could extend the time before new disposal sites are needed.

g. Water Service

Some of the water delivery systems in the Basin are inadequate for the existing service area populations. Others do not have the capacity to serve major increases in population. Water service may also be limited by the water rights held by water companies and public utilities. For example, the Incline Village General Improvement District estimates that it will need 4,600 acre-feet of water per year if all parcels within its service area are built upon. The district has water rights for 3,115 acre-feet per year. Water rights in the Lake Tahoe Basin are discussed on pages 235 through 243.

h. Energy Utilities

Natural gas, which is brought in by pipeline, is the largest source of energy in the Lake Tahoe Basin. Existing supply lines are adequate, but some additions will be necessary if development continues. Peak demand for electricity, almost all of which is generated outside the Basin, has exceeded the reliable capacity of existing electrical transmission systems. Reliable capacity is determined by the capacity when the most critical component of the system is out of service. The Sierra Pacific Power Company has proposed a master plan consisting of a series of steps by which capacity can be increased gradually to serve various levels of development. Increases in demand for liquified petroleum gases and fuel oils, now used by about 9,000 residential and commercial customers, can be served by increasing the number of trucks used to deliver supplies or by increasing reserve tank capacity.

2. Local Agency Revenues

a. Historical Profile

Over the years cities, counties, and special districts have relied heavily on property tax revenues to pay for the services which they provide. In the 1950's and early 1960's, local capital improvements were in large part funded by general obligation bonds repaid through property taxes. By the late 1960's and early 1970's an inflationary trend had started increasing property values. Assessments and property taxes rose along with the property values.

As assessments and property taxes rose, people became increasingly concerned with their rising property taxes. In 1969 the California State Legislature established a homeowners tax exemption which relieved homeowners of approximately $200 to $250 of property taxes per year. Local government did not lose any revenue, however, because the State made up the difference from income and sales taxes.

In the mid-1970's inflation in housing values skyrocketed. Assessments and property taxes followed. Local governments had so much money available that they rarely had to raise tax rates to provide for necessary services. By that time, however, the once generous attitude of the voters towards taxes and general obligation bonds had turned sour. Fewer and fewer bonds received the required vote for passage at elections.

b. The Property Tax Revolution

In June of 1978 the frustration of California property taxpayers culminated in the passage of Proposition 13, an initiative amending the California Constitution. Proposition 13 severely limits local government's ability to collect property tax revenues, to pass general obligation bonds, or to increase other taxes. Proposition 13 cut property tax revenues by nearly $7 billion. The state used surplus funds, built up over a four year period, to "bail out" local government. The bail-out funds held the loss in total revenues to local government to about ten percent. As the accumulated state surplus is exhausted, it is unlikely that state funding of local government will continue at current levels, especially if a downturn in the economy reduces state revenues. Thus, Proposition 13 may have a far greater impact in the future that is has thus far.

The State of Nevada also has a property tax limitation provision in its Constitution. Since before 1900, the limit has been $5 per $100 of assessed valuation. The statutory ratio of assessed value to market value in Nevada is 35 percent.

c. Uncertainties in Predicting Revenues

In the wake of Proposition 13, it is impossible to predict with any certainty the ability of a given unit of local government to raise revenues for the services it provides.

- Local agencies in California no longer can set property tax rates to cover budgeted or projected costs. Proposition 13 establishes the formula by which property tax rates are determined.

- Proposition 13 limits reassessments. When property is purchased or newly constructed, it can be reassessed at its market value. Otherwise, the assessed value may increase by only two percent per year. Restrictions on development in the Lake Tahoe Basin will reduce the value of property subject to the restrictions, reducing property tax revenue which may be collected on that property. At the same time, the restrictions will increase the market value of property where development is allowed or already has occurred. Even if it could be determined how much the property not subject to the development restrictions would increase in value, the effect on property tax revenues could not be determined without knowing how often the property will be sold. About 15 percent of the residential units in the Basin are sold or exchanged each year, but it cannot safely be assumed the turnover rate will remain constant.

- Property tax revenues are not necessarily allocated to the cities or districts where they are raised. Before Proposition 13, cities and districts levied their own property taxes on the property within their boundaries. Now the county supervisors distribute all the property tax revenue raised within the counties, and are not required to distribute the taxes to the cities or districts within which they are collected. Even before Proposition 13, a county did not have to spend all of the property taxes it received in the same areas as where the taxes were collected. In recent years a large portion of the property tax revenues collected in the Lake Tahoe Basin by Placer and El Dorado county has been spent outside the Basin to serve areas on the western slope of the Sierras.

- General obligation bonds, previously relied upon to raise capital for public services, are no longer viable because local agencies do not have enough control over their revenues to provide adequate security. Other kinds of bonds carry higher interest rates. As a result, it is now more difficult and expensive for local government to raise capital to build new facilities to serve developing areas.

- The ability of local government to raise fees is clouded by pending litigation and may be limited by state legislation in response to opposition to increasing fees.

- The amount of state and federal funds which will be provided to local government is unknown. The California state surplus is nearly gone and it is uncertain to what extent the state will reduce local government's responsibility for existing state and federally mandated programs. A proposed income tax initiative, if approved by the California voters, would severely restrict state revenues. Federal subventions may also be greatly reduced in the near future. Appropriations for the Federal Clean Water Grants Program have been less than the amounts authorized in the Clean Water Act for the last two years. The last year of authorization for funding of the program is the 1981-82 fiscal year.

Placer and El Dorado Counties lost nearly $32 million in property tax revenues as a result of Propostion 13. At least for the next few years, until the full impact of Propostion 13 is understood, it will be extremely difficult to determine whether local government can raise enough revenues to provide adequate services for new development.

This plan proposes that a land purchase plan be adopted as a means of implementing restrictions on development, although regulatory programs shall be imposed in the absence of a land purchase program. A property acquisition program could be created by legislation establishing a National Scenic Area. Draft proposed legislation being considered by Representative Fazio (California) for introduction in Congress includes a provision authorizing reimbursement of local government for lost property tax revenues. Considering both the increased property tax values of property where development is allowed and the reduced service costs to local government for property purchased for a National Scenic Area, the net impact on local government finances may be minor. Nevertheless, National Scenic Area legislation should include an authorization to reimburse losses of property tax revenues. Such legislation would at least eliminate some of the uncertainties about what future local government revenues will be.

d. Relationship of Revenues to the Cost of New Developments

In reviewing the impact of restrictions on development on local agency finances, the impact on local revenues should not be considered in isolation from the increased cost of providing service to additional development. New construction raises the assessed value of the property which is developed, but local government also must provide more services.

A study by California's Office of Planning and Research in May 1979 found that in nine out of ten cities surveyed, new housing did not generate enough tax revenues to pay for the increased service cost to local government (Office of Planning and Research, 1979). Whether new development pays for itself depends largely on whether it can be accommodated within the capacity of existing public services, or whether capital expenditures to expand public service facilities will be required.

Many of the public services in the Lake Tahoe Basin are at or near their capacity. It may well be that restrictions on development would have a positive impact on local government finances because the new development would not pay for itself.

e. Costs and Benefits of Erosion Control Projects

Chapter III of this plan identifies $95 million in erosion and urban runoff control projects required to correct erosion problems caused by development, especially roadbuilding. Roughly $17 million of these projects are on state highways in California and Nevada. All but a few of the remaining projects are on city and county streets and roads.

Erosion problems on public streets and roads are the legal responsibility of local government. Paying the full cost of these projects would place a very heavy burden on local government finances, however. In California, under Alternatives A (No Growth), B (Strict Adherence to Land Capability), and C (Proposed Alternative), the total cost of the projects which are not on state highways is close to $55 million. Even though the cost of implementation would be spread over twenty years, it is unlikely that local government could raise that much money. Therefore this plan proposes to use state and federal grants, and seek legislation for new sources of funds, so that the total local share in

California can be held to $10 million or less--about $500,000 per year. Under Alternative D (Control Worst Problems), where the total cost of projects on local streets and roads would be less than $6 million, grant funds could also be used to reduce the local share.

The cost of erosion control projects will be at least partially offset by reduced road maintenance costs. The State Water Resources Control Board recently conducted an erosion control study and demonstration project at a heavily eroding site in the Lake Tahoe Basin (White, 1978). The study found that over a ten year period the project would pay for itself in reduced road maintenance costs to local government. The savings would be enough to pay for the entire cost of the project, not just the share local government would have to pay if the project were paid for in part by the state and federal grants.

Considering the local responsibility for creating erosion problems in the construction of streets and roads, and the savings in road maintenance costs, the local share of project costs under Alternatives A, B, and C is justified. Basin residents, as well Basin visitors benefit from protecting Lake Tahoe. Alternatives D (Control Worst Problems) and E (No Action), would require less expenditure by local government, but the savings in road maintenance costs would be less, especially under Alternative E.

F. Economic Impacts

Because Lake Tahoe is a year-round destination resort, maintaining a high-quality environment, especially the Lake itself, is essential to maintaining the economic base of the Basin. To the extent that the alternatives preserve water quality, they will also preserve the long-term viability of the Basin economy.

Implementation of control measures to protect water quality will also have adverse economic impacts, especially in the short-term. Economic impacts must be considered in the preparation of water quality plans. Under the federal Clean Water Act, ecomomic impacts cannot justify setting lower standards than are necessary to protect the existing high quality of the waters of Lake Tahoe. But economic considerations can form the basis for choosing among alternatives which meet or exceed the federal nondegradation standard. A water quality plan may also propose measures to mitigate economic impacts.

1. Land Values

Alternatives A (No Growth), B (Strict Adherence to Land Capability), C (Proposed Alternative), and D (Control Worst Problems) all place some restrictions on land use. These restrictions range from a total prohibition on building (Alternative A) to a prohibition on new subdivisions with development allowed on existing parcels outside of the stream environment zones and high erosion hazard lands (Alternative D).

Most of the subdivisions in the Basin were laid out without consideration of the need to preserve environmentally sensitive areas and to limit coverage according to land capability. There are about 16,000 vacant lots in existing subdivisions on the California side of the Basin, 15,000 of which are residential lots. If the restrictions called for under the Proposed Alternative (C) are implemented, as many as 12,000 of these 16,000 lots could not be used for residential or commercial development. The impact in Nevada would be similar, although there are fewer vacant lots.

When this plan is adopted, vacant lots which cannot be built upon without violating the prohibitions set in the plan will substantially decline in value. At the same time, land which has already been developed or where future development is allowed will increase in value because of the more limited supply of developable land. In addition, homeowners in subdivisions which have not been completely built-out may reap substantial aesthetic and economic benefits from restrictions on further development. Nearby open space will be protected. Persons who own houses in the Basin may have an interest in purchasing adjacent vacant land to provide yards, buffer zones, and natural areas for their own use and enjoyment.

Regardless of the overall impact on land values, restrictions on development will seriously effect the individual lot owners who find they cannot build on their lots. A land purchase program should be established to provide relief to these lot owners.

a. Land Purchase Programs

A program to purchase lots in the Lake Tahoe Basin, which are not suitable for development, and thereby relieve landowners of the financial impact of regulation, could be established by several different means. One method would be through creation of a National Scenic Area in the Lake Tahoe Basin. Funds could be provided from the federal Land and Water Conservation Fund, which is supported by revenues from offshore oil production. A federal land acquisition program could also be established which would make use of funds raised by selling Bureau of Land Management land in parts of Nevada outside the Lake Tahoe Basin to pay for land purchases in the Basin.

Property acquisitions could be made by the California Tahoe Conservancy Agency if funds are appropriated. The Regional Transportation Plan for the California side of the Basin calls for state legislation to establish a road use or parking fee, with $25 million of the revenues raised over the next ten years allocated to the California Tahoe Regional Planning Agency.

The Parklands and Renewable Resources Investment Program, proposed in a bill before the California Legislature (SB 547), includes $25 million for Lake Tahoe land purchases. The $25 million could be used as part of the funding for a National Scenic Area, or for land purchase by state agencies if Congress fails to pass the legislation needed to establish a federal program. A high priority is placed on purchase of lots in stream environment zones. The Parklands and Renewable Resources Investment Program, which includes parks, fisheries, soil conservation and water conservation elements, will require approval by the California voters, probably in June 1980.

To prevent further deterioration of Lake Tahoe, controls on development must be implemented as soon as possible, without any delay pending establishment of a land purchase program. At the same time, every effort should be made to establish a land acquisition program, and to provide adequate funding for the purchase of individual lots which cannot be used for residential or commercial construction.

Because development restrictions will greatly reduce the market value of the property where development is prohibited, payment of the fair market value of the property is not the best way to achieve the purposes of a land purchase program. Market value may well be reduced to less than the original purchase price. A better approach than purchase at fair market value would be to pay the original purchase price plus interest and any special assessments paid by the lot owner.

The State Water Resources Control Board will propose and urge enactment of the legislation necessary to establish a land purchase program for the Lake Tahoe Basin. Accordingly, the State board welcomes public comment on how such a program can best be established. If the necessary legislation has been introduced and is proceeding towards enactment by the time the State Board adopts this plan, the State Board will lend its support to the pending legislation. Otherwise, the State Board will prepare its own legislative proposal. Even after regulatory controls are in force, and the threat to water quality from additional development is averted, the State Board will continue its efforts to establish a land purchase program, so that the financial burden on lot owners can be eliminated.

As a start towards creating a land purchase program, this plan proposes that at least $5 million in Clean Lakes grant funds from the Environmental Protection Agency be used to buy land and development rights in the Lake Tahoe Basin. The state share needed to match a Clean Lakes grant can be provided by a State Water Resources Control Board commitment to expend funds available under the Clean Water and Water Conservation Bond Law of 1978.

Under the Proposed Alternative (C), the State Board will commit $10 million in bond funds to protecting Lake Tahoe. Although these bond funds cannot be spent to buy lots -- they will be used to construct erosion control projects -- part of the matching Clean Lakes grant can be used to buy lots to prevent development which threatens water quality. Commitments by other state or local agencies to expend funds for erosion control projects or property acquisition could increase the funds available for property acquisition under a Clean Lakes grant.

b. Other Means of Mitigating Reductions in Land Values

Transfer of development rights provides another means by which the financial impact on lot owners of restrictions on development can be reduced. Land use ordinances could provide transferable development rights to lot owners whose property cannot be used for residential or commercial construction after development restrictions are adopted. For example, the owner of a lot on high erosion hazard land could be issued a transferable right to build an additional unit elswhere in the Basin. This right could be used, on any lot where development would not violate the development restrictions set by the water quality plan, to build one more unit than applicable zoning ordinances otherwise would allow. The holder of a transferable development right could buy another lot, and use the right to build an extra unit, or sell the right to another lot owner. The value of transferable development rights will depend on how many of the rights are issued, and how many places they may be used. Under Alternatives A (No Growth) and B (Strict Adherence to Land Capability), a large number of transferable development rights would be issued and there would be few if any lots on which they could be used. Under Alternaitve C (Proposed Alternative), transferrable development rights would have more value, but their value would still be limited, as there would be far more rights issued than lots on which they could be used. Under Alternative D (Control Worst Problems), on the other hand, transferable development rights would have considerable value. The number of lots where the rights could be used would be almost three times the number of rights issued.

A few landowners who cannot build on their property because of restrictions against stream environment zone encroachment may be able to receive payments through the Water Bank Program. The Agricultural Stabilization and Conservation Service provides annual payments to landowners who agree to protect wetlands on their property. The program applies only to freshwater marshes and open water. The wetland area to be protected must be at least two acres, although several landowners may participate jointly.

c. Utility Assessments

Because of the changes in land values caused by restrictions in development, special assessments now imposed on lots in the Basin should be adjusted, or purchased as a part of a land purchase program. Sewer assessments in the South Tahoe Public Utility District range from $400 to $4,000 per lot. These assessments impose an unfair burden on lot owners who will not be able to use the sewer system because restrictions on development prevent construction on their lots. A land purchase program is needed to eliminate this inequity. Buying the property relieves the landowner of the burden of any special assessments. Special assessments could also be paid for separately, without buying the land itself. Paying the landowner for special assessments on the property, purchasing the landowner's rights to connect to the utilities for which the assessments were imposed, is a means of acquiring the development rights to the property. A top priority in the expenditure of the Clean Lakes grant funds used for property acquisition will be placed on the purchase of utility assessments. Paying for these assessments can assure that all property owners affected by development restrictions receive some relief, while efforts continue to obtain the legislation and funding needed for a complete land purchase program.

2. Employment

Employment patterns in the Lake Tahoe Basin are different from most areas. The Basin attracts a large number of seasonal workers. Many young people work at the casinos, in other tourist trades, and on construction during the summer, and for the ski resorts in the winter.

