Water Quality Management Plan for the Lake Tahoe Region

Volume I.
Water Quality Management Plan

TAHOE
REGIONAL
PLANNING
AGENCY

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WATER QUALITY MANAGEMENT PLAN
FOR THE
LAKE TAHOE REGION

VOLUME I. WATER QUALITY MANAGEMENT PLAN

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VOLUME I

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SECTION I. CONTROL NEEDS AND PROGRAMS

I. INTRODUCTION

The Tahoe Regional Planning Agency (TRPA) has prepared this water quality management plan under section 208 of the federal Clean Water Act (33 USC 466 et seq.) and the Code of Federal Regulations (40 CFR Part 130 and Part 35). The preparation of these documents was supported, in part, by a grant to TRPA under section 208 of the federal Clean Water Act. The terms "water quality management plan," "WQM plan," and "208 plan" are, for the purposes of this volume, interchangeable.

This 208 plan also includes elements of the TRPA Regional Plan package which have not heretofore been adopted by TRPA. The adopting ordinance, Ordinance 88-23, identifies those parts of the 208 plan that are also enacted as part of TRPA's Regional Plan package. They include the Handbook of Best Management Practices, the Stream Environment Zone Protection and Restoration Program, and the Capital Improvements Program for Erosion and Runoff Control.

To the extent feasible, this 208 plan is consistent with other environmental control plans applicable to the Tahoe Region, including the U.S. Forest Service's 208 plan for National Forest lands in California, TRPA's 1982 Air Quality Plan, and the state implementation plans for air quality. TPRA's 1982 Air Quality Plan is currently under revision consistent with the post-1987 attainment policies of the U.S. Environmental Protection Agency.

A. PROGRAM HISTORY

In 1969, California and Nevada created the Tahoe Regional Planning Compact (P.L. 91-148; 83 Stat. 360), which named TRPA the regional land use and environmental resource planning and regulatory agency for the Tahoe Region. The 1969 Compact established the basic structure of TRPA, voting procedures, and policy direction.

In 1974, the governors of California and Nevada designated TRPA an areawide planning agency under section 208 of the Clean Water Act. TRPA prepared a 208 plan, and adopted the plan in January, 1978. The Clean Water Act requires state certification and federal approval of 208 plans.

Nevada certified the 1978 plan, but California denied certification in July, 1978, revoked TRPA's designation as an areawide planning agency, and assumed responsibility for preparation of a water quality plan for the California portion of the Tahoe Region. The California State Water Resources Control Board (SWRCB) reaffirmed this decision in November, 1978 (SWRCB, 1981). In October, 1980, the SWRCB adopted a water quality plan of its own for the portions of the Tahoe Region in California, the Lake Tahoe Basin Water Quality Plan (SWRCB, 1980).

Subsequent to extensive amendments to the Tahoe Regional Planning Compact in 1980 (P.L. 96-551; 94 Stat. 3233), TRPA adopted a revised 208 plan on May 28, 1981, which incorporated portions of the water quality plan adopted by the SWRCB. California then restored TRPA's 208 designation and certified the 208 plan with conditions on June 18, 1981. The Nevada Department of Conservation and Natural Resources certified TRPA's 208 plan with conditions on July 17, 1981. EPA approved the TRPA plan, also with conditions, on September 4, 1981.

The Compact, amended in 1980, called for TRPA to adopt environmental threshold carrying capacities ("environmental thresholds" or "thresholds") to protect the values of the Region, and to adopt a Regional Plan to attain and maintain the thresholds. TRPA adopted a comprehensive set of thresholds on August 26, 1982. The thresholds appear in Attachment 1.

In 1983, the SWRCB amended the Lake Tahoe Basin Water Quality Plan (SWRCB, 1980). The amendment did not affect the control measures of the plan, but clarified that discharge prohibitions and waste discharge requirements would not specify the manner of compliance (SWRCB, 1983). TRPA did not amend its 208 plan as a result of the SWRCB action, however.

In April, 1984, TRPA amended the Regional Plan Goals and Policies and adopted Plan Area Statements as land use guidelines (TRPA, 1984c, Ordinance 84-1). This action followed months of debate by the TRPA Governing Board on several difficult issues, such as development on sensitive lands. Immediately upon adoption of the amendments, the League to Save Lake Tahoe and the California Attorney General brought suits against TRPA. The complaints of the plaintiffs alleged that TRPA had violated the Compact because (1) the Regional Plan was incomplete and did not meet the requirements of the Compact, (2) the EIS prepared on the Regional Plan was inadequate and did not meet the requirements of the Compact, and (3) projects would be approved without TRPA making the proper findings required under Article V(g) of the Compact.