In the winter, approximately 25 percent fewer workers are employed in the Basin than in the summer months. During the fall and spring off-seasons many Basin residents are unemployed. This employment pattern leads to a higher than average unemployment rate in the Basin.

In 1974, 51% of the workers in the Basin were employed in four major industries: gaming (29.7%), construction (10%), motel (6.7%) and recreation (4.6%). Most of the remaining workers were employed in the following service industries: retail trade (17.6%), finance (6.9%), business services (5.1%), and transportation and utilities (4.6%).

Implementation of a water quality plan will have a significant employment impact on the construction trades and on supporting services, such as finance. Fewer jobs will be generated under the alternatives setting stricter development controls; the employment precluded by the development controls will exceed that generated by construction of erosion control projects. The estimated construction employment affected by this plan for each of the five alternatives is found in

Table V-15. These figures, estimated for a buildout period of 20 years, represent average annual employment. Once buildout is complete, the jobs cease, no matter which alternative is accepted. Even under the No Action Alternative (E), the Basin will be built out, and construction jobs curtailed, within the near future. As the number of new construction starts is reduced, an increasing economic incentive may develop for reconstruction and remodeling of existing structures.

It should be emphasized that the difference between the employment projected for Alternative E (No Action) and the projections for the other alternatives does not represent a drop in employment below current levels. The employment projections for Alternative E assume a much higher rate of housing construction than is now the case in the Basin. Thus most of the employment projected under Alternative E would be in addition to current employment. The current rate of housing construction on the California side of the Basin is slightly below the rate assumed for Alternative D (Contral Worst Problems).

3. Impacts of the Financial Plan

The proposed financial plan suggests the use of Basin user fees, increased transient occupancy tax, and recreation fees. A study prepared for the Tahoe Regional Planning Agency indicates that the small increase in individual visitor expenditures due to the proposed fees would not discourage visitors from coming to the Basin (McDonald and Smart, Inc., 1974).

G. Environmental Resources

1. Water Rights

Only a limited amount of water is legally available for municipal and domestic use in the Lake Tahoe Basin. If water use in the Basin increases beyond that limit, the rights of downstream water users dependent on the Lake's outflow into the Truckee River will be infringed.

In 1968, after 13 years of extensive debate and negotiation, the Joint California-Nevada Interstate Compact Commission adopted the "California-Nevada Interstate Compact" allocating water in the Lake Tahoe, Truckee River, Carson River and Walker River Basins. California ratified the compact in 1970; Nevada ratified in 1971. Although ratification by Congress is still pending, the compact has been accepted in both states as the only comprehensive basis available for allocating water rights. The principal uncertainty concerning the allocation made by the interstate water compact involves the unresolved claims of the Paiute Tribe of Indians of Pyramid Lake. These claims are for more water at Pyramid Lake, the terminus of the Truckee River, than is provided under the Compact. Thus, the allocation set by the interstate water compact sets an upper limit on the amount of water which can be diverted for use in the Lake Tahoe Basin, but there is a possibility that the amount available will be less.

TABLE V–15

EMPLOYMENT

PERSON-YEARS of EMPLOYMENT in HOUSING CONSTRUCTION UNDER VARIOUS ALTERNATIVES

	A	B	C	D	E
	NO GROWTH	STRICT ADHERENCE to LAND CAPABILITY	PROPOSED ALTERNATIVE	CONTROL WORST PROBLEMS	NO ACTION
CALIFORNIA	0	30	160	420	770
NEVADA	0	20	20	30	490
BASIN TOTAL	0	50	180	450	1,260

PERSON-YEARS of EMPLOYMENT in EROSION CONTROL PROJECT CONSTRUCTION

	A	B	C	D	E
BASIN TOTAL	200	200	200	50	0

TOTAL PERSON-YEARS of EMPLOYMENT in CONSTRUCTION

	A	B	C	D	E
BASIN TOTAL	200	250	380	500	1,260

The figures for housing construction (over an estimated 20-year period) are based upon the projections of the number of housing units at buildout under each alternative, the assumption that the housing mix will remain the same as in 1978, and the construction jobs per unit estimates. in Dornbusch (1978). Projected employment in erosion control project construction based on Tahoe Regional Planning Agency (Draft 208 Plan, Vol. III, 1977).

Consistent with the hydrologic conditions of the Lake Tahoe watershed, where the groundwater and surface water systems are interconnected, the compact allocation is based on all diversions, from ground and surface water. The compact sets the total amount of water which may be diverted for use in the Lake Tahoe basin at 34,000 acre-feet per year, with 23,000 acre-feet per year allocated to California and 11,000 acre-feet per year allocated to Nevada.

The State Water Resources Control Board, which is responsible for administering California's water rights program, issued a Report on Water Use and Water Rights in the Lake Tahoe Basin in January, 1980. The report determined that after water rights held by the Forest Service, state parks requirements, and certain exports and depletions are taken into account, 19,000 acre-feet per year is available for use on private lands on the California side of the Basin. Table V-16 shows the breakdown among these uses.

The report also estimated the amount of water used at the current level of development, at buildout of existing subdivisions, and with new subdivision construction for various levels of water consumption per household. These estimates are shown in Table V-17. At the present level of development, with water use per unit at levels observed in 1974 and 1975, the estimated water use on private land on the California side is nearly 14,000 acre-feet per year. If existing subdivisions are built out, annual water use on private lands will exceed 19,000 acre-feet unless consumption per household is reduced to levels below the average for 1974 through 1977. Conservation could reduce consumption, but water use per unit has been increasing as a result of higher occupancy rates and more landscape irrigation.

The No Action Alternative (E), which would allow new subdivisions, would result in water use on private land in California in excess of the amount available under the compact, unless consumption per unit is cut to well below current levels. Alternative D (Control Worst Problems), which would allow construction on most of the lots in existing subdivisions, would hold water use to below 19,000 acre-feet if per unit consumption follows the 1974-77 average, but not if use follows the maximum levels observed. The Proposed Alternative (C) will hold water use on private lands on the California side of the Basin to less than 19,000 acre-feet per year unless consumption rates are significantly higher than have been observed.

Water supply for Nevada presents a similar picture. Total diversion for use on the Nevada side of the Basin is about 6,000 of the 11,000 acre-feet allocated under the interstate water compact. With reasonable efforts to hold down consumption, there should be enough water to accommodate the development projected under Alternative D. It is unlikely, however, that this will be enough water to serve development beyond buildout of existing subdivisions, as would be allowed under the No Action Alternative (E).

TABLE V–16

ALLOCATION of WATER RIGHTS

on the CALIFORNIA SIDE of the LAKE TAHOE BASIN

USE	ACRE-FEET PER YEAR
Sewer infiltration water exported from the Basin	600
Depletion associated with lake storage and flow enhancement	500
Potential State of California requirements	350
Water Rights currently held by the U.S. Forest Service	2,550
Municipal and Domestic Use	19,000
TOTAL	23,000

TABLE V-17

POTENTIAL LEVELS of MUNICIPAL, DOMESTIC and IRRIGATION WATER DEMAND on PRIVATE LANDS for the CALIFORNIA PORTION of the LAKE TAHOE BASIN A/

ANNUAL WATER DEMAND (ACRE-FEET/YEAR)	
1. CURRENT DEVELOPMENT	
Drought Condition 1/	11,093
Present Average 2/	12,414
Present Maximum 3/	13,888
Potential Occupancy 4/	18,190
2. BUILDOUT OF EXISTING SUBDIVISIONS	
Drought Condition	17,825
Present Average	19,928
Present Maximum	22,245
Potential Occupancy	29,454
3. ADDITIONAL SUBDIVISION	
A. California Tahoe Regional Planning Agency General Plan	
Drought Conditions	20,983
Present Average	23,718
Present Maximum	26,375
Potential Occupancy	35,356
B. Tahoe Regional Planning Agency General Plan	
Drought Conditions	25,945
Present Average	30,012
Present Maximum	33,518
Potential Occupancy	45,046

A/ Includes golf courses, stockwatering, and pasture lands, but does not include use on Forest Service and State lands.

1/ The minimum rate of water use observed in either 1976 or 1977.

2/ The average rate of water use observed for 1974–1977.

3/ The rate of water use observed in the year of maximum use, usually 1974 or 1975.

4/ The present average rate of water use expanded to reflect increased occupancy of available dwelling units. Annual average occupancy is assumed to expand from the present 56% to a potential 78% within the California portion of the Basin. Average summer occupancy rates are assumed to increase from 72% to 100% with a proportional winter time occupancy increase from 48% to 67%.

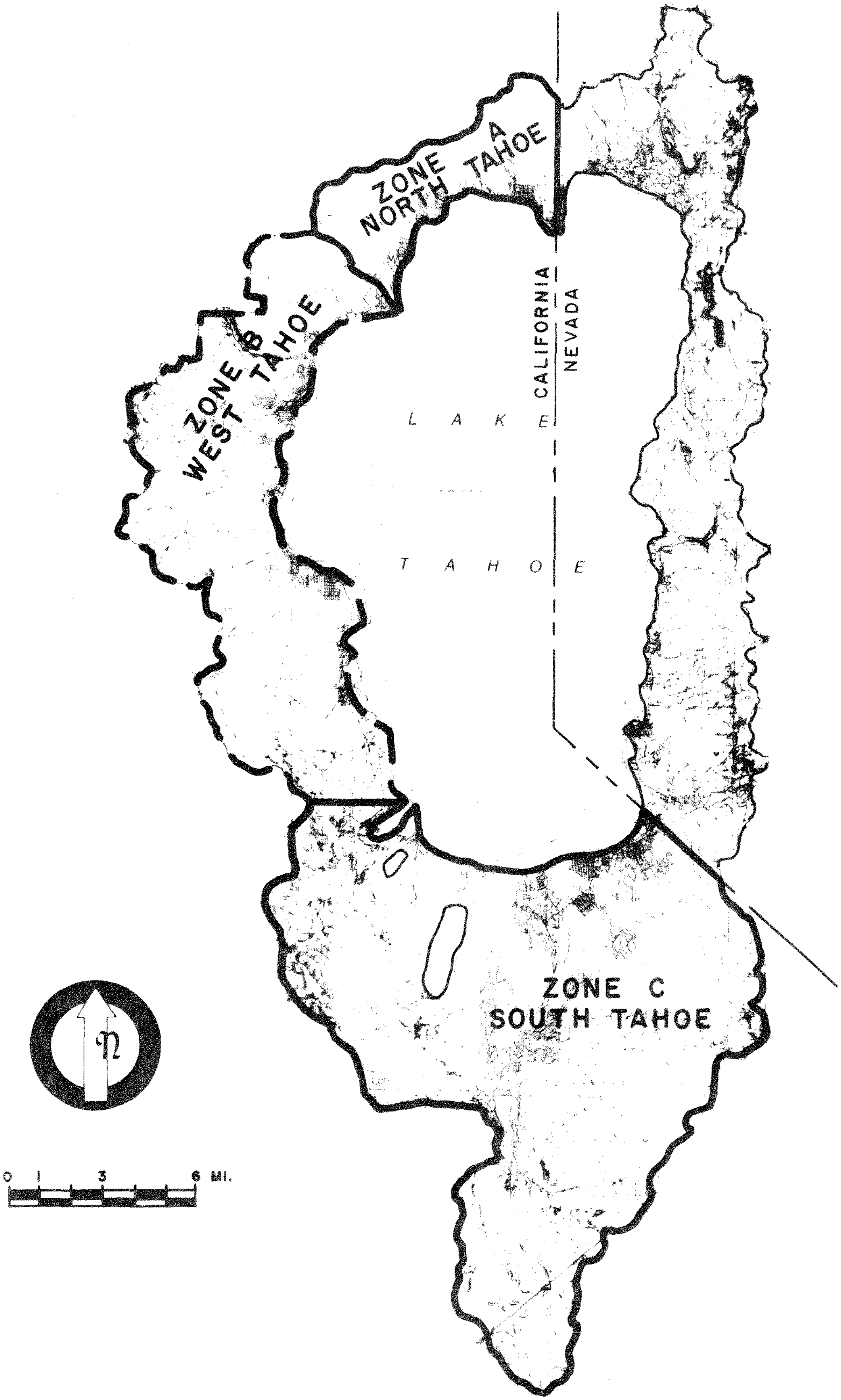
In Nevada, all water diversions require a permit from the State Engineer. Over the past ten years, the State Engineer has acted to limit the amount which may be diverted on the Nevada side of the Basin to ensure that diversions will not exceed the amount allocated the compact.

The California State Water Resources Control Board has adopted a policy of limiting new water rights permits in accordance with the compact allocation. The State Board does not have permit authority over all diversions, however. The largest group of diversions not subject to permit is groundwater diversions. Fifty-four percent of the total diversions for use on the California side of the Basin are from groundwater. Local government has authority to regulate groundwater pumping, and special groundwater districts can be created, but current state law does not require local government to act, even when groundwater pumping exceeds available supply.

The water rights study recommends that the State Board issue new water rights permits subject to conditions which ensure that issuance of the permits will not result in water use in excess of the amount available under the interstate water compact. The North Tahoe Public Utility District, Tahoe City Public Utility District, and South Tahoe Public Utility District have applied to the State Board for permits to divert surface water to provide water service within their districts. The 19,000 acre-feet per year available for use on private land in California can be allocated among three zones which correspond to the division of the Basin among the public utility districts. Figure V-5 depicts the three zones, and Table V-18 indicates the allocation among them. The water rights study recommends that a permit be issued to each of the public utility districts for the amount of water allocated to the zone within which it provides service. The amount of water the utility may divert under the permit will be determined by the amount allocated to the zone minus the total of all other diversions, including groundwater diversions, for use on private lands within the zone. Thus the permits are designed to prevent the utility from diverting water in excess of the amount allocated to California under the interstate water compact.

The water rights report also recommends that local and regional agencies involved in land use planning consider the limitations set by the interstate water compact, and that the state's water quality program take the availability of water into account. The California Water Code directs State Board and Regional Boards to take water supply into account during water quality planning and in issuing waste discharge requirements. The public utility districts provide sewerage service, for which they are subject to waste discharge requirements issued by the Lahontan Regional Board. Any additional development in the Basin, which will increase water use, will not be possible without a connection to the sewerage systems. The number of units which may connect to the sewerage systems is limited by sewage treatment capacity. Accordingly, any water quality plan approved by

Figure V-5



CALIFORNIA WATER USE ZONES

TABLE V–18

ALLOCATION of WATER AVAILABLE for USE on PRIVATE LANDS
AMONG the THREE ZONES on the CALIFORNIA SIDE
of the LAKE TAHOE BASIN

ZONE		ACRE-FEET/YEAR
North Tahoe – Zone A (North Tahoe Public Utility District)		2,890
West Tahoe – Zone B (Tahoe City Public Utility District)		4,010
South Tahoe – Zone C (South Tahoe Public Utility District)		12,100
	TOTAL	19,000

the State Board shall require that waste discharge requirements issued for these sewerage systems include conditions designed to prevent water use in the Basin beyond the compact limitations. The conditions could take several different forms, ranging from connection limitations to water conservation programs. The precise form the conditions shall take can be determined when waste discharge requirements are renewed or modified.

The erosion control projects proposed in Chapter III, some or all of which will be implemented under all but the No Action Alternative (E), require use of irrigation water for revegetation. Native plants will be used, however, except for some temporary stabilization, and once established will not require irrigation. In addition, the projects involving the most extensive revegetation are within the highest priority groups, and therefore should be completed before development in the Basin causes water use to approach the limits set under the compact. To make sure that the irrigation needed for revegetation can be carried out within the limits of water supply, the State Board's water rights decisions should reserve water for revegetation. Once it is determined that reserving water for revegetation is no longer necessary, the water can be made available for municipal and domestic use.

2. Air Quality

The clear mountain air of the Lake Tahoe Basin has deteriorated over the past two decades. In summer, a gray-brown haze frequently collects along the south shore. The normal visibility of greater than 30 miles often is reduced to 17 to 20 miles. Automobile exhaust is the principal source of air pollution. The Basin's bowl-like shape lends itself to temperature inversions which trap pollutants in a thin layer near the ground. The high altitude of the Basin also results in more intense ultraviolet radiation, contributing to the formation of photochemical smog.

State and federal air quality standards for carbon monoxide and oxidants are shown in Table V-19. Numerous violations of state and federal carbon monoxide standards have been recorded. In November 1978, one monitoring station in the City of South Lake Tahoe recorded two violations of the federal one hour standard (35 ppm), 25 violations of the federal eight hour standard (9 ppm), and 30 violations of the state eight hour standard (6 ppm). The highest recorded eight hour average was 30.5 ppm. Violations of state oxidant standards have also been recorded.