The plaintiffs moved for a preliminary injunction, and the U.S. District Court, Eastern District of California, granted the injunction on June 15, 1984. The court enjoined TRPA from accepting, reviewing, or approving project applications, except those the Court specifically exempted. TRPA, the Tahoe-Truckee Sanitation Agency, and the Tahoe Shorezone Representation appealed the preliminary injunction to the Ninth Circuit Court of Appeals, which affirmed the lower court's order in July, 1985.

In August, 1985, after attempting for a year to resolve the alleged deficiencies in the Regional Plan and settle the litigation, TRPA organized a Consensus Building Workshop to recommend resolutions to key issues surrounding the Regional Plan. The Workshop included not only TRPA, the plaintiffs, and intervenors in the litigation, but also many other groups whose interests should be represented in any agreement on the Regional Plan. These additional groups represented conservation and property rights interests, governmental units, utilities, and other community interests.

The Workshop proposed consensus solutions to the key issues and, in September, 1986, TRPA adopted amended Regional Plan Goals and Policies reflecting the recommendations of the Workshop. In February, 1987, TRPA adopted a land use plan in the form of Plan Area Statements and Maps (TRPA, 1987d). In May, 1987, TRPA adopted the first 52 chapters of a Code of Ordinances implementing the Regional Plan (TRPA, 1987b). These actions led to settlement of the litigation and the lifting of the preliminary injunction in July, 1987.

At this time, TRPA proposes to amend the 1981 208 plan to make it consistent with the Regional Plan. The Regional Plan cannot be fully implemented without the amendments.

B. THE 1981 208 PLAN

TRPA Ordinance 81-4 (TRPA, 1981c) identifies the various elements of the 1981 208 plan. In general, the plan consists of:

- the Handbook of Best Management Practices (TRPA, 1978),
- the Water Quality Problems and Management Program (TRPA, 1977b), as amended and supplemented by certain provisions of the Lake Tahoe Basin Water Quality Management Plan, Draft Environmental Impact Statement (TRPA, 1981d), and the May 1981 addendum thereto (TRPA, 1981e), and
- for the portion of the Region within California, the Water Quality Problems and Management Program (TRPA, 1977b), as amended and supplemented by certain provisions of the Lake Tahoe Basin Water Quality Plan (SWRCB, 1980).

The 1981 plan controls water quality problems in the Tahoe Region through controls on land use (e.g., subdivisions), erosion, runoff, disturbance to stream environment zones, forest practices, fertilizer use, wastewater, atmospheric deposition of nutrients, spills, vessel wastes, dredging, and projects in the shorezone. A summary of the provisions of the 1981 208 plan, and a table comparing the 1981 provisions to these amendments, appear in Section II.

Nevada, California, and EPA placed 16 conditions of approval on the 1981 plan. The SWRCB did not certify provisions of the 1981 plan which applied to management of high erosion and runoff hazard lands in Nevada. These provisions involved the program of "case-by-case review" of single family dwellings, which has since expired. (See TRPA Ordinance 81-5, as amended (TRPA, 1981b).)

C. PURPOSE OF THE PROPOSED AMENDMENTS

TRPA is amending the 208 plan for two reasons: First, to incorporate work accomplished since 1981 to refine and implement the 1981 208 plan. Second, to incorporate changes, primarily to regulatory programs, resulting from amendments to TRPA's Regional Plan Package in 1986 and 1987. These amendments provide more flexibility in managing land use, and provide stronger programs to protect and enhance water quality.

After the adoption of the 208 plan in 1981, and supported by a section 208 grant from USEPA, TRPA commenced efforts to provide a basis for implementing the plan, including:

-- assessment and refinement of strategies for environmentally sensitive lands,

-- development of on-site runoff control strategies,

-- development of an implementation strategy for erosion and urban runoff controls,

-- development of implementation plans including specific steps necessary to implement those strategies,

-- development of financial and institutional strategies for plan implementation, and

-- public participation.

These objectives were described in the Phase IV work program (TRPA, 1981a). TRPA completed the Phase IV work program simultaneously with the planning mandates of the 1980 amendments to the Tahoe Regional Planning Compact. These two efforts were compatible and interrelated.