The amount of air pollution in the Basin will depend mostly on the amount of automobile traffic. Ninety-five percent of the carbon monoxide emissions in the basin are from automobiles. Automobile emissions also account for most of the emissions of reactive hydrocarbons and oxides of nitrogen, the precursors of photochemical smog.

TABLE V–19

STATE and FEDERAL STANDARDS
for CARBON MONOXIDE and OXIDANTS
for the LAKE TAHOE BASIN

POLLUTANT	AVERAGING TIME	CALIFORNIA STANDARD	NEVADA STANDARD	FEDERAL STANDARD
OXIDANT	1 hour	0.10 ppm	0.10 ppm	0.12 ppm
CARBON MONOXIDE	12 hours	10 ppm	–	–
	8 hours	6 ppm	6 ppm	9 ppm
	1 hour	40 ppm	35 ppm	35 ppm

Eighty-five percent of the summer emissions of reactive hydrocarbons and 90 percent of the summer emissions of oxides of nitrogen are from automobiles. Carbon monoxide pollution is largely a function of traffic congestion. Emissions are much higher in stop and go traffic, and problems occur on a localized basis near the most congested areas. Emissions of reactive hydrocarbons and oxides of nitrogen are more closely related to total miles driven, on the other hand, and these emissions may travel some distance from their source before they interact with sunlight to form oxidants.

a. The Lake Tahoe Basin Nonattainment Plan

The federal Clean Air Act requires each state to prepare a plan for attainment and maintenance of federal air quality standards. The California Air Resources Board has adopted and submitted for approval by the Environmental Protecton Agency a Lake Tahoe Basin Nonattainment Plan. The plan includes controls designed to achieve federal carbon monoxide standards in the Basin. Control measures adopted by the Air Resources Board include:

- inspection and maintenance of motor vehicle emission control devices;
- a basinwide public transportation system;
- traffic flow improvements and controls;
- snow removal improvements;
- a subdivision moratorium;
- mail delivery;
- new source review.

The Nevada Environmental Commission adopted the Nonattainment Plan for the Nevada side of the Lake Tahoe Basin. The Commission referred to further study most of the elements of the basinwide public transportation system. It rejected a road user fee. Nevada also rejected a subdivision moratorium. The other controls adopted by Nevada are essentially the same as those adopted in California.

b. Consistency of Water Quality and Nonattainment Plans

All of the five alternatives except the No Action Alternative (E) are consistent with the Nonattainment Plans adopted by California and Nevada.

i. Growth Projections

The populations projected for the five alternatives are based on projections of the number of housing units which will be built. The Nonattainment Plans project growth in terms of housing units, without translating these units into population. Housing unit projections for the water quality plan alternatives and the Nonattainment Plans are compared in Table V-20.

The Nonattainment Plans project growth for two alternatives, with high and low growth rates. The Nonattainment Plans do not choose between the two alternatives. Control measures are adopted to attain federal carbon monoxide standards under either condition. The growth projections for California are based on buildout of existing subdivisions, which will occur by 1995 under either the high growth or low growth alternative, with no new subdivision construction. The projections for Nevada are based on different growth rates for the high and low alternatives, but assume growth will include new subdivision development under either alternative.

Alternative E (No Action) is not consistent with the Nonattainment Plans. Under Alternative E (No Action), new subdivisions could be built in California, and buildout of all existing and new subdivisions is projected to occur by 1995. The additional growth allowed under Alternative E (No Action) would increase emissions above those planned for in the Nonattainment Plans. Table V-20 also indicates that far more units will be built in Nevada under Alternative E (No Action) than are projected in the Nonattainment Plans. The different growth projections for Nevada are not necessarily inconsistent, however. Both Alternative E (No Action) and the growth projections for the Nonattainment plans are based on development as allowed by Tahoe Regional Planning Agency zoning. The projection shown for Alternative E (No Action) is the ultimate number of units to be built. While it can be projected that under Alternative E (No Action) all units in California will be built by 1995, no projection is made as to how soon all units in Nevada will be built. The housing unit projections for Nevada in the Nonattainment Plans are for units built by 1995, not the ultimate number of units.

The projected growth under Alternatives A through D is lower than that projected by the Nonattainment Plans. Emissions projections in the Nonattainment Plans indicate that air pollution from both mobile and stationary sources will be lower at lower levels of development. Restrictions on development beyond those assumed in the Nonattainment Plans will help ensure attainment of federal standards for carbon monoxide, and help bring air pollution levels closer to state

TABLE V–20

GROWTH PROJECTIONS for WATER QUALITY PLAN ALTERNATIVES
and NONATTAINMENT PLANS

	PROJECTED NUMBER of HOUSING UNITS *						
	A	B	C	D			E
	NO GROWTH	STRICT ADHERENCE to LAND CAPABILITY	PROPOSED ALTERNATIVES	CONTROL of WORST PROBLEMS	NONATTAINMENT PLANS Low Growth	NONATTAINMENT PLANS High Growth	NO ACTION
CALIFORNIA	37,530	38,516	43,288	53,646	55,325	55,325	66,272
NEVADA	10,098	10,687	11,875	14,508	20,852	31,837	43,725
BASIN TOTAL	47,628	49,203	55,163	68,154	75,177	87,162	109,997

* Projected units under Alternatives (A)–(E) are the ultimate number of housing units in the Basin. Projected units for Nonattainment Plans are for the year 1995, and further expansion in Nevada is expected.

In projecting housing units on the California side of the Basin, the nonattainment plans assumed there would be fewer units per lot than are assumed in the projections for the five alternative water quality plans. Both the high and low growth nonattainment plan scenarious project the number of units at buildout of existing subdivisions in California. Following the assumptions used in projecting housing units for the water quality plan alternatives, there would be 59,240 housing units in California at buildout of all lots in existing subdivisions.

standards for carbon monoxide and oxidants. Protection of air quality will be greatest under Alternative A (No Growth) and Alternative B (Strict Adherence to Land Capability), but Alternative C (Proposed Alternative) should also yield significant improvement over the emission levels projected in the Nonattainment Plans.

To the extent there is spillover of population, with workers commuting to the Basin from adjacent areas, development controls will result in some commuters driving greater distances. Spillover is not expected to be large, however, amounting to a fraction of the growth which is prevented in the Basin. Any increase in emissions caused by longer commuting distances will be compensated for by the reduction in the number of trips generated in the Basin. To cut down on the number of autos commuting into the Basin, peripheral parking facilities can be provided outside the Basin, so travelers can car pool or board buses, as is called for by the California Nonattainment Plan.

Increased commuting distances may not have any effect on carbon monoxide problems. Carbon monoxide problems are localized in the most congested areas. It makes no difference whether a person driving through those areas is commuting from inside or outside the Basin.

Stationary sources, which will be limited by development controls even if there is a spillover of population, will assume greater importance in the future. Reactive hydrocarbons and carbon monoxide emissions from mobile sources will decline as more recently manufactured vehicles with better emissions controls comprise a larger portion of the vehicle fleet. The Nonattainment Plans project that in 1995, 45 percent of all summer emissions of reactive hydrocarbons will be from stationary sources. In winter, when carbon monoxide pollution is most serious, 25 percent of all carbon monoxide emissions will be from stationary sources.

ii. <u>Sewage Treatment Plant Capacity</u>

The Clean Air Act calls for nonattainment plans to quantify increases in emissions which may result directly or indirectly from expansion of sewage treatment capacity. The Environmental Protection Agency can withhold construction grants for increases in sewage treatment capacity which are not taken into account in the Nonattainment Plans.

Some of the growth projected in the Nonattainment Plans can occur without exceeding the existing capacity of the sewage treatment systems serving the Lake Tahoe Basin, but most can occur only if the systems are expanded. The Nonattainment

Plans project the increase in emissions from both stationary and mobile sources which would occur as a result of development made possible by treatment plant expansion. In 1995, nine to twelve percent of the emissions in the Basin under the low growth alternative, and seventeen to twenty percent of the emissions under the high growth alternative, would be attributable to expansion of sewage treatment capacity.

Under each alternative except Alternative E (No Action), sewage treatment plant capacity is limited to that necessary to accommodate a level of development which is lower than projected under the Nonattainment Plan. Under Alternative E (No Action), however, there is a possibility of expansion of sewage treatment capacity beyond that taken into account in the Nonattainment Plans.

iii. Control Measures

None of the control measures proposed in Alternatives A through D will interfere with implementation of the Nonattainment Plans. The prohibitions adopted in the water quality plan will provide for exceptions for measures reasonably necessary to implement the Nonattainment Plans, including construction of facilities for a basinwide transportation system.

iv. Effect of the Nonattainment Plans on Water Quality

Implementation of the Nonattainment Plans will benefit water quality. Improved snow removal procedures, adopted by both states,will reduce siltation from highways. A subdivision moratorium, adopted as part of the California Plan, will prevent erosion threatened by new subdivision development. The public transportation system adopted by the Air Resources Board as part of the California Plan will also help protect water quality. Reduced automobile traffic will improve the quality of runoff from roads and parking lots. Road user charges approved as part of the transportation system will provide funding for erosion control projects and for purchase of land where development is threatened, as well as for construction of public transportation facilities. On June 21, 1979, the State Water Resources Control Board adopted a resolution urging the Environmental Protection Agency to approve the California Plan and to take all action within its power to ensure that the Plan is implemented.

Reduced automobile traffic will hold down emissions of oxides of nitrogen, which may account for part of the nitrogen in precipitation. The controls adopted in the Nonattainment Plans probably will not be sufficient to prevent increases in oxides of nitrogen emissions, however. The Nonattainment Plans are directed towards meeting federal standards for carbon monoxide, not towards preventing increases in oxides of nitrogen. Because of improved emissions controls on automobiles, emissions of carbon monoxide in the Basin will be reduced by 35 to 45 percent by 1995, even if none of the control measures in the Nonattainment Plans are implemented. Oxides of nitrogen emissions, on the other hand, will increase by 10 to 30 percent. Many control measures adopted in the Nonattainment Plans are aimed at traffic flow improvement, without affecting the total amount of driving. These measures will help attain carbon monoxide standards without having a significant impact on oxides of nitrogen.

3. Energy Use

Energy use in the Lake Tahoe Basin will depend largely on the extent of residential and commercial development. The energy needed to construct erosion and urban runoff control projects will be comparatively smaller than that used to construct new residential and commercial structures and to serve those structures after they are completed. There are no major industrial energy users in the Basin. About half of the energy used in the Basin is natural gas, liquified petroleum gas, and fuel oils, most of which is used for commercial and residential space heating. Transportation fuels account for about one third of the energy use in the Basin. About one sixth of the energy used is electricity. The largest energy consumers are the south shore casinos, followed by the sewage treatment facilities; but these large users together use less than ten percent of the electricity used in the Basin.

Energy consumption will be lowest under Alternative A (No Growth). New residential and commercial units would not be allowed, and lower population levels in the Basin would hold down the amount of automobile use and sewage export. Energy use under the other alternatives could be somewhat greater. A major increase in energy use would be likely under Alternative E (No Action).

4. Fauna and Flora

a. Vegetation

Most of the Lake Tahoe Basin is covered by pine and fir forests intermixed with brushland and meadows. Although several other vegetation zones can be found in the Basin, development has occurred almost exclusively in areas of mixed-pine, pine-fir, lodgepole pine, chaparral, and riparian vegetation.

In most developed areas, Jeffrey pine is the dominant tree. Some of the deeper volcanic soils of the north Basin support nearly pure stands of white fir. Mixed coniferous forests are found in many areas. Red fir is common at higher elevations.

Lodgepole pine forests indicate unstable floodplains or high groundwater tables when they are found at lower elevations. Nearly pure lodgepole pine stands can be found in some areas of very high groundwaters.

The species composition of riparian communities varies along two gradients: elevation and moisture. At higher elevations, willows and sedges predominate. At lower elevations, the dominants are aspen and black cottonwood. Bog associations can be found at higher elevations and marshes at lower elevations. Lower elevation riparian communities are often found in subdivided lands and include, in addition to aspen and black cottonwood, Lemmon's willow, creek dogwood, and numerous herbs and grasses. The greatest impact of urbanization on vegetation has been the conversion of several marshes and meadows to residential and commerical uses.

Of the more than 500 native plant species in the Basin, 17 are listed as rare or endangered by the Smithsonian Institution or the California Native Plant Society. The habitats for two of these species, the Tahoe Yellow Cress (Rorippa subumbellata) and Bolander's Mountain Dandelion (Phalacroseris bolanderi) are in presently urbanized areas or areas zoned for development. Tahoe Yellow Cress can be found in moist areas between 6,000 and 8,000 feet, especially near the Lake. The habitat for Bolander's Mountain Dandelion is wet meadows in red fir and Lodgepole pine forests between 7,000 and 9,300 feet.

The most important impact on vegetation from implementation of a water quality plan will be the protection afforded to riparian vegetation by the prohibition on stream environment zone encroachment set under all but Alternative E (No Action). Stream environment zones are defined to include riparian vegetation. Development restrictions will also protect native vegetation in other areas zoned for development.

Erosion and surface runoff control projects will cause some short-term disturbance of vegetation. Most of the disturbance will occur along roadway margins. During detailed facilities planning, projects will be designed to avoid unnecessary removal of vegetation. Construction will be carried out in accordance with best management practices to avoid unnecessary disturbance of vegetation. Disturbed areas will be revegetated using native plants. Many erosion control projects will have a beneficial impact on vegetation because native plants will be reestablished on areas stripped of vegetation.

b. Fish and Wildlife

The wildlife of the Lake Tahoe Basin includes 71 mammal species and 204 bird species. Mammal species include three types of deer, black bear, mountain lions, and fifteen medium-sized furbearing mammals. Large mammals and furbearing species are decreasing in population. Only four of the furbearing species -- raccoon, spotted skunk, striped skunk, and coyote -- are tolerant of human disturbance of their habitats.

Birds in the Basin include 22 waterfowl species. Ten of these species nest in the Basin, using marshlands as nesting areas. Four upland game species depend on grassland for nesting and feeding. Eighty-six other species require marsh, meadow or grassland habitats.

Seven amphibian species and eleven reptile species have been identified in the Basin, but relatively little is known about their distribution and abundance. The amphibians depend on moist areas near streams, the Lake shore, and in marshes. The most commonly observed reptiles are gopher snakes, which live in dry shrub lands, and garter snakes, which live in marshes and meadows.

Twelve game fish species and fifteen nongame fish species have been identified in the Lake Tahoe Basin. These fish feed on over 100 species of insects and other aquatic invertebrates.

Table V-21 lists the species in the Basin which have been designated as rare, threatened or endangered by the state or federal governments. Only one endangered species, the southern bald eagle, is a known seasonal inhabitant of the Basin. The historical peregrine falcon habitat in the Basin has been destroyed or greatly altered by development. No peregrine falcons have nested in the Basin since the early 1940's, although migrants are seen occasionally. There have been no wolverine sitings in the Basin for over 20 years. The Lahontan cutthroat trout, once abundant in the Lake, is now limited to Marlette Reservoir on the Nevada side of the Basin.

The most significant feature of the five alternatives with respect to fish and wildlife is the extent to which habitat is protected or subject to further encroachment by development. The greatest benefits to wildlife will result from protection of marshes, meadows, and other areas in stream environment zones, as would occur under Alternatives A (No Growth) through D (Control Worst Problems). The prohibition against new subdivisions, also applicable under Alternatives A through D, will protect some additional wildlife habitat. In addition some habitat protection will be provided by the various restrictions on development in existing subdivisions set under these four alternatives. Aside from stream environment zones, however, areas within existing subdivisions are not likely to be as important for wildlife habitat as other areas in the Basin.

TABLE V–21

RARE, THREATENED, and ENDANGERED SPECIES

in the LAKE TAHOE BASIN

	DESIGNATION	
	FEDERAL	STATE
MAMMALS		
Wolverine (gulo luscus)	–	Rare
BIRDS		
Southern Bald Eagle (Haliaeetus leucocephalus leucocephalus)	Endangered	Endangered
Peregrine Falcon (Falco peregrinus)	Endangered	Endangered
FISH		
Lahontan Cutthroat Trout (Salmo clarki henshawki)	Threatened	–

Erosion control will benefit fish and wildlife, especially aquatic organisms. Most game fish require clean gravel beds for eggs to hatch. Sedimentation can suffocate fry, as well as the organisms on which they feed. Alternatives A (No Growth) through C (Proposed Alternative) all would reduce sediment levels in Basin streams by about 40 percent, although sediment levels in streams draining developed areas still will be well above natural levels.

Alternative D (Control Worst Problems) would reduce sediment loads by about 20 percent, while No Action (E) would allow sediment loads to increase by over 30 percent. While increased sediment loads will hurt game fish populations, the corresponding increases in nutrient concentrations will stimulate algal growth, possibly allowing the Lake to support larger populations of fish and aquatic invertebrates.

Neither the short-term disturbance caused by construction of erosion control projects, nor the long-term benefits from revegetation using native plants, is likely to have much effect on wildlife. Most of the erosion control projects are along roadways or in other areas of extensive human disturbance.

5. Cultural and Historic Resources

For centuries, Washoe Indians used the Lake Tahoe Basin as a summer range for hunting, gathering, and fishing. Other Indians from nearby areas frequented the Basin, although not as regularly as by the Washoe. There are many archeological sites throughout the Basin, but no central location of activities. As the Lake Tahoe Basin was developed, many of the old historic sites were destroyed.

The land use restrictions set by the various alternatives, except Alternative E (No Action), would preserve areas of high archeological potential from disturbance. Because most of the construction for the priority list erosion control projects will take place in currently urbanized areas, there should be few or no construction impacts on archeological or historic sites. Before construction of any erosion control facilities, the areas to be disturbed will be surveyed for archeological or historic resources. If any such resources are found, measures will be taken to preserve or recover them.

6. Aesthetic Impacts

Property owners in the Lake Tahoe Basin were surveyed in 1971 about their attitudes toward development. The three most popular activities reported were "fishing", "hiking", and "picnicking". The three greatest problems were "water pollution", "scenic destruction", and "too much commercialism". Two-thirds of the respondents objected to high density development, and 88 percent disapproved of highrise development, especially if visible from the Lake. Architectural controls in commercial and residential areas were favored by 96 percent and 84, percent respectively. Considering these attitudes, limitations on the extent of urbanization and the loss of forest lands would probably be seen as a beneficial aesthetic impact by most Basin residents. Protecting the water quality of Lake Tahoe and its tributaries would have a beneficial aesthetic impact. Increased growth of attached algae is detracting from the aesthetic appearance of near-shore waters. Preserving the deep blue color of the Lake Tahoe is essential to protecting the outstanding scenic values of the Basin.

Alternative C (Proposed Alternative) would control water pollution and limit scenic destruction. It would also have an impact on the extent of commercialism. The tighter controls under Alternative A (No Growth) and Alternative B (Strict Adherence to Land Capability), would provide further controls on scenic destruction caused by development. While Alternative D (Control Worst Problems) may not be adequate to protect water quality, it would provide a great deal of protection against water pollution and scenic destruction over what would occur under Alternative E (No Action). Alternative E would allow further encroachment of stream environment zones, permit construction of new subdivisions, and lead to greater deterioration of water quality.

Erosion and urban runoff control projects also affect Basin scenery. Revegetation of areas stripped of vegetation and stabilization of eroding slopes should have a positive visual impact. Revegetation will be accomplished using native plants in natural community compositions and densities, although some non-native grasses must be used to stabilize areas until native plants can take hold.

Retaining walls or rock-filled gabions will often be needed to stabilize oversteepened roadway slopes. These structures will use native rock, but still may not be aesthetically pleasing to some people. Eroding slopes, mud-covered roads, and silt-laden surface runoff are not aesthetically pleasing either, however, and the structures are needed to control erosion and water pollution. Detailed facilities planning for priority list projects will focus on means to minimize adverse aesthetic impacts.

Roadside drainage projects may also raise aesthetic concerns. Curbs and gutters are not considered attractive by some Basin residents and visitors because they affect the rustic atmosphere of the Basin. Eroding ditches and gullies cannot be considered attractive, however, and the roadside drainage projects are needed to correct these problems. In most cases, the drainage facilities can be altered in response to aesthetic objections without affecting surface runoff control. Aesthetic considerations will be taken into account in detailed facilities planning.

7. Short-Term Impacts of Erosion Control Project Construction

Short-term impacts of erosion control project construction include dust generation, noise, emissions from construction equipment, traffic and safety hazards, and temporary access restrictions. Mitigation measures for these impacts will be included in detailed planning of erosion control projects. These measures should include:

- sprinkling with water to hold down dust;
- proper mufflers on all construction equipment;
- sound barriers where necessary;
- emissions control devices on motorized equipment;
- traffic control measures;
- safety barriers with lights as needed;
- notification of landowners whose access may be temporarily blocked.

To prevent erosion during construction, erosion control projects will follow the same best management practices as are applied to other construction sites in the Basin.

The adverse impacts of erosion control project construction will be minor and of short duration. Many, such as noise and emissions from motorized equipment, will occur only while construction is underway. Revegetation will prevent long-term dust problems.

H. ENVIRONMENTAL CHECKLIST

The following environmental checklist summarizes the possible environmental impacts of implementing the Proposed Alternative (Alternative C). Explanations are provided for all "yes" or "maybe" answers.

YES	MAYBE	NO	
			1. Earth. Will the proposal result in:
		X	a. Unstable earth conditions or in changes in geologic substructures?
X			b. Disruptions, displacements, compaction or overcovering of the soil? • Proposed erosion and urban runoff control facilities will require earthmoving to install storm drains, gutters, and similar facilities.
X			c. Change in topography or ground surface relief features? • Some erosion control projects will include regrading of oversteepened roadway slopes to stable angles.
		X	d. The destruction, covering or modification of any unique geologic or physical features?
	X		e. Any increase in wind or water erosion of soils either on or off the site? • All erosion control projects will be carried out in accordance with best management practices to minimize the risk of erosion during project construction. Early storms could still result in some erosion from project sites. The long-term reduction in erosion from project sites far exceeds any short-term erosion which may occur during project construction.
		X	f. Changes in deposition or erosion of beach sands, or changes in siltation, deposition or erosion which may modify the channel of a river or stream of the bed of the ocean or any bay, inlet or lake?
		X	g. Exposure of people or property to geologic hazards such as earthquakes, landslides, mudslides, ground failure, or similar hazards?
			2. Air. Will the proposal result in:
		X	a. Substantial air emissions or deterioration of ambient air quality.

YES-MAYBE-NO

___ ___ X b. The creation of objectionable odors?

___ ___ X c. Alteration of air movement, moisture or temperature, or any change in climate, either locally or regionally?

3. Water. Will the proposal result in:

___ ___ X a. Changes in currents, or the course or direction of water movements, in either marine or fresh waters?

X ___ ___ b. Changes in absorption rates, drainage patterns or the rate and amount of surface water runoff?

- Many of the proposed erosion and surface runoff control measures will increase absorption of water by soil and plants and thus decrease the amount of storm runoff to levels closer to natural conditions. Some minor local alterations in drainage patterns will occur from installation of storm sewers to control urban runoff. Natural drainage courses will be used as much as possible.

X ___ ___ c. Alterations to the course or flow of flood waters?

- In some areas flood waters will be redirected by erosion and urban runoff control projects. Natural drainage courses will be maintained as much as possible.

___ ___ X d. Change in the amount of surface water in any water body?

X ___ ___ e. Discharge into surface waters, or in any alteration of surface water quality, including but not limited to temperature, dissolved oxygen or turbidity?

- Implementation of controls on erosion and surface runoff will reduce concentrations of suspended sediment and other pollutants in streams in the Lake Tahoe Basin.

___ ___ X f. Alteration of the direction or rate of flow of ground waters?

___ ___ X g. Change in the quantity of ground waters, either through direct additions or withdrawals, or through interception of an aquifier by cuts or excavations?

___ ___ X h. Substantial reduction in the amount of water otherwise available for public water supplies?

YES-MAYBE-NO

YES	MAYBE	NO	
		X	i. Exposure of people or property to water related hazards such as flooding or tidal waves?
			4. Plant Life. Will the proposal result in:
		X	a. Change in the diversity of species, or number of any species of plants (including trees, shrubs, grass, crops, microflora and aquatic plants)?
		X	b. Reduction of the numbers of any unique, rare or endangered species of plants?
		X	c. Introduction of new species of plants into an area, or in a barrier to the normal replenishment of existing species?
		X	d. Reduction in acreage of any agricultural crop?
			5. Animal Life. Will the proposal result in:
		X	a. Change in the diversity of species, or numbers of any species of animals (birds, land animals including reptiles, fish and shellfish, benthic organisms, insects or microfauna)?
		X	b. Reduction of the numbers of any unique, rare or endangered species of animals?
		X	c. Introduction of new species of animals into an area, or result in a barrier to the migration or movement of animals?
		X	d. Deterioration to existing fish or wildlife habitat?
			6. Noise. Will the proposal result in:
X			a. Increases in existing noise levels? • During construction of erosion and surface runoff projects people in the immediate area of the projects will experience increased noise levels. Once construction is completed, there will be no noise from the facilities.
		X	b. Exposure of people to severe noise levels?

YES-MAYBE-NO

___ ___ X 7. Light and Glare. Will the proposal produce new light and glare?

X ___ ___ 8. Land Use. Will the proposal result in substantial alteration of the present or planned land use of an area?

- Implementation of the plan will restrict further urbanization of the Lake Tahoe Basin which would be allowed under existing land use ordinances. Restrictions on growth within the Basin may increase growth pressures in adjacent areas, resulting in a conversion of range and forest land to housing and urban development.

9. Natural Resources. Will the proposal result in:

___ ___ X a. Increase in the rate of use of any natural resources?

___ ___ X b. Substantial depletion of any nonrenewable natural resource?

___ ___ X 10. Risk of Upset. Does the proposal involve a risk of an explosion or the release of hazardous substances (including, but not limited to, oil, pesticides, chemicals or radiation) in the event of an accident or upset conditions?

X ___ ___ 11. Population. Will the proposal alter the location, distribution, density, or growth rate of the human population of an area?

- The plan would restrict urbanization in the Lake Tahoe Basin to existing urban areas, and may lead to an increase in occupancy rates. It is also possible that some spillover of population into adjacent areas may occur. The greatest single factor in determining the amount of spillover will be the extent of casino expansion and the resulting increase in employment in gaming and related services.

___ ___ X 12. Housing. Will the proposal affect existing housing, or create a demand for additional housing?

YES-MAYBE-NO

13. Transportation/Circulation. Will the proposal result in:

___ ___ X a. Generation of substantial additional vehicular movement?

___ ___ X b. Effects on existing parking facilities, or demand for new parking?

___ ___ X c. Substantial impact upon existing transportation systems?

___ ___ X d. Alterations to present patterns of circulation or movement of people and/or goods?

___ ___ X e. Alterations to waterborne, rail or air traffic?

X ___ ___ f. Increase in traffic hazards to motor vehicles, bicyclists or pedestrians?

- During construction of erosion control projects the presence of construction vehicles, safety barriers, and the like may pose some increased hazard to motor vehicles, pedestrians, and bicyclists. All projects will follow any necessary safety practices in order to minimize this hazard. Once construction is complete, the facilities will not pose any hazard.

14. Public Services. Will the proposal have an effect upon, or result in a need for new or altered governmental services in any of the following areas:

___ ___ X a. Fire protection?

___ ___ X b. Police protection?

___ ___ X c. Schools?

___ ___ X d. Parks or other recreational facilities?

___ X ___ e. Maintenance of public facilities, including roads?

- Maintenance of most erosion control facilities will be the responsibility of local government. Little maintenance will be required, however, and the facilities will reduce other road maintenance costs.

___ ___ X f. Other governmental services?

YES-MAYBE-NO

15. Energy. Will the proposal result in:

YES	MAYBE	NO	
X			a. Use of substantial amounts of fuel or energy? • Construction of erosion and surface runoff control projects will require use of fuel for construction equipment. These fuel requirements will be less than would be required to construct and serve the development prevented by restrictions on development set under the plan. Energy and fuel requirements for maintenance of erosion and surface runoff control projects will be small.
		X	b. Substantial increase in demand upon existing sources of energy, or require the development of new sources of energy?

16. Utilities. Will the proposal result in a need for new systems, or substantial alterations to the following utilities:

YES	MAYBE	NO	
		X	a. Power or natural gas?
		X	b. Communication systems?
		X	c. Water?
		X	d. Sewer or septic tanks?
X			e. Storm water drainage? • Proposed erosion and urban runoff projects include storm drainage facilities.
		X	f. Solid waste and disposal?

17. Human Health. Will the proposal result in:

YES	MAYBE	NO	
		X	a. Creation of any health hazard or potential health hazard (excluding mental health)?
		X	b. Exposure of people to potential health hazards?

YES	MAYBE	NO	
		X	18. Aesthetics. Will the proposal result in the obstruction of any scenic vista or view open to the public, or will the proposal result in the creation of an aesthetically offensive site open to public view?

YES-MAYBE-NO

___ ___ X 19. Recreation. Will the proposal result in an impact upon the quality or quantity of existing recreational opportunities?

___ ___ X 20. Archeological/Historical. Will the proposal result in an alteration of a significant archeological or historical site, structure, object or building?

21. Mandatory Findings of Significance.

___ ___ X a. Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?

___ ___ X b. Does the project have the potential to achieve short-term, to the disadvantage of long-term, environmental goals? (A short-term impact on the environment is one which occurs in a relatively brief, definitive period of time while long-term impacts will endure well into the future.)

___ ___ X c. Does the project have impacts which are individually limited, but cumulatively considerable? (A project may impact on two or more separate resources where the impact on each resource is relatively small, but where the effect of the total of those impacts on the environment is significant.)

___ ___ X d. Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?

Discussion of Environmental Evaluation. By far the most important environmental consequences of implementation of the Proposed Alternative (Alternative C) would be the prevention of adverse environmental impacts, especially further deterioration of water quality, which would occur if the plan is not implemented. By comparison, the environmental impacts caused by plan implementation are relatively minor. Feasible mitigation measures available to the State Water Resources Control Board, including best management practices to be followed during project construction, have been incorporated into the plan to minimize environmental impacts.

Plan implementation could result in adverse environmental impacts in areas adjacent to the Lake Tahoe Basin by increasing growth pressures. Alternatives which allow more growth in the Basin would reduce growth pressures outside the Basin, but the environmental damage from allowing increased growth in the Basin, especially increased water pollution from erosion, far outweighs the damage threatened by growth pressures outside the Basin. Feasible mitigation measures to limit the threat of a population spillover from the Basin include limits on casino expansion and zoning to protect sensitive lands. These measures are not within the authority of the State Board. Other agencies with authority are encouraged to adopt these measures.

Determination. Based on this initial evaluation, I find that there are no feasible alternatives or feasible mitigation measures available to the State Water Resources Control Board which would substantially lessen any significant adverse environmental impact of the proposed Lake Tahoe Basin Water Quality Plan. The proposed plan will not have any significant adverse environmental impacts for which such alternatives or mitigation measures are available but have not been incorporated. This determination is subject to revision based on comments on this draft.

Date January 4, 1980

CWhitney

Clinton L. Whitney
Executive Director

CHAPTER VI

INTERSTATE ISSUES

Activities on both sides of Lake Tahoe affect water quality. California, Nevada, and the federal government have recognized the need for basinwide controls to prevent further deterioration of water quality. At the same time, each state must bear responsibility for sources of pollution within its control. Water quality control measures should be implemented in both states, but failure of either state to implement adequate controls cannot excuse the other from doing what it can to control pollution of Lake Tahoe.

Implementation of this water quality plan (Alternative C) on the California side will reduce total sediment generation and the associated nutrient loads on Lake Tahoe. Nevada may or may not be willing to set controls as strong as those proposed here, but almost certainly can be expected to take some action to control erosion and surface runoff problems in the Lake Tahoe Basin. Nevada already is constructing some of the erosion and urban runoff control projects called for in this plan. A recent statewide public opinion poll conducted for the League to Save Lake Tahoe found that the vast majority of Nevada residents favor strengthening environmental controls to protect Lake Tahoe. Even if Nevada were to take no action, however, and there were a net increase in sediment generation in Nevada, implementation of the proposed water quality plan in California and on National Forest lands could reduce total sediment generation in the Lake Tahoe Basin by over ten percent. If the water quality plan is implemented in both states, a total reduction in sediment generation of nearly 40 percent is possible. The reduction in sediment generation reflects a comparable reduction in nutrient loadings on Lake Tahoe.

A. 208 PLANNING

In an effort to establish a unified program to protect water quality, Nevada and California jointly designated the Tahoe Regional Planning Agency as the agency responsible for preparing a water quality plan (208 plan) for the Lake Tahoe Basin. Instead of adopting a plan to implement the basinwide controls needed to protect the Lake, the Tahoe Regional Planning Agency adopted a plan that would not achieve effective controls on either side of the Lake. In the absence of effective action by local government or the Tahoe Regional Planning Agency, the states and the Environmental Protection Agency now must assume the responsibility of ensuring that the plan meets the requirements of the Clean Water Act.