The final Goals and Policies (TRPA, 1986a) include three key concepts which TRPA cannot fully implement under the provisions of the 1981 208 plan and which, therefore, make amendments to the 208 plan necessary. These three concepts involve the Individual Parcel Evaluation System (IPES), certain policies relating to soil conservation and the regulation of impervious coverage, and the criteria for identifying and protecting stream environment zones (SEZs), as follows:

IPES. Because of concerns about the declining water quality of Lake Tahoe, TRPA has regulated development in the Tahoe Region since the 1969 Compact was created based on the potential for water quality impacts. In 1972, TRPA ordinance established ten land use districts and seven land capability districts based on soils and geomorphology, established permissible uses and land coverage limits in the various districts, and adopted a general plan and land capability maps (TRPA, 1972).

Although these rules gave TRPA some ability to control water quality impacts from development, new residential subdivisions were created, additional commercial, tourist, and recreational development took place, and the water quality of Lake Tahoe continued to decline. By the late 1970's, approximately 18,000 vacant residential parcels existed in the Region, representing a large potential for additional single-family home construction.

The 1981 208 plan attempted to control the potential water quality impacts of developing these and other parcels. Under the plan, TRPA determined eligibility for development of single-family homes by limiting new impervious coverage to land capability districts 4, 5, 6 and 7, as set forth in Land Capability Classification of the Lake Tahoe Basin, A Guide for Planning (Bailey, 1974; hereinafter "Bailey Report").

Regulation of new single-family homes under the 1981 208 plan has been controversial, for several reasons. First, the soils maps (Rogers, 1974), which form the basis of the land capability maps, do not have sufficient resolution to consistently identify soils on parcels which are typically 1/3 acre or less in size, which has lead to misunderstandings about the building potential of individual parcels. (See Urban Land Institute, 1985.) Second, approximately 1/3 of the vacant residential parcels in the Region are mapped in land capability districts 1, 2, and 3, making it impossible for owners of many parcels to pursue building permits, even though they pay sewer and street assessments and local taxes on their property.

The 1984 Goals and Policies (TRPA, 1984b) attempted to resolve this controversy by establishing a point system for rating vacant parcels, under which TRPA could have approved up to 300 single-family dwellings in land capability districts 1, 2, and 3 from 1986 to 1988. But the point system was controversial, and contributed to the ensuing litigation over the Regional Plan.

Based on recommendations from the Consensus Building Workshop, TRPA developed principles to apply to vacant residential parcels. The Workshop recommended that a new system for determining eligibility for construction be developed and implemented which (1) is credible and understandable by the public, (2) is as accurate, objective, and scientific as possible, (3) is compatible with other systems applicable to other land uses, (4) includes a transfer-of-development program, (5) includes incentives for remedial erosion control, and (6) includes an objective and technically-based appeal process. The Workshop also recommended that monitoring programs be implemented and tied closely to the new system.

The resulting system, known as the Individual Parcel Evaluation System or IPES, was developed by TRPA in consultation with a technical steering committee, and is codified in Chapter 37 of the TRPA Code of Ordinances (TRPA, 1987b). The system is described in more detail in Chapter IV of this Section. See Attachment 3 for a list of the members of the technical steering committee.

Soils and Coverage. As mentioned above, TRPA began to implement controls on impervious coverage in the various land capability districts in the early 1970's. In the 1981 208 plan, TRPA set the allowable impervious coverage for a given parcel or project area by applying the coverage coefficients in the Bailey Report, from 1 to 30 percent. Exceptions were permitted for approved erosion control work; projects necessary to implement the air quality nonattainment plan or the transportation element of the Regional Plan; or projects necessary for public recreation or the protection of the public health, safety, or general welfare, provided all feasible alternatives have been exhausted (TRPA, 1981b). The TRPA threshold for soil conservation, adopted in 1982, states that impervious cover shall comply with the Bailey Report.

The 1984 Goals and Policies reflected a flexible interpretation of the Bailey Report. A coverage table was used for single family homes, similar to the table in the TRPA's 1972 land use ordinance, which allowed coverage in excess of the Bailey coefficients in some situations. Coverage in excess of the Bailey coefficients also was permitted for commercial and other intensive land uses. Like the point system, these rules were controversial and contributed to the litigation over the 1984 Regional Plan.