1. The Tahoe Regional Planning Agency Plan

The 208 plan approved by the Tahoe Regional Planning Agency in 1978 identifies water quality problems, but fails to provide for implementation of the necessary control measures. The need for erosion and urban runoff control projects is identified, and the necessary projects are listed, but the plan lacks adequate commitments from state or local agencies to implement these projects. The need for systems to control on-site surface runoff problems is identified, but site owners are not required to install these systems except as part of projects to modify or expand the sites. The threat to water quality from future development, especially development in high erosion hazard lands and stream environment zones, is recognized, but development in these areas still is permitted. Table VI-1 compares the Tahoe Regional Planning Agency plan with the 208 plan proposed here (Alternative C).

If the State Water Resources Control Board were to accept the Tahoe Regional Planning Agency's plan, the effect on water quality would not be significantly improved over the No Action Alternative (Alternative E) discussed in Chapter V. Instead of achieving the reduction in sediment and nutrient loads necessary to prevent further deterioration of the Lake, the plan would allow an increase in the loads of over 30 percent. Accordingly, the State Board rejected the Tahoe Regional Planning Agency plan for failure to meet the water quality needs of the Lake Tahoe Basin.

The State Board also found that the Tahoe Regional Planning Agency has not exercised the strong environmental controls needed to protect the Lake. The State Board therefore revoked the bi-state agency's designation as the 208 planning agency. Nevertheless, in an effort to obtain implementation of control measures on both sides of the Lake, it is proposed that the bi-state agency be given another chance to submit an acceptable plan.

Based on public comments received on this draft 208 plan, a final plan will be prepared and adopted by the State Water Resources Control Board. The final 208 plan shall not take effect, however, if the Tahoe Regional Planning Agency submits a plan which provides for implementation of adequate control measures. When it adopts the final 208 plan, the State Board will adopt a detailed list of the conditions necessary for approval of an alternative plan submitted by the Tahoe Regional Planning Agency. To provide the agency with an opportunity to meet these conditions, the plan adopted by the State Board would not become effective until after a specified period. If the Tahoe Regional Planning Agency submits a plan which meets these conditions, the State Board can approve the agency's plan and restore the agency's designation as 208 planning agency for the Lake Tahoe Basin.

2. Environmental Protection Agency Review

After the State Board approves a 208 plan for the Lake Tahoe Basin, the plan will be subject to review and approval by the Environmental Protection Agency. If the Tahoe Regional Planning Agency fails to submit an acceptable plan, and the State Board's 208 plan takes effect, the Environmental Protection Agency will be faced with far different plans for the two sides of the Lake. Nevada has conditionally approved the 208 plan submitted by the Tahoe Regional Planning Agency in 1978.

TABLE VI–1

COMPARISON of TAHOE REGIONAL PLANNING AGENCY
and STATE WATER RESOURCES CONTROL BOARD 208 PLANS

PLAN ELEMENT	TAHOE REGIONAL PLANNING AGENCY	STATE WATER RESOURCES CONTROL BOARD (Proposed Alternative)
Erosion and urban runoff problems.	Erosion and urban runoff control projects. No regulatory program or specific commitment of funds to implement projects.	Erosion and urban runoff control projects. Regulatory program to require implementation of projects. $10 million in state bond funds committed.
Runoff problems from current uses (on-site runoff problems and problems on private forest lands).	Problem sites identified: runoff management systems and operating practices proposed. Control measures required only when site modification or expansion is proposed.	Problem sites identified; runoff management systems and operating practices proposed. Control measures required at all sites.
New subdivisions.	No zoning changes adopted; new subdivisions permitted on all lands zoned for urban use.	New subdivisions prohibited.
Stream environment zone encroachment.	New construction required to follow best management practices. Further study of possible zoning changes for unsubdivided lands in stream environment zones which are zoned for urban use.	New construction in stream environment zones prohibited.
High erosion hazard land development.	New construction required to follow best management practices. Further study of possible zoning changes for unsubdivided lands on high erosion hazard land which are zoned for urban use.	New construction on high erosion hazard lands prohibited.
Excess coverage (excessive area of impervious surface created by new construction).	No coverage limits adopted beyond limits set by existing land use ordinances.	Coverage limits set by land capability system applied to every lot.
National Forest Lands.	Forest Service implements necessary control measures.	Forest Service implements necessary control measures.

The Environmental Protection Agency should not approve the Nevada plan unless it is substantially strengthened. The Nevada plan lacks implementation commitments to control existing erosion problems, and does not include the development controls needed to prevent future problems. Acceptance of the Nevada plan would be completely inconsistent with the mandates of the Clean Water Act. Moreover, the Tahoe Regional Planning Agency has not met the conditions set by Nevada when the state approved the plan. The Environmental Protection Agency should require Nevada to revise the 208 plan and include control measures comparable to those in this plan.

Both the Nevada plan and this plan address water quality problems and control needs on both sides of the Lake Tahoe Basin, but neither can be considered an adequate 208 plan for the entire Basin. The control measures set by Nevada are inadequate, and the State Water Resources Control Board lacks the ability to implement control measures outside of California. Even so, the Environmental Protection Agency is not required to wait for Nevada to revise its plan before acting on the State Board's 208 plan. In reviewing any 208 plan, the Environmental Protection Agency can approve some provisions while rejecting others. This plan proposes control measures consistent with the objectives of the Clean Water Act, and will include a commitment to implement these controls on the California side of the Lake when it is adopted as a final 208 plan by the State Board. The Environmental Protection Agency should accept the State Board's plan as the provisions of the Lake Tahoe 208 plan applicable in California.

Ideally, the same water quality control measures would be implemented in Nevada as in California, but the Environmental Protection Agency should not sacrifice water quality protection in the interest of uniformity. By approving the State Board's 208 plan, and supporting its implementation, the Environmental Protection Agency can assure major progress in controlling pollution of Lake Tahoe. The Environmental Protection Agency can continue efforts to obtain an adequate plan from Nevada while the California plan is being implemented.

3. Interim Control

California state law requires preparation of water quality plans. The plans must set water quality objectives, and establish a program of implementation for achieving those objectives. Water quality plans usually are prepared by the Regional Water Quality Control Boards, subject to review and approval by the State Water Resources Control Board. In some cases, the State Board prepares the plans.

It is hoped that the Environmental Protection Agency will promptly approve the State Board's 208 plan. Environmental Protection Agency approval is required for a 208 plan to become effective under the federal Clean Water Act. To prevent any undue delay before the state begins implementing the measures needed to protect Lake Tahoe, the

State Board will adopt this plan both as the 208 plan for the Lake Tahoe Basin and as the water quality plan for the Basin required under state law. The State Board will implement controls pursuant to state law pending approval of the plan by the Environmental Protection Agency.

Other agencies may also adopt interim controls. It may be especially important to adopt interim controls on stream environment zone encroachment, construction on high erosion hazard lands, and other poor development practices, to prevent irreversible damage before this plan is approved.

B. GROWTH PRESSURES IN NEVADA CAUSED BY CONTROLS IN CALIFORNIA

If the development restrictions called for as part of this plan are implemented in California only, increased growth pressures could be expected on the Nevada side of the Lake. While the rate of growth might increase, however, the ultimate level of development would be the same.

Even if California adopts no development restrictions beyond those currently in force, there will be sufficient demand for development in Nevada to expect buildout of all areas where residential or commercial construction is permitted. However, the extent of development possible in Nevada is limited by Tahoe Regional Planning Agency zoning. Potential growth is also constrained by public ownership of over half of the land on the Nevada side of the Basin. More land purchases by the Forest Service are expected.

Although the Tahoe Regional Planning Agency grants some zoning changes, it is unlikely that the Agency will make extensive changes in its land use ordinance to allow development beyond that currently allowed under the ordinance. If the bi-state agency is abolished, its rules and ordinances will continue in force as the rules and ordinances of a strengthened Nevada Tahoe Regional Planning Agency.

Thus, there is no reason to delay implementation of water quality control measures in California pending adoption of similar controls in Nevada. Pollution controls in California will result in net reduction of pollution of the Lake, rather than a relocation of pollution sources to the Nevada side. Development may occur more rapidly in Nevada, but the ultimate level of development, and the resulting nutrient and sediment loads, will not be significantly different. California should encourage measures to prevent the pollution of Lake Tahoe threatened by additional development in Nevada, but the threat is the same regardless of the controls in force in California.

C. EFFORTS BY CALIFORNIA TO CONTROL POLLUTION IN NEVADA

The State Water Resources Control Board will seek to influence Nevada to adopt the controls needed to solve erosion and surface runoff problems on the Nevada side of the Basin. For the most part, this effort will depend on persuasion and on the example California sets by implementing contols on the California side of the Lake. To date, neither state has adopted the strict controls needed to protect Lake Tahoe water quality. If California is willing to act, Nevada may be too.

In some cases, the authority of the Environmental Protection Agency under the Clean Water Act may be used to control pollution affecting Lake Tahoe. If the Environmental Protection Agency determines that a discharge in one state might affect water quality in a neighboring state, the Agency must notify the neighboring state. If the neighboring state objects to issuance of the permit, and the Agency determines that the discharge may not meet any water quality requirement of the neighboring state, the permit cannot be issued unless conditions are set ensuring compliance with the requirement. Among the activities requiring permits under the Clean Water Act are storm sewer permits and construction or filling in streams and wetlands. If the State Water Resources Control Board objects to a storm sewer permit to be issued in Nevada, the Environmental Protection Agency can require that the permit contain conditions adequate to preserve the water quality of Lake Tahoe. The Environmental Protection Agency may also prevent issuance of permits for activities encroaching on stream environment zones.

The Clean Water Act and the federal common law of nuisance also make it possible for a state to bring suit directly against persons in another state causing pollution of interstate waters. Citizen suits may be brought by a state or by private citizens to enforce the permit requirements of the Clean Water Act. Common law nuisance actions may be brought against any source of interstate water pollution, whether or not a permit is required.

For the most part, however, the State Water Resources Control Board will concentrate on implementation of this plan in California, where it has direct responsibility for water pollution control. Implementing controls in California will also increase the likelihood of success in any actions brought against sources of pollution in Nevada. As the United States Supreme Court observed in a common law nuisance suit involving pollution of Lake Michigan:

> "While federal law governs, consideration of state standards may be relevant. Thus a State with high water quality standards may well ask that it not be compelled to lower itself to the more degrading standards of a neighbor."

By its example in implementing water pollution controls in California, the State Water Resources Control Board will also create pressure for Nevada to adopt strict controls.

D. CASINO EXPANSION

Roughly one-third of the visitors to the Basin are attracted primarily by the entertainment and gaming offered at Nevada casinos. Job opportunities generated by the casinos -- casino employment and related service employment -- account for half of the permanent population of the Lake Tahoe Basin. A major portion of the water pollution in the Basin, therefore, can be attributed to the highway, residential and commercial development required to serve casino visitors and employees.

Further expansion of casino development can be expected unless Nevada or the federal government promptly intervenes. In the absence of effective controls on development practices which cause water pollution, the growth generated by this casino expansion will cause a significant worsening of water quality problems in the Basin.

1. Expansion Potential

There are six casinos on the north shore of Lake Tahoe, and eight casinos on the south shore. While the north and south shore have about the same number of casinos, the casinos are larger and the level of activity is greater on the south shore. In 1974 south shore casinos had 13.8 million visitors, while patronage at north shore casinos was only 1.8 million.

A 1977 Tahoe Regional Planning Agency Report, Impacts of Potential Hotel/Casino Expansion at Lake Tahoe, assessed the potential for casino expansion in the Lake Tahoe Basin. The report found that four casino developments which had already been approved, Harvey's expansion, Park Tahoe, Hotel Oliver, and Tahoe Palace, would double the casino floor area and casino employees at the south shore. One of these four, the Park Tahoe, has since been completed. Congress has appropriated funds for the purchase of the Tahoe Palace site, and Douglas County is negotiating for the purchase of the Hotel Oliver site.

The report also assessed the potential for major new casino construction on land zoned for gaming facilities in 1968. The Tahoe Regional Planning Compact requires the Tahoe Regional Planning Agency to permit gaming on any land zoned for gaming as of February 5, 1968. Based on the number of sites large enough to construct a major casino, the report found that fifteen new casino projects might reasonably be expected at some time in the future. Table VI-2 sets forth the number of existing casinos and potential casinos identified. In assessing possible additional casino construction, the report considers only the potential for construction of major casinos on sites which are not occupied by other commercial structures.

TABLE VI–2

LAKE TAHOE BASIN CASINOS

	EXISTING (MAJOR and MINOR)	APPROVED (MAJOR)	POTENTIAL (MAJOR)	TOTAL
NORTH SHORE	6	0	8	14
CRYSTAL BAY (state line)	5	0	1	7
INCLINE VILLAGE	1	0	7	8
SOUTH SHORE	8*	2**	7	17
TOTAL	14*	2**	15	31

* Includes Park Tahoe

** Does not include Park Tahoe or Harvey's expansion

Internal expansion of existing casinos can also be expected through conversion of hotel and casino areas currently not used for gaming to casino floor space. Figure VI-1 illustrates the extent of casino expansion at major south shore casinos between 1971 and 1978. Internal expansion of the six major casinos on the south shore exceeded the expansion resulting from construction of the Park Tahoe facility.

2. Growth Induced by Casino Expansion

The Tahoe Regional Planning Agency report predicts the increases in population and additional automobile trips generated as a result of additional casinos. The report found that the four approved casino additions would add 12,140 new employees, 7,100 gaming employees and an in increase in service employment of 4,970 employees, representing 8,620 new households and 24,140 new residents. The report estimated that during August, the peak month, the casino additions would generate 44,345 vehicle trips per day, an increase of 128 percent over the traffic generated by existing south shore casinos.

The report also estimated the population growth and vehicle trips generated by a new casino typical of the fifteen potential new casinos.

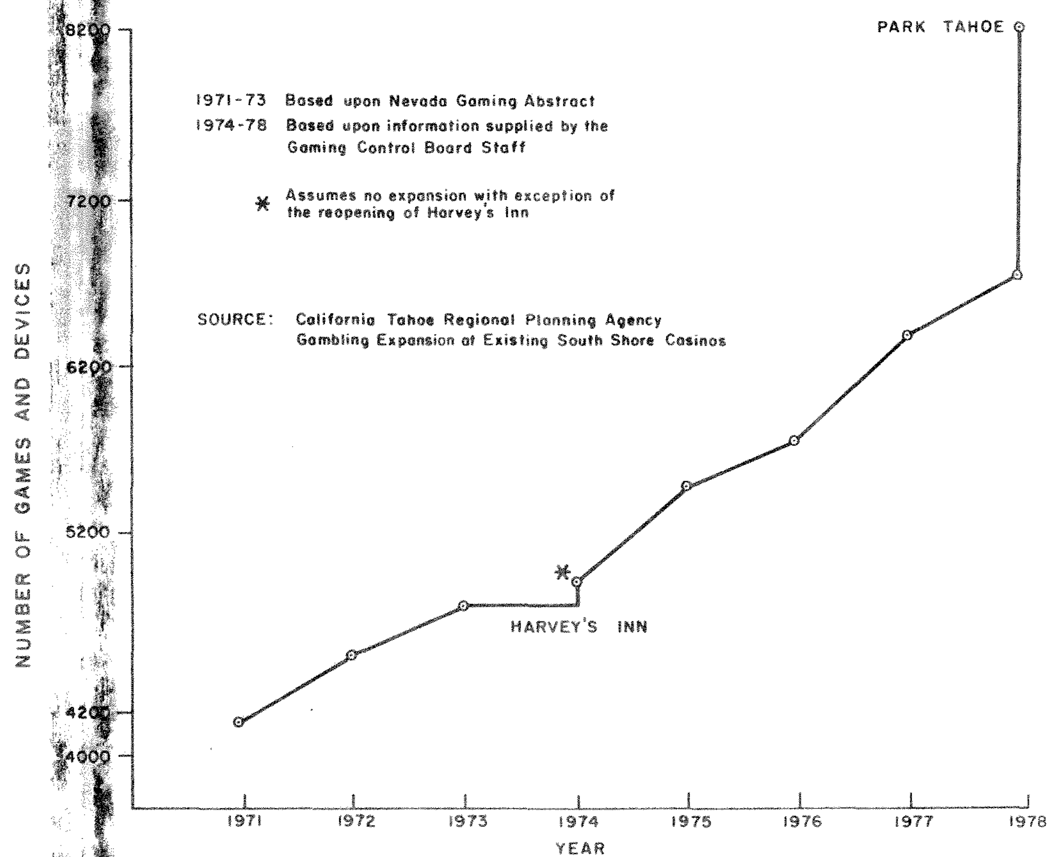
The typical new casino would create about 2,550 new jobs, adding 1,820 new households and increasing the resident population by 5,000 people. This increase would be about one-sixth of the 1974 resident population at the south shore, or one-third of the 1974 resident population at the north shore. The typical new casino would generate about 11,000 vehicle trips per day.

3. Social and Environmental Impacts

The development needed to serve the increases in resident and visitor populations generated by casino expansion poses a serious threat to the water quality of Lake Tahoe. Implementation of the development restrictions called for in this plan, prohibiting development on environmentally sensitive lands, in excess of land capability, or outside existing subdivisions, could prevent most water quality problems. If controls are implemented on the California side only, however, water quality problems threatened by development in Nevada will not be prevented. About three-quarters of the gaming and service employees working in the south shore Nevada casino core live in California, and most of the hotel and motel units serving casino visitors are in California, but the pattern could change. The increased traffic generated by casino expansion would also cause water quality problems, including degraded runoff from areas of intensive vehicular use.

The vehicle trips generated by the four approved casino additions represent a 56 percent increase in total traffic in the south shore state line area. Traffic along the Highway 50 corridor already

Figure VI–1



EXPANSION AT SOUTH SHORE CASINOS

exceeds the highway's capacity, causing extended traffic jams. Assuming continuation of the current pattern by which 72 percent of all vehicle trips to the casino area originate in California, traffic volume on Highway 50 west of the state line would increase by 70 percent. Highway 50 traffic near Kingsbury grade on the Nevada side would increase by 37 percent. The Tahoe Regional Planning Agency report estimates that ten additional traffic lanes in California and six additional lanes in Nevada would be needed for these traffic volumes. The seven potential major new south shore casinos identified by the report would add even more traffic than the four approved additions. New casino construction on the north shore would also exceed the capacity of the transportation system. The Highway 28 corridor at Crystal Bay is near capacity, and construction of additional lanes will not be possible.

The Tahoe Regional Planning Agency report notes that over the past ten to fifteen years Tahoe area developers have catered to the second home market, and that the trend is likely to continue. The additional population brought to the Lake Tahoe Basin as a result of casino expansion would worsen the current shortage of low income housing. About half of the new units required would be for low income families. The additional housing demand, coupled with the short supply, would result in higher occupancy of existing units, and a possible spillover of development to areas outside the Basin. As occupancy increases, water use would also increase, as would demands for public services.

Measures directed at the problems created by casino expansion could have their own adverse impacts. It may be possible to handle some of the additional traffic by building new roads, but not without serious adverse environmental impacts, especially on water quality. In short, the Lake Tahoe Basin does not have the capacity to accommodate additional casino development. Casino expansion, including approved but unbuilt casinos and internal expansion of existing casinos, should not be allowed. Primary responsibility to control casino expansion rests with the State of Nevada. If Nevada fails to act, federal legislation will be required.

CHAPTER VII

CONCLUSION

Lake Tahoe is an outstanding national resource. The exceptional clarity and purity of the waters of the Lake are priceless as both a scientific and a scenic treasure.

Federal law requires that the high quality of the Lake be maintained. For most waters of higher quality than necessary to support fish, wildlife, and recreation, lower water quality may be allowed if social and economic considerations outweigh the value of maintaining higher quality water. No degradation is allowed, however, for waters of exceptional recreational or ecological significance.

Development practices in the Lake Tahoe Basin have caused a deterioration of water quality, and further deterioration is threatened. Algal productivity in the Lake has doubled over the past twenty years, and there has been an increase in the growth of attached algae in nearshore waters.

This draft plan, prepared pursuant to Section 208 of the Clean Water Act, identifies the control measures needed to stop deterioration of the Lake. To prevent further increases in algal productivity, which will lead to changes in color and clarity of the Lake, the total loadings of nutrients to the Lake must be reduced to well below present levels. The principal source of this pollution is erosion. Control measures are needed for existing erosion problems and to prevent development which will cause erosion problems in the future. These measures include:

- Revegetation, slope stabilization, road surfacing and drainage projects costing $95 million;

- Best management practices for areas with on-site surface runoff problems;

- Strict controls on development, including prohibitions against new subdivisions, construction in stream environment zones or on high erosion hazard lands, or land disturbance in excess of land capability;

- Best management practices to control erosion from forest lands.

Together, these measures can preserve the water quality of Lake Tahoe.

Most of the other environmental impacts of these control measures are positive. Restrictions on development will protect scenic areas and wildlife habitat. Erosion control projects will restore native vegetation. These projects will cause some short-term disturbance, but in the long run will greatly reduce erosion.

Development around Lake Tahoe is rapidly approaching and in some respects has already exceeded the carrying capacity of the Basin. Traffic volumes exceed highway capacity in the most congested areas. New road construction would cause serious water pollution problems. Air quality does not meet state or federal standards. Water quality control measures which restrict development in the Basin will also help alleviate other environmental problems.

Protecting the water quality of Lake Tahoe is essential to maintaining the economic viability of the Lake Tahoe Basin as a scenic resort area, but the control measures needed to protect the Lake will also create economic hardships. Fewer construction jobs will be created by erosion control projects than would be generated by unrestricted development, although construction employment will decline in any event as available land is exhausted. The most serious economic hardship will be the decline in the value of property which cannot be used for residential or commercial construction as a result of the restrictions on development needed to protect water quality.

In addition to the Proposed Alternative, four other alternatives are considered. Two set stricter controls; two set weaker controls. The two weaker alternatives would impose fewer economic hardships, but would not prevent further deterioration of water quality. The Clean Water Act does not permit the State Water Resources Control Board to allow deterioration of Lake Tahoe on the basis of social and economic considerations.

While the State Board may not allow further deterioration of Lake Tahoe water quality, the Clean Water Act does not require the State Board to go beyond the controls necessary to maintain the existing quality of the Lake. Social and economic factors should be considered in deciding whether to adopt controls which are stricter than is necessary to maintain water quality. The two stricter alternatives would provide further reductions in nutrient and sediment loads, but the difference in total loadings between these two alternatives and the Proposed Alternative is small. The slightly higher loadings under the Proposed Alternative will not prevent attainment of the federal nondegradation standard. The stricter alternatives would provide an additional margin of safety. They could also further any later efforts to restore water quality, reversing some of the deterioration which already has occurred. In addition, the stricter alternatives would help prevent further traffic congestion, help reduce air pollution, and preserve more open space than the Proposed Alternative. But the stricter alternatives would have a greater economic impact on property owners in the Lake Tahoe Basin. In the absence of a land purchase program to buy the lots where development would be prohibited, it is not recommended that the development restrictions set by this plan go beyond those needed to prevent further deterioration of water quality.

Several federal, regional, state and local agencies can help implement this water quality plan. Local government, the Tahoe Regional Planning Agency, and the California Tahoe Regional Planning Agency can adopt regulatory programs to control most existing and threatened water pollution problems. The Forest Service can implement controls on National Forest lands. These agencies and others with authority to carry out or enforce water quality control measures are encouraged to help implement the plan.

Some of the implementation measures proposed in this draft would require legislation. Existing programs can provide money for many of the erosion control projects needed in the Basin, but new sources of funds may also be required. The ideal solution to the threat of erosion and stream environment zone encroachment from further development is the creation of a land acquisition program. Land purchases could prevent water pollution while eliminating the hardship on lot owners caused by prohibitions on development. The State Water Resources Control Board strongly supports legislation to provide for the purchase of all lots which cannot be developed without violating the development restrictions called for by this plan.

While other agencies may play a major role, and it is hoped that the legislation proposed in this plan is enacted, the State Water Resources Control Board must accept ultimate responsibility for assuring that the plan is implemented. The Legislature has designated the State Board as the agency responsible for carrying out the mandates of the Clean Water Act in California, as well as for formulating and adopting state water quality control policy. If other agencies fail to implement controls, the State Board must use the authority vested in it by the Legislature to assure that water quality is protected. Additional legislation may be desirable, but the hope that it may be adopted cannot excuse a failure to implement the controls that can be enforced using existing authority. Nevada should assume equal responsibility to implement water pollution controls, but the State Board has a responsibility to do what it can to protect Lake Tahoe regardless of the course Nevada follows. The Legislature has given the State Board the authority needed to order cleanup of existing pollution problems, and to prevent any further development which threatens to cause pollution. Bond funds administered by the State Water Resources Control Board can pay for a major portion of the erosion control projects called for in this plan.

Implementation of the Proposed Alternative in both California and Nevada would assure that the outstanding water quality of Lake Tahoe is preserved. Implementation in California alone, without implementation in Nevada, would still reduce the total nutrient and sediment loads reaching Lake Tahoe, although not enough to prevent any further deterioration of water quality. Accordingly, the State Board should adopt the Proposed Alternative. When it adopts the Proposed Alternative, as a final water quality plan, the State Board should offer the Tahoe Regional Planning Agency another chance to adopt an adequate plan. If the bi-state agency fails to adopt an adequate plan, the plan adopted by the State Board will take effect in California, and the State Board will assure the plan is implemented.

Implementation of this plan will require both strict regulatory controls and a major commitment of public funds, but that is what is required to meet water quality standards. By implementing this water quality plan in California, the State Water Resources Control Board will meet its responsibility to prevent water quality deterioration. The State Board urges Nevada and the federal government to do their share, so that the extraordinary clarity and deep blue color of Lake Tahoe may be preserved.

APPENDIX A

NUTRIENT AND SEDIMENT MODEL

The concentration of pollutants in Lake Tahoe, as in other water bodies, is determined by the balance between sources and sinks. For a given pollutant, this balance can be expressed by the following relationship:

$$\text{Change of storage of Pollutant in Lake Tahoe} = \text{Mean Annual Input} - \text{Mean Annual Loss} \qquad \text{(equation 1)}$$

or as in equation 2 below:

$$(V-\Delta S)dC = Q_R C_R dt + Q_P C_P dt + Q_G C_G dt - VCKdt \qquad \text{(equation 2)}$$

where:

V = Lake Volume

ΔS = mean annual change in storage

C = pollutant concentration in Lake Tahoe at time t

dC = incremental change in pollutant concentration over time increment, dt

Q_R = mean annual surface runoff into Lake

C_R = mean concentration of pollutant in surface runoff

Q_P = mean annual precipitation on Lake surface

C_P = mean concentration of pollutant in precipitation

Q_G = mean annual groundwater inflow to Lake

C_G = mean concentration in pollutant in groundwater

K = annual percentage removal of pollutants from Lake including losses to atmosphere, sediments, outflow through the Lower Truckee River, and destructive processes within the Lake.

Since the mean annual change in storage is negligible, only 0.02 percent of the Lake's volume, the ΔS term can be ignored and equation 2 rewritten as:

$$VdC = (Q_R C_R + Q_P C_P + Q_G C_G)\ dt - VCKdt \qquad \text{(equation 3)}$$

Let:

$W = Q_R C_R + Q_P C_P + Q_G C_G$, the annual pollutant loading on the Lake

Then equation 3 becomes:

$$\frac{dC}{dt} = \frac{W}{V} - CK \qquad \text{(equation 4)}$$

Intergrating equation 4 yields:

$$C_t = \frac{W}{KV}(1-e^{-Kt}) + C_o e^{-Kt} \qquad \text{(equation 5)}$$

where:

C_t = nutrient concentration at time t

C_o = initial pollutant concentration at time, t = o

Equation 5 can be utilized to determine the concentration of a pollutant in the Lake at any time following a change in loading rate.

Letting "t" approach infinity, the ultimate (equilibrium) concentration of a substance in the Lake, C_u, is given by equation 6, below:

$$C_u = \frac{W}{KV} \qquad \text{(equation 6)}$$

Since the residence time of a pollutant in the Lake (R) = 1/K, equations 5 and 6 can be rewritten as follows:

$$C_t = \frac{RW}{V}(1 - e^{\frac{-t}{R}}) + C_o e^{\frac{-t}{R}} \qquad \text{(equation 7)}$$

$$C_u = \frac{RW}{V} \qquad \text{(equation 8)}$$

The use of equations 7 and 8 is based on the following assumptions:

1. All inputs of pollutants have been considered and quantified.
2. The annual rate of removal of a pollutant is a fixed fraction of the total amount of pollutant in the Lake.

APPENDIX B

SEDIMENT AND NUTRIENT YIELDS

Numerous factors, both natural and man-made, affect the rate at which any particular watershed will discharge nutrients and suspended sediment to Lake Tahoe. In order to determine the amounts of nutrients and sediments entering Lake Tahoe, the California State Water Resources Control Board conducted a study of the water quality of surface runoff. Other studies of the effects of urbanization on the water quality of Lake Tahoe have been conducted. These studies are summarized below.

State Board Study

Factors Affecting Sediment Yield -- Sediment from various watersheds in and around the Lake Tahoe Basin has been monitored by investigations during the last six years. Several studies have shown that the rate of suspended sediment yield (metric tons/hectare/year) is closely related to urbanization or soil disruption (Glancy, 1976; Brown, et al., 1973; White, 1978). Studies of the Incline Village area of Nevada have shown that urbanization has increased the rate of suspended sediment yield approximately 13 fold. A survey of 25 watersheds in and around the Lake Tahoe Basin has shown that, out of 48 independent variables describing these watersheds, four variables are most significant in describing the rate of suspended sediment yield. These are:

- watershed slope
- watershed elevation
- amount of highly erodible soil with low infiltration rates
- extent of watershed urbanization

Although bio-stimulatory substances such as nitrogen and phosphorus correlated most closely with other variables, the extent of watershed urbanization was almost always a factor.

A 1978 study by the State Board has shown that the amount of sediment production is related to the degree of urbanization and natural erodibility of a watershed (White, 1978). Two watersheds with approximately the same percentage of urbanization had widely variable sediment yield characteristics. One highly erodible watershed had the most highly erodible portion of the watershed developed. Suspended sediment production was observed to be over 100 fold above natural background levels. The other, less erodible watershed was developed only on the least sensitive areas. As a result, suspended sediment production was seen to increase only three to four fold over natural background levels.

Natural Rates of Suspended Sediment Yield -- In the Lake Tahoe Basin natural background levels of sediment production are extremely difficult to determine. Almost all watersheds have undergone some degree of lasting disturbance since the first white man set foot in the Basin 135 years ago. The Lake Tahoe Basin in its natural undisturbed state almost certainly did not have high rates of suspended sediment and nutrient production. Over geologic time, the Basin had the opportunity to become extremely stable. Only during cataclysmic runoff events would the undisturbed watersheds yield high amounts of sediment. In such undisturbed watersheds, runoff channels would be well defined and would have naturally eroded to basement rock or rubble to the extent they became naturally stabilized. Unless disrupted by some external force or cataclysmic event, such naturally stabilized watersheds would yield sediment at an extremely low rate. As an example, the 1978 State Board study revealed that a naturally stabilized and undisturbed yet potentially highly erodible portion of a watershed on the west shore would discharge approximately 0.035 metric tons/hectare/year in a normal year. In addition, a study of an undisturbed portion of the heavily forested Idaho granitic batholith revealed natural erosion rates of approximately 0.088 metric tons/hectare/year (Megehan, 1972). If such erosion rates were applied to the Lake Tahoe Basin as a whole (81,760 hectares), the annual basinwide suspended sediment yield would range from 2,800 to 7,200 metric tons/year. These levels should be considered the upper limit of natural background suspended sediment production since much of the land area of the Tahoe Basin is not highly erodible and is considerably more stable than the sample areas discussed above. The principal reasons that the waters of Lake Tahoe have remained so clear are extremely small watershed size and the low natural loadings of sediment and nutrients from the tributary watersheds.

Model for Predicting Suspended Sediment Yield -- Much of the Lake Tahoe Basin is no longer in a natural undisturbed state. As a result of urbanization, the Basin-wide levels of sediment and nutrient production are much higher than natural levels. Without an extensive monitoring program designed to cover all disturbed and remaining undisturbed areas of the Basin, a precise evaluation of natural and developed levels of total suspended sediment production cannot be made. Instead, a method was developed to estimate total Basin-wide suspended sediment production based upon a limited number of thoroughly evaluated watersheds. Relationships were sought which, based upon a small number of independent variables, would provide a reliable estimate of the monitored level of suspended sediment production. Watersheds selected for this evaluation were limited to those which had well developed estimates of annual suspended sediment production during a period with normal rainfall, usually 1973. The estimates of annual suspended sediment production had to be based upon a well correlated relationship between suspended sediment concentration and water discharge levels to produce an estimate of the total load of suspended sediment. Where monitoring programs measured total sediment, adjustments were made to account for bed load sediment contributions, which are generally estimated to be a relatively small portion (10%) of total sediment load. The watersheds which were selected for this analysis are listed in Table B-1.