Based on recommendations from the Workshop and the IPES technical committee, the 1986 Goals and Policies (TRPA, 1986a) incorporated new policies for the regulation of impervious coverage based on the concepts of base land coverage, coverage transfers, and mitigation of excess coverage. These policies are described in detail in Chapter IV.

Stream Environment Zones. Since its creation in 1969, TRPA has established policies to protect stream environment zones (SEZs). These policies are described in detail in Volume III, SEZ Protection and Restoration Program, and in Chapter IV.

TRPA's Interim Plan, adopted in August, 1970, called for the protection and conservation of the Region's meadowlands, floodplains, and stream courses for recreational, wildlife, and aesthetic enjoyment. The 1970 Interim Plan said that riparian growth shall be retained and protected, and that unnecessary bridges, culverts, or encroachments in the flood plain shall be prohibited (TRPA, 1970). In 1972, TRPA ordinances stated that no clearing, grading, or filling shall take place within an SEZ, with the exception of required drainage facilities (TRPA, 1972).

The 1981 208 plan continued these policies by restricting construction, grading, and vegetation removal within SEZs pending adoption of a new regional plan. Development in SEZs is permitted only for certain public health and safety, recreation, and environmentally-oriented projects (TRPA, 1981b).

Although the Consensus Building Workshop agreed with the need to continue to protect SEZs, it recommended that TRPA refine some of the existing SEZ provisions. Thus, the Regional Plan Goals and Policies (TRPA, 1986a), the Code of Ordinances (TRPA, 1987b), and these proposed 208 amendments include changes in the areas of exceptions, restoration, identification procedures, and setbacks.

II. SETTING

A. THE WATERSHED

1. General Description

The Lake Tahoe Basin is located between two mountain ranges, the Carson Range on the east and the Sierra Nevada on the west. It is bisected by the California-Nevada state line. Approximately one-third of the Basin is in Nevada and two-thirds is in California. On the California side, portions of Alpine, El Dorado, and Placer counties are within the Basin, while on the Nevada side, portions of Douglas and Washoe counties and Carson City are within the Basin (Figure 1). The total land area comprises approximately 207,430 acres (Rogers, 1974) with more than 70 percent publicly owned. Lake Tahoe is the dominant feature of the watershed and is world renowned for its crystal clear water and beautiful setting. Lake Tahoe is approximately 12 miles wide and 22 miles long. Maximum elevation of the Lake is 6,229.1 feet above sea level, while minimum elevation is 6,223 feet, controlled by the dam at Tahoe City, California. The surface of Lake Tahoe is approximately 192 square miles in size with about 71 miles of shoreline. The Lake's maximum depth is 1,645 feet with an average depth of 1,027 feet (TRPA 1982b).

The topography of the Basin consists chiefly of steeply sloping mountains with a few flat or moderately sloping landforms where most development has occurred. Elevations of the peaks surrounding the Basin range from a low of about 8,000 feet above sea level to a high of 10,881 feet at Freel Peak in the southeast portion of the watershed. This creates a bowl-shaped watershed, with a relatively flat bottom filled by Lake Tahoe, which occupies approximately 38 percent of the total area of the Basin (Bailey, 1974). This makes for a relatively large area of receiving waters in comparison to the surrounding land area of the Basin.

2. Climate

The climate of the Tahoe Basin is characterized by long, relatively mild winters with short, dry summers. Precipitation normally falls as snow during the winter months. During the summer months, there are infrequent thunderstorms. At elevations less than 6,500 feet, approximately 65 percent of the annual precipitation is in the form of snow. For the higher elevations, as much as 90 percent of the precipitation is snow (TRPA, 1982d).

Most storms that reach the Basin are Pacific storm fronts that move through the area from west to east (TRPA, 1982b). These storms must first rise over the crest of the Sierra Nevada on the west before entering the Basin. Thus, the western side of the Basin receives