TABLE B–1

LAKE TAHOE VICINITY WATERSHED AREAS
USED to DEVELOP a RELATIONSHIP
between ANNUAL SEDIMENT PRODUCTION, and LEVEL of DEVELOPMENT

WATERSHED	AREA (hectares)	DESCRIPTION	PERCENT DEVELOPED	Average Land Capability Class	Annual Sediment Yield (metric tons/ hectare/year	YEAR	SOURCE
1. Lonely Gulch Creek at Hwy 89	38	Developed portion of watershed only	30%	1.0	3.660	1973	White, 1978
2. Lonely Gulch Creek at Rubicon Bay	275	Total watershed	4%	1.0	0.536	1973	White, 1978
3. Lonely Gulch Creek above reservoir	237	Undeveloped portion of watershed only	0%	1.0	0.034	1973	White, 1978
4. Grass Lake Creek at Hwy 89	1,810	Undeveloped except for State Hwy 89	1%	1.0	0.100	1972–74	Kroll, 1976
5. Eagle Creek at Hwy 89	1,650	Undeveloped	0%	1.0	0.042	1972–74	Kroll, 1976
6. Meeks Creek at Hwy 89	2,090	Undeveloped except for jeep and hiking trails	0%	1.0	0.033	1972–74	Kroll, 1976
7. Quail Lake at Hwy 89	250	Undeveloped except for reservoir	0%	1.8	0.023	1972–74	Kroll, 1976
8. Dollar Creek at Hwy 27	280	Undeveloped except for reservoir	0%	4.3	0.019	1972–74	Kroll, 1976
9. Trout Creek at Hwy 50	10,460	Lower watershed heavily urbanized	6%	4.5	0.342 A/	1972–74	Kroll, 1976
10. Upper Truckee River at Hwy 50	14,190	Lower watershed	20%	4.0	1.37 A/	1972–74	Kroll, 1976
11. Ward Creek at Hwy 89	1,980	Lower watershed slightly subdivided with small ski area	1.1%	4.0	0.280 B/	1973	Leonard, 1978
12. West Martis Creek near Hwy 267	540	Most heavily developed portion of watershed	4.3%	5.0	0.289	1975	White, 1978
13. West Martis Creek near Hwy 267	980	Total watershed except East fork	2.4%	4.0	0.241	1975	White, 1978
14. First Creek	264	Undeveloped portion above urban area	0%	1.0	0.075 C/	1973	Glancy, 1976
15. First Creek	46	Developed portion near Lake	30%	2.67	3.03 C/	1973	Glancy, 1976
16. Wood Creek	404	Undeveloped portion above urban area	0%	1.0	0.043 C/	1973	Glancy, 1976
17. Wood Creek	122	Developed portion near Lake	30%	5.5	1.19 C/	1973	Glancy, 1976
18. Incline Creek	1,365	Undeveloped portion above urban area	0%	1.0	0.018 C/	1973	Glancy, 1976
19. Incline Creek	443	Developed portion	30%	4.13	0.670 C/	1973	Glancy, 1976

A/D Does not include the undeveloped land capability class 1a and 1c lands which were assumed to yield sediment at a rate of 0.038 tons/hectare/year. Includes only suspended sediment. Bed load estimates were subtracted.

B/ Does not include the "naturally" unstable portion of the Ward Creek watershed tributary to the South Fork above monitoring Station No. 2.

C/ Original data by Glancy has been reduced by 33% to account for bed load gravel and sediment transport. Other data sources do not include bed load.

The 19 watersheds or sub-watersheds which are listed in Table B-1 were evaluated to determine if a relationship exists between the land capabilities of each of the watersheds and suspended sediment production.

Each of the 19 watersheds or sub-watersheds listed in Table B-1 was evaluated to determine the average area-weighted land capability class, according to the following relationship:

$$ALCC = \sum_{L=1}^{7} \frac{(LCC_i) \cdot (AREA_i)}{AREA_T}$$

Where: ALCC = Average Land Capability Class

LCC_i = Land Capability Classes 1-7

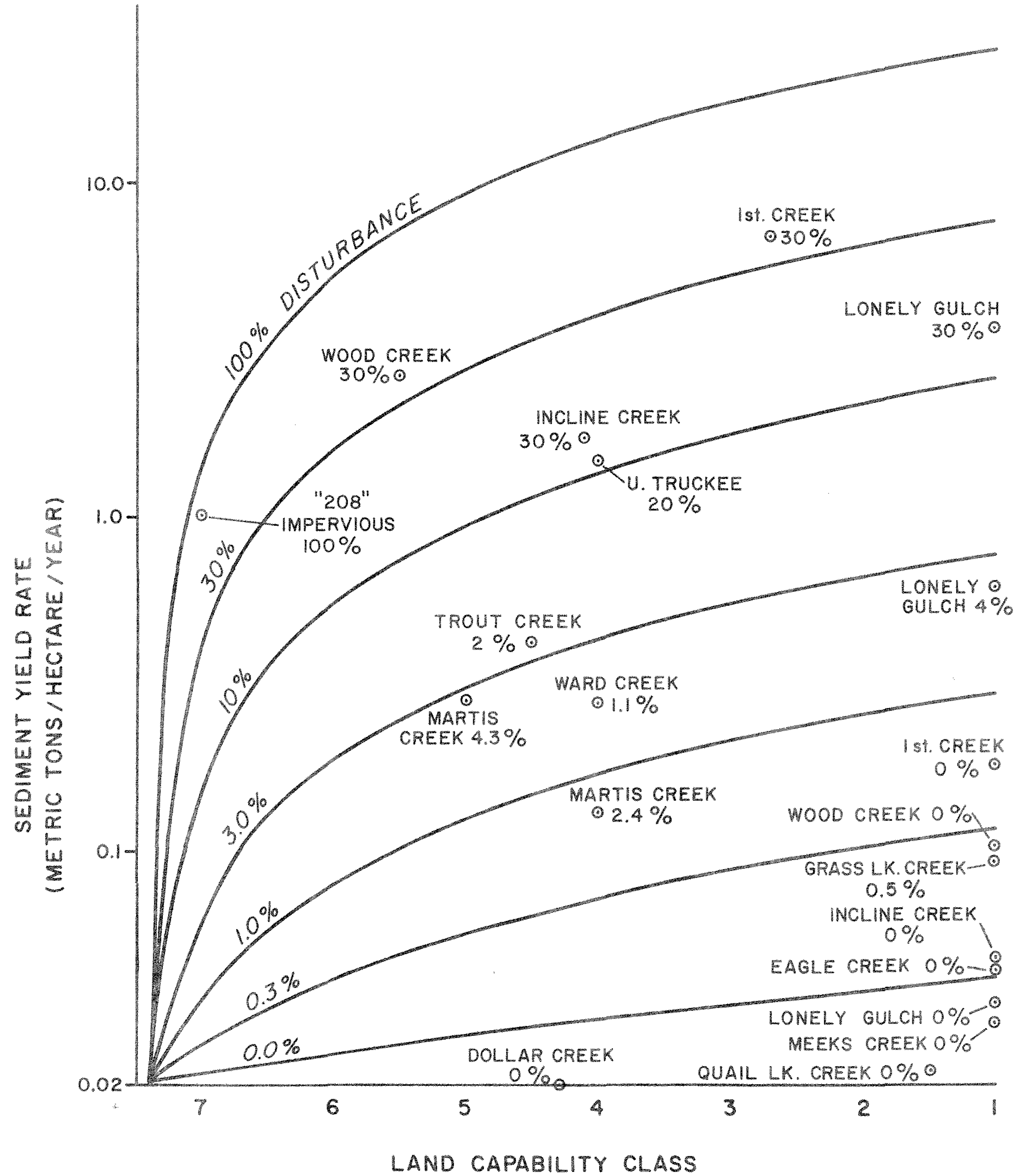
$AREA_i$ = Area of Land Capability Classes 1-7

$AREA_T$ = Total Area of the Watershed

The land capability system, developed by the United States Forest Service in cooperation with the Tahoe Regional Planning Agency, classifies land within the Basin on a scale of one to seven according to tolerance for development without sustaining permanent damage through erosion or other causes (Bailey, 1974). The system provides a single quantification of the several factors related to sediment production. It must be viewed, however, as a general, relative indication of the erosion potential of a given area. It can be very hard to locate land capability zone boundaries precisely. Furthermore, a proportional increase in land capability class does not necessarily imply a proportional decrease in erosion potential.

In addition to land capability class, the percent or degree of urbanization has also been selected as a factor to correlate with sediment production. Percent development means the percentage of a particular area that is either disturbed, unvegetated terrain, or impervious surface coverage. On this basis the two independent variables, average watershed land capability class and percent of watershed disturbed, were related to the annual average suspended sediment production rates from each of the watersheds listed in Table B-1. Figure B-1 depicts the points and the resultant nomograph which was derived from these data points. The overall relationship which appears to provide the "best fit" between the independent variables and suspended sediment production is:

FIGURE B-1



Sediment Yield Rate as a Function of Percent Disturbance and Land Capability Class for the Lake Tahoe Basin

$$SS = 0.0467 - 0.0037(LCC) + [0.2901 - 0.0395(LCC)] \cdot PD$$

Where: SS = Suspended Sediment Yield (metric tons/hectare/year)

LCC = Land Capability Class (1-7)

PD = Percent Disturbance

The land capability class is slightly modified in the above equation as follows:

Land Capability Class	LCC
1a	1
1b	7
1c	1
2	2
3	3
4	4
5	5
6	6
7	7

Land classes 2 through 7 retain their same value, and classes 1a and 1c both retain a value of 1, which reflects the steep, fragile and high erosion hazard characteristics of these lands. Land class 1b, poorly drained areas, has been assigned the value of 7 because low-lying marshy and poorly drained areas are assumed to have low sediment production rates similar to class 7 lands.

In addition to the evaluation of the 19 watersheds, an estimate of sediment production from 100 percent impervious surface coverage for capability class 7 lands in the south Tahoe area was also made. The average suspended sediment concentration from impervious surfaces collected as part of the sampling program for the Tahoe Regional Planning Agency's Draft 208 Plan was 160 mg/l for over 200 samples collected during the winter of 1974-75. Sampling sites included rooftop drainage, paved parking lots and paved roadway drainage on class 7 lands. By applying this concentration to the total mean annual precipitation of 75cm, assuming a 0.8 runoff coefficient, the annual rate of sediment yield from a 100 percent impervious surface on class 7 lands is 1,000 metric tons/ hectare/year on a mean annual basis.

Although based upon only 20 points, the equation is statistically valid and can be used to predict erosion rates with a suitable degree of confidence. The correlation coefficient and percent significance of the correlation are as follows:

$$R = 0.69$$

Percent Significance = 95%

The above equation can only be viewed as an extremely simple empirical formula describing the most probable relationship between suspended sediment production, land capability and amount of land disturbance. As percent disturbance (PD) in the above equation tends to zero, the equation becomes:

$$SS = 0.0467 - 0.0037 \, (LCC)$$

which provides an approximation of the suspended sediment production which occurs at natural, undeveloped background levels. When applied to the Lake Tahoe Basin at the following acreage levels, the natural suspended sediment production is found to be 3,100 metric tons/year:

Land Capability Class	Acres	Hectares
1a and 1c	129,800	52,530
1b	18,950	7,670
2	4,770	1,930
3	12,900	5,220
4	7,050	2,850
5	16,730	6,770
6	8,800	3,560
7	3,030	1,230
	202,030	81,760

The level of 3,100 metric tons/year is at the low end of the 2,800 to 7,600 metric tons/year range which was discussed earlier as an upper range based solely on high erosion potential lands on forested granitic terrain. A suspended sediment yield of 3,100 metric tons/year for the Basin, an average of 0.038 metric tons/hectare/year, is very low, but almost all undisturbed drainages in the Lake Tahoe Basin which have been sufficiently monitored have sedimentation rates on this order. They are:

	Watershed Area (hectares)	Sediment Rate (metric tons/hectare/year)
Lonely Gulch Creek	237	0.034
Eagle Creek	1,650	0.042
Meeks Creek	2,090	0.033
Quail Lake	250	0.023
Dollar Creek	280	0.019
First Creek	262	0.075
Wood Creek	404	0.043
Incline Creek	443	0.018
Area-weighted Average		0.036

The area-weighted average suspended sediment transport rate for these watersheds is 0.036 metric tons/hectare year which corresponds closely to the Basin-wide estimate of 0.038 metric tons/hectare/year. Although this average is lower than that estimated for the forested Idaho granitic batholith by Megehan (0.088 metric tons/hectare/year), the level of precipitation in the Tahoe Basin is lower. Erosion plot studies conducted by researchers from the University of California at Davis (Singer, unpublished) further substantiate the suspended sediment yields estimated here. The average erosion rate for Lake Tahoe Basin soils which had land capabilities ranging from 3 to 6 was 0.0023 metric tons/hectare/year. The highest single erosion rate, recorded for the Waca soil type with a land capability class of approximately 3, was 0.0307, slightly lower than the rates predicted here for overall suspended sediment transport from an undisturbed watershed.

Estimates of Suspended Sediment Production -- Based upon the equations given above, it is possible to estimate the level of suspended sediment production that has occurred or will occur due to development of the Lake Tahoe Basin. The estimated levels of suspended sediment production for the present level of development of the Lake Tahoe Basin and for potential future levels are listed in Table B-2. Estimates of suspended sediment production are given for buildout of the existing subdivided areas and further expansion which would include new subdivisions.

As shown in Table B-2, the State Water Resources Control Board model predicts the suspended sediment production at the present level of development to be 60,800 metric tons/year, which represents a 20-fold increase over the natural level of suspended sediment production. If development is allowed to occur according to the California Tahoe Regional Planning Agency Plan, the suspended sediment yield will increase to 70,500 metric tons/year at full buildout and 79,400 metric tons/year if further expansion is allowed. Under the Tahoe Regional Planning Agency Plan, the loads will increase to 72,000 metric tons/year at buildout and 83,900 metric tons/year if further expansion occurs.

The values given in Table B-2 should only be viewed as relative estimates of potential levels of suspended sediment generation which are likely to occur at various levels of development as based upon existing water quality data for average hydrologic conditions. These values were obtained by using the equation which predicts disturbance of a watershed to predict the urban sediment load. All stream environment zones were considered to be in land capability class 1b. This yields an artificially low value for suspended sediment loads from stream zones since class 1b lands typically have low erosion rates. Many stream environment zones occur on lands in other capability classes which produce greater amounts of sediment than class 1b lands.

To correct the low estimate of suspended sediment production from stream environment zones, the urban sediment load estimates from these areas were increased in proportion to the area of stream environment zones in land capability classes other than 1b. In California, this resulted in an increase in total estimated sediment yield of 1820 metric tons/year at present development

TABLE B-2

ESTIMATES SEDIMENT YIELD
WITHIN the LAKE TAHOE BASIN

DEVELOPMENT LEVEL	ESTIMATED SEDIMENT PRODUCTION Metric tons/year	
	BUILDOUT	EXPANSION
Natural Undeveloped Conditions	3,100	
Present Level of Development	60,800	
Full Development – CTRPA General Plan	70,500	79,400
Full Development – TRPA General Plan	72,000	83,900

levels. Nevada levels were increased by 1180 metric tons/year. An additional 5,530 metric tons/year was added to account for runoff from dirt roads on forest lands. The suspended sediment yield from these roads was calculated as follows:

	Miles	Acres	Land Capability	Sediment Yield
California	256	620	3.22	4,090
Nevada	64	155	1.55	1,440
Total	320	775	2.89	5,530

A very high percentage of forest roads are on high erosion hazard lands. The acreage estimates assume an average width of influence of 20 feet.

An additional load of 10,000 metric tons/year was added to account for forest land disturbances which are not reflected in the suspended sediment equation. For example, the suspended sediment equation does not account for the high sediment rates observed in the following watersheds due to the listed reasons:

- Blackwood Creek -- Extremely high stream bank erosion due to channelization of stream for quarry operations.

- South Fork Ward Creek -- Extremely high erosion rates from steep, unstable area probably due to early logging practices.

- Second and Third Creeks, Incline Village -- Extremely high rates due to destabilization of stream channels as a result of extremely high storm flows in 1965 and 1967, and possibly due to pre-urban logging activities.