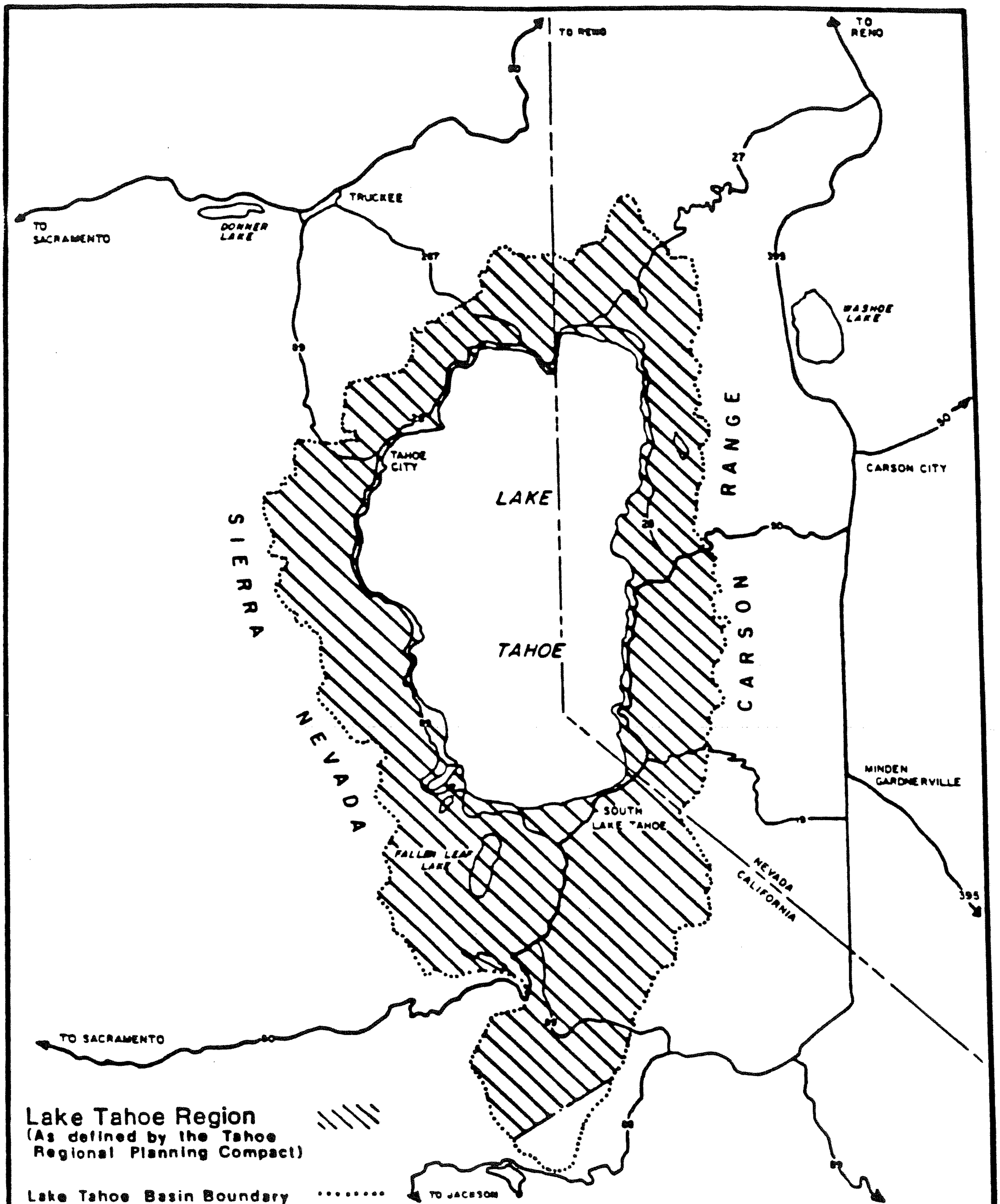


FIGURE 1 Location Map, Tahoe Region

approximately twice the precipitation of the eastern side. As shown in Figure 2, the western portions receives between 35 and 80 inches per year, while the east receives between 20 and 35 inches. Figure 2 also shows that precipitation increases with elevation.

Temperatures are highly variable within the Basin. The lower elevations, especially areas close to Lake Tahoe, are warmer than the higher elevations. Average annual temperatures range from the upper 40s (^{o}F) for lower elevations to the upper 30s (^{o}F) for the higher elevations. The average growing season for the lower elevations is short, extending from mid-June to the end of August. The short, dry growing season makes revegetation within the Region difficult (Rogers, 1974).

3. Geology and Geomorphology

The Tahoe Basin was formed as the result of regional faulting and subsequent uplift and downdrop to form a relatively flat valley surrounded by steeply sloping mountains (Bailey, 1974). This formation is typical of the geomorphic characteristics of the Great Basin (Fiero, 1986). With time, water filled the downdropped area and formed Lake Tahoe, creating a watershed where the land area is relatively small in comparison to the receiving waters of the Lake. The continuous mountain ridgeline around the Lake is interrupted only once at the Lake's only outlet, the Truckee River, at Tahoe City, California.

The Basin is underlain by granitic rock with several different rock overlays. In the north, volcanic rock overburden dominates while in the northeast, in the Incline Village area, a large alluvial fan formed by the creeks emptying into Crystal Bay dominates.

The Carson Range and the Sierra Nevada of the east, west, and south are primarily granitic rock with occasional metamorphic rock. The Sierra Nevada was extensively modified by glaciation, leaving the southern portion dominated by glacial moraines and glacial outwash deposition which forms the broad, gently sloping valleys along Upper Truckee River and Trout Creek. The Carson Range was untouched by glacial activity.

Bailey (1971) described the geomorphology of the Tahoe Basin and recognized 15 geomorphic units that occur within six major geomorphic groups (Table 1). These groups are further subdivided into three hazard categories.

FIGURE 2 Mean Annual Precipitation Isohyets, Tahoe Region

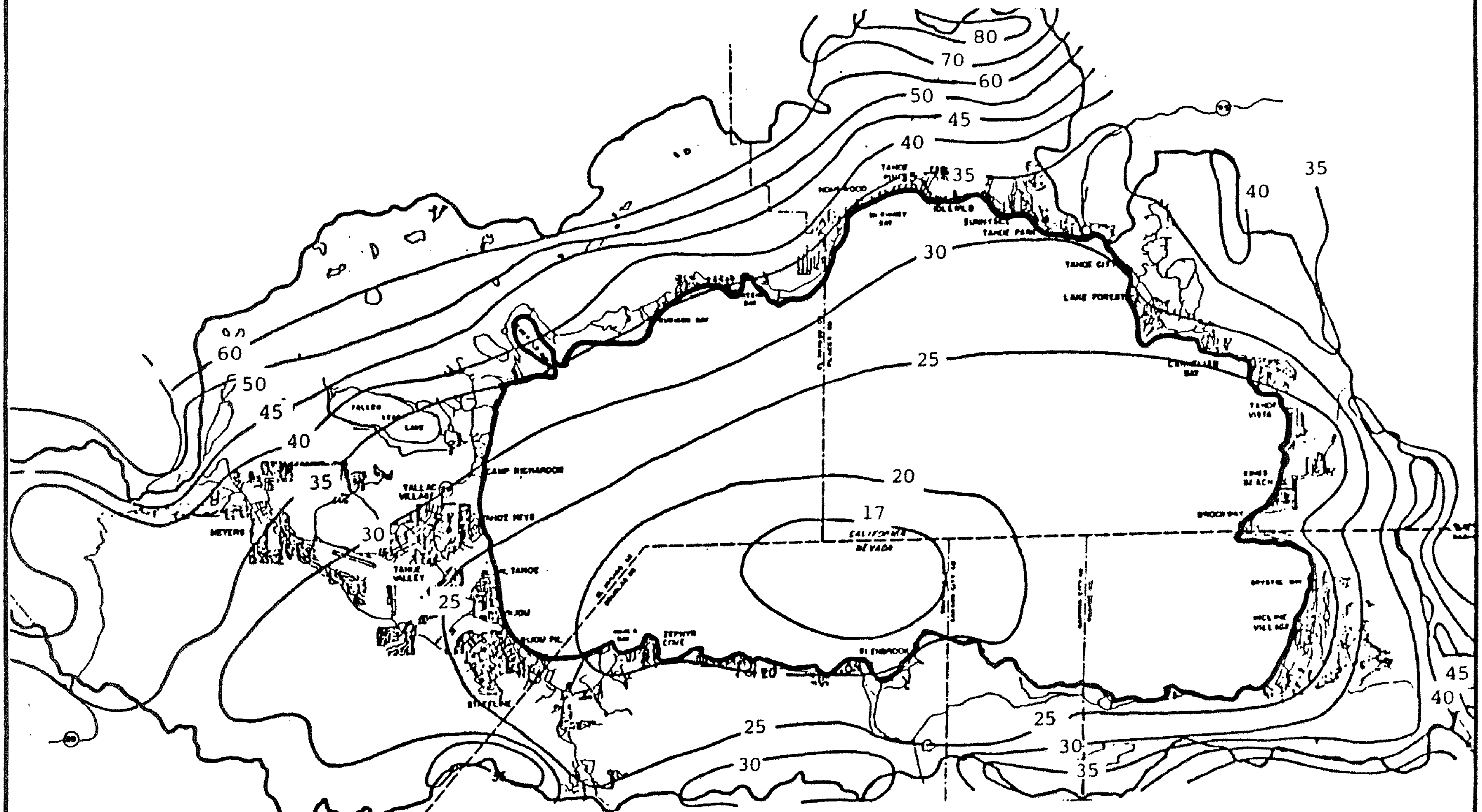


TABLE 1

Geomorphic Groups and Units of the Tahoe Region

1. Glaciated Granitic Uplands
   1a. Glaciated granitic uplands

2. Glaciated Volcanic Flowlands
   2a. Glaciated volcanic flowlands undifferentiated
   2b. Rocky ridge lands

3. Streamcut Granitic Mountain Slopes
   3a. Granitic foothills
   3b. Strongly dissected lands
   3c. Steep strongly dissected lands
   3d. Moderately dissected weakly glaciated lands
   3e. Subalpine rim lands

4. Streamcut Volcanic Flowlands
   4a. Toe slope lands
   4b. Headlands

5. Depositional Lands
   5a. Moraine land undifferentiated
   5b. Outwash, till, and lake deposits
   5c. Alluvial lands

6. Oversteepened Slopes
   6a. Canyon lands
   6b. Escarpment lands

Geomorphic Groups

1. Glaciated Granitic Uplands are located along the Sierran crest; from the Upper Truckee River headwaters to Ellis Peak. This upland area that has had repeated glacial activity. Vegetation is sparse, soils are shallow, climate is harsh, and the ecosystem is very fragile.

2. Glaciated Volcanic Flowlands encompass the same area as group 1. The difference is the rock type involved and the topography of this area which is generally less extreme due to the weaker nature of volcanic rock. Landforms include both steeply sloping lands and the broad, gently sloping valley bottoms.

continued

Table 1, continued

3. Streamcut Granitic Mountain Slopes lie within the Carson Range and were shaped by the erosive action of streams and water forces. This area is characterized by steep canyons and deeply incised stream channels and is underlain by granitic bedrock whose surface is typically decomposed to variable depths (grus). Soils are shallow, coarse, easily eroded, and have a low water holding capacity. All those factors combine to form a very fragile ecosystem.