Diffuse watershed disruption due to off-road vehicles and old logging areas will also contribute to suspended sediment production from forest lands. Suspended sediment sources in Ward Canyon, Blackwood Canyon and Incline Village, which have been monitored by various investigations, are estimated to yield an additional 3,000 metric tons per year, about 0.65 metric tons/hectare/year, above otherwise natural, undisturbed rates. Many other non-urbanized watershed areas which have not been monitored for water quality data may also have higher than natural background suspended sediment generation rates. Approximately 15,500 hectares are estimated to have the potential for higher than natural background sediment production rates.These areas are mostly on fragile la or lc lands on the north and east shores of the Lake Tahoe Basin. The majority of these lands were logged at one time, or have other visible signs of watershed disruption. On this basis, about 10,000 metric tons of suspended sediment per year above otherwise natural suspended sediment yields is estimated to be produced from non-urban forest lands.

The estimates in Table B-2 are useful only as a tool to predict the probable level of sediment yield which will result from standard construction and maintenance practices on lands typical of the Lake Tahoe Basin. Conditions which are not found in the base data (see Table B-1) will not show up when applied to the Basin as a whole. The following types of conditions will not be reflected:

- Erosion due to a high degree of stream channelization.
- Abnormally high erosion in areas which are unusually unstable.
- Sediment reduction due to filtering by a large stream environment zone or marshy area.
- Sediment reduction due to settling in large lakes, such as Fallen Leaf and Cascade Lakes.
- Lower levels of sediment production from areas which have been developed using best management and construction practices.

The model will greatly overestimate sediment loads for areas where, once erosion has occurred, total sediment yield is reduced due to settling or uptake in low-lying stream environment zones. In all of the watersheds or sub-watersheds used as a data base, there was very little opportunity for suspended sediment, once generated, to be removed by the stream environment zones or large lakes. The only exception would be the removal provided by small lakes and reservoirs found in the Grass Lake Creek, Eagle Creek, Meeks Creek, Quail Lake Creek, and Dollar Creek watersheds, which are incorporated in the data base.

The model does not estimate bed load sediment movement; only suspended sediment yield is included. Because of bed load sediment movement, total sediment production in the Lake Tahoe Basin is somewhat higher than suspended sediment production. Bed load movement is extremely difficult to quantify. Most monitoring programs which have been conducted within the Lake Tahoe Basin do not include estimates of bed load sediment movement. In addition, the best data available for correlating sediment levels with nutrient concentrations include suspended sediment but not bed load measurements.

Relationship between Sediment and Nutrient Loads -- In order to estimate the nutrient load to Lake Tahoe under various levels of development, sediment and nutrient loading data from several sampling programs were examined. The data collected during preparation of the Tahoe Regional Planning Agency's Draft 208 Plan are used because they are more extensive in terms of site coverage. Utilizing these data, the relationships between dissolved nutrients and sediment content in runoff have been calculated and are presented in Table B-3. Two sets of values are shown in the table, reflecting changes in the relationship between sediment and dissolved nutrient concentrations as the

TABLE B–3

DISSOLVED NUTRIENTS ASSOCIATED
with SUSPENDED SEDIMENTS in TAHOE BASIN RUNOFF *

	NUTRIENT COEFFICIENT (Kg dissolved nutrient/10^3kg. sediment)		
	Total Nitrogen – N	Phosphate – P	Total Iron
General Forest Lands	3.15	1.52	5.23
Combined Urban and Forest Lands **	2.33	1.26	3.08

* Based on data in 1977 Draft 208 plan, Table III–4 (Tahoe Regional Planning Agency, 1977)

** Coefficients reflect present mix of land uses in the Tahoe Basin. Virtually identical coefficients appear to hold for full development of the Basin in accordance with the Tahoe Regional Planning Agency Plan (Table III–5, Tahoe Regional Planning Agency, 1977).

intensity of erosion increases. In general, the quantities of nutrients in runoff per unit of suspended sediment is higher when erosion rates are low than when erosion rates are high. Hence the nutrient coefficients for general forest land are higher than the coefficients for combined urban and forest lands. The entries in Table B-3 when multiplied by a sediment loading rate provide an estimate of the associated dissolved nutrient loads. Sediment loads to Lake Tahoe appearing in Table B-2 have been converted to their dissolved nutrient equivalents using the above method. General forest land nutrient coeffiecients have been used to estimate nutrient loads under natural conditions. Nutrient coefficients for combined urban and forest lands have been used to estimate nutrient loads for present conditions and additional development.

Particulate bound nutrient loads are greater than dissolved nutrient loads in surface runoff. Particulates have been estimated to carry 1.7 times more nitrogen than the dissolved load of Glenbrook Creek (Glancy 1977). Leonard, et al. (in press), indicate that particulates carry 5.3 times more phosphorus than the dissolved phosphorus load in Ward Creek. Similarly, Glancy's (1977) study of Glenbrook Creek indicates that particulates carry most of the phosphorus, 9.7 times as much as the dissolved load. Leonard, et al. (in press), indicate that the particulate iron load is 20 times the dissolved iron load in Ward Creek. Basinwide particulate nutrient loads have been estimated here by multiplying the dissolved nutrient loads by 1.7 for total nitrogen, 6.9 for phosphorus, and 20 times for iron.

Table B-4 sets forth the dissolved and particulate nutrient loads predicted for natural conditions, the present level of development, and full development according to the California Tahoe Regional Planning Agency and Tahoe Regional Planning Agency General Plans. There have been substantial increases (up to 1,530%) in the loads of nutrients above natural conditions.

The Tahoe Regional Planning Agency and California Tahoe Regional Planning Agency General Plans contain restrictions on the maximum allowable densities on lands falling into each land capability class. The major difference between the two plans is the lower land coverage allowed under the California Tahoe Regional Planning Agency Plan. If future growth is allowed in accordance with either the California Tahoe Regional Planning Agency Plan or the Tahoe Regional Planning Agency Plan, there will be substantial increases in the nutrient loads to Lake Tahoe.

Results of Related Studies

During the last ten years, numerous studies of the relationship between urbanization of the Tahoe Basin and the water quality of Lake Tahoe have been conducted. A study prepared for the Tahoe Regional Planning Agency's Draft 208 Plan had many of the same objectives as the recently completed State Water Resources Control Board study. The study prepared for the Tahoe Regional Planning Agency is discussed in detail and the findings of other studies are summarized below.

TABLE B–4

NUTRIENT LOADS to LAKE TAHOE
(metric tons/year)

DEVELOPMENT LEVEL	TOTAL NITROGEN – N			TOTAL PHOSPHORUS – P			TOTAL IRON		
	Dissolved	Particulate	Dissolved + Particulate	Dissolved	Particulate	Dissolved + Particulate	Dissolved	Particulate	Dissolved + Particulate
Natural Conditions	9.7	16.6	26.3	4.7	32.4	37.1	16.2	324	340.2
Present Level of Development (percent increase above natural)	142	241	383 (1360%)	77	529	606 (1530%)	187	3740	3927 (1050%)
Full Development–CTRPA General Plan* (Percent increase above natural)	185	314	499 (1800%)	100	690	790 (2030%)	245	4900	5145 (1400%)
Full Development–TRPA General Plan* (percent increase above natural)	196	332	528 (1900%)	106	729	835 (2150%)	258	5160	5418 (1500%)

* Includes buildout of all lands zoned for development.

1977 Draft 208 Plan (Tahoe Regional Planning Agency Study) -- A water quality sampling program was conducted during the winter and spring snowmelt period of 1974-75 to define the concentration of pollutants in runoff generated within the Basin. Over 200 sampling sites were established, and over 1,000 samples of runoff were analyzed. Sampling sites represented a multitude of land use activities and conditions of urbanization. In addition to sampling during the snowmelt period, data were collected during several rainfall runoff events.

The runoff volume was calculated for each watershed by determining the mean annual precipitation for the watershed, the area in each land use district in the watershed, and the runoff coefficient for each land use district. The runoff volume under natural conditions was estimated by using the runoff coefficient for the general forest land use district.

The water quality of runoff from each of the land uses permitted by the Tahoe Regional Planning Agency General Plan was calculated from the nutrient and sediment data collected during the sampling program. Table B-5 contains the average dissolved nutrient and sediment concentrations from each land use district. Data are also shown for samples of runoff from urbanized areas containing a mix of land uses which show conditions typical of snowmelt runoff from densely urbanized areas of the Basin. Samples were not obtained for runoff from rural estates, conservation reserve, and medium tourist residential land. Runoff samples were assigned to land use categories if the runoff was collected exclusively from water generated within that land use type or if water generated within the land use type strongly predominated. If no single land use type could be selected, the sample was assigned to the general urbanized runoff category.

The data show a general trend of greater pollutant concentration with increasing intensity of land use. Commercial, general commercial, and public services are the highest pollutant contributors. The concentration of pollutants from residential areas does not correlate with density -- most likely due to other overriding factors, such as site specific conditions of roadway and drainage systems.

To evaluate the effects of surface runoff on Lake Tahoe, a mass balance model was used to estimate the average annual surface water runoff and loading of pollutants on the Lake based upon the existing level of development. These calculations assume the use of prior development practices without the institution of effective environmental controls on development. Runoff volume and pollutant loading were calculated for each separate land use district in each watershed of the Basin based upon water quality data obtained in the sampling program. The annual loadings of nutrients and suspended sediment under natural conditions in the Basin were calculated by using the runoff quantity and quality coefficients of the general forest land use category. As shown in Table B-6, the Tahoe Regional Planning Agency model indicates a 100 percent increase in the sediment load and susbstantial increases in the nutrient loads

TABLE B-5

RUNOFF QUALITY FROM VARIOUS LAND USE DISTRICTS

TRPA Land Use District	Suspended Solids mg/l	Turbidity FTU	Nitrate Nitrogen mg N/l	Total Nitrogen mg N/l	Total Phosphate mg PO_4/l	Total Iron mg/l	Chloride mg/l	Grease & Oil mg/l
Tourist Commercial	4,020	1,084	0.35	1.26	0.85	4.22	26.9	67.7
General Commercial	733	832	0.15	1.68	1.27	1.07	21.9	33.0
Public Service	323	105	0.10	1.88	0.79	4.32	108.0	23.8
High Density Residential	249	92	0.08	0.72	0.79	1.40	24.3	20.0
Medium Density Residential	489	52	0.04	0.55	0.47	0.36	7.7	3.6
Low Density Residential	613	169	0.12	1.18	0.72	0.34	7.1	0.8
Recreation	48	21	0.06	0.60	0.38	0.54	7.5	5.3
General Urbanized Area	482	252	0.09	1.12	0.83	1.34	24.5	34.4
General Forest	66	6	0.03	0.21	0.10	0.35	1.4	0.6

TABLE B–6

SEDIMENT and DISSOLVED NUTRIENT LOADS
to LAKE TAHOE as ESTIMATED
by the TAHOE REGIONAL PLANNING AGENCY DRAFT 208 PLAN

DEVELOPMENT LEVEL	LOADS, METRIC TONS PER YEAR				
	Suspended Solids	NO_3 Nitrogen	Total Nitrogen	Total Phosphate	Iron
Natural Undeveloped Conditions	32,000	14	102	50	170
Present Level of Development	64,000	19	149	81	197
Percent Increase Above Natural Conditions	100%	36%	46%	62%	16%
Full Development: TRPA General Plan	76,000	21	168	94	204
Percent Increase Above Natural Conditions	138%	50%	65%	88%	20%

due to development of the Basin. The nutrient and sediment loads were calculated based on the projected land uses defined by the Tahoe Regional Planning Agency General Plan. As shown in Table B-6, the 1977 Draft 208 Plan indicated there will be a 138 percent increase in the sediment load, and the nutrient loads will increase by 20 to 88 percent beyond the natural loads if full development occurs according to the Tahoe Regional Planning Agency General Plan.

State of California, Division of Soil Conservation -- The major sources of sediment reaching the Upper Truckee River and Trout Creek are roadways, streambanks, and sheet erosion. Subdivision roads are the major supplier of sediment contributing approximately 48 percent, streambanks about 39 percent, and sheet erosion about 13 percent of the total from the watershed. These sources contribute approximately 40,500 metric tons of sediment per year to the Upper Truckee River and Trout Creek. This produces an annual loading rate of approximately 1.7 metric tons/hectare.

U. S. Geological Survey, Incline Village Study, 1970-73 -- Estimated annual sediment yield from the developed portions of the watersheds in this area is from 12 to 13 times that from the undeveloped area. The highest measured concentration of nitrogen consisted of dissolved ammonia and occurred during the periods of heavy runoff coinciding with heavy sediment transport. The Incline Village watersheds total approximately 22 square miles in area with approximately 21 percent developed and the remainder in a natural forest state. The sediment contribution from undeveloped areas ranges from 0.18 to 2.3 metric tons/hectare/year while that from areas being urbanized ranges from 2.2 to 26.6 metric tons/hectare/year.

State of California, Department of Transportation -- During June 1971, the Department of Transportation conducted surveys to determine the annual quantity of erosion of slopes along State Highways 50, 89, 28, and 267 within the Lake Tahoe Basin. The total quantity of sediment reaching streams and available for transport was also estimated. The survey procedures used to develop the estimated annual slope erosion quantities represent subjective interpretations. No actual measurement of sediment production from the slopes was made. The results of the study indicate that there are 17 watersheds within the Basin that should receive immediate attention for corrective action to reduce highway slope erosion.

In order to compare one watershed to another, it was necessary to make estimates of the rate of erosion by mile of slope and by mile of highway in the watershed. Individual estimates were also made of the quantities of sediment that were eroded from the slope and the quantity of sediment actually reaching streams available for transport to the Lake. The estimated total sediment production from highway slopes was 1,900 metric tons/year for the approximately 64 miles of California state highways in the Basin.

Lake Tahoe Area Council, May 1971 -- The algal growth potential of streams draining undisturbed forest lands is not significantly different from that of Lake Tahoe. Streams which drain areas being subjected to development average about 1.6 times the growth-stimulating potential of Lake Tahoe.

Land undergoing development is especially productive of algal growth-stimulating nutrients. Human occupancy of land under well developed conditions shows an appreciable excess in algal growth-stimulating nutrients over that from land under natural conditions. The presence of humans and human activity on a watershed definitely increases the rate of eutrophication of its surface waters. Creeks draining populated areas show about twice the concentration of nutrients found in Lake Tahoe.

Anaylsis of data presented in annual progress reports from this study reveal that the total nitrogen concentrations for disturbed tributaries was almost two times higher than that of the center of the Lake. Disturbed watersheds also contribute two to six times higher concentrations of phosphorus than undisturbed watersheds. In general, tributaries draining disturbed areas produce higher sediment and nutrient loads and support more algal growth than tributaries draining undisturbed areas.

California Regional Water Quality Control Board, Lahontan Region, Siltation Evaluation for the Lake Tahoe Basin, 1976 -- Siltation resulting from land development and erosion has a negative effect on invertebrate aquatic life which are a source of food for fish. Significant reductions in abundance and diversity along with the elimination of several types of insect larvae were observed downstream of disturbed areas.

Comparison of Tahoe Basin Loading Studies -- The studies of sediment and nutrient rates to Lake Tahoe yield various loading rates for sediment and nutrients. As shown in Table B-7 the natural sediment load estimated by the State Water Resources Control Board is substantially lower than the natural sediment load estimated by the study prepared for the Tahoe Regional Planning Agency's Draft 208 Plan. The Tahoe Regional Planning Agency estimate is too high because it is based on the assumption that runoff quality from lands zoned general forest reflects natural sediment yields. Since there has been a significant amount of disturbance on general forest lands, the actual natural sediment load would be far less than the 32,000 metric tons/year Tahoe Regional Planning Agency estimate.

TABLE B-7

COMPARISON of SWRCB and TRPA SUSPENDED SEDIMENT LOADS

(metric tons/year in RUNOFF)

	SEDIMENT	
	SWRCB	TRPA
Natural undeveloped conditions	3,100	32,000
Present level of development	60,800	64,000
Full development: TRPA General Plan	83,900	76,000

APPENDIX C

THE UNIVERSAL SOIL LOSS EQUATION

The Soil Conservation Service has developed an equation for prediction of soil losses from agricultural lands by rainfall. This equation has since been used to predict sediment yields from eroding roadway slopes, areas cleared of vegetation such as construction sites, and a number of other situations. The resulting soil loss includes only that due to sheet erosion. Losses from rill, gully, channel erosion, and sloughing are not included in the empirical data upon which the equation is based. The general form of the equation is:

$$A = RKSLCP$$

Where: A = computed soil loss per unit area

R = rainfall factor

K = soil erodibility factor

S = slope-gradient factor

L = slope-length factor

C = cropping-management factor

P = erosion control practice factor

APPENDIX D

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