4. Streamcut Volcanic Flowlands encompass the northwest portion of the Basin and consists of gently sloping mountains and valleys. Soils are deep, fine-textured, and have the highest natural fertility and lowest erosion potential within the Basin. The underlying volcanic rock is fractured and permeable.

5. Depositional Lands are found along the valley bottoms and adjacent to the Lake. These soils are deep, poorly drained, and have low erosion potential. Vegetation is lush and includes much of the native, riparian wetland areas.

6. Oversteepened Slopes include landforms from Echo Summit north to Emerald Bay. This area is characterized by very steep to vertical cliffs dominated by rock outcrops, rubble, sparse vegetation, and shallow to no soil cover. Debris and snow avalanches are common within this group.

Geomorphic Units

The geomorphic units were delineated using the following criteria:

1. Minimum size of one square mile.
2. Broad similarity in type of landform development (relief and drainage patterns, slope, texture of dissection, etc.)
3. Distinctive internal structure of the landform and surface material.
4. Distinctive pattern of land and water areas.

Each of these geomorphic groups and units has a unique capability to withstand use and development. Bailey (1974) ranked the geomorphic units within each group into three categories according to their hazard potential by examining the following characteristics of each unit: (1) depth to water table, (2) soil texture, (3) soil-plant relationships, (4) depth to bedrock, and (5) potential for floods and landslides.

Category I, High Hazard Lands, encompasses approximately 61 percent of the Tahoe Basin land area. In this category, the characteristics of the geomorphic units are fairly consistent and have the same potential hazard over most of their area. Planning development within this group is difficult because of the problem of avoiding hazardous situations. This group represents the areas most sensitive to development pressures and consists of:

1. Glaciated granitic uplands.
2a. Glaciated volcanic flowlands undifferentiated.
2b. Rocky ridge lands
3b. Strongly dissected lands
3c. Steep, strongly dissected lands
3d. Moderately dissected weakly glaciated lands
3e. Subalpine rim lands
5. Alluvial lands
6a. Canyon lands
6b. Escarpment lands

Category II, Moderate Hazard Lands, encompasses approximately 25 percent of the land area of the Tahoe Basin. Category II geomorphic units have high hazard characteristics, but differ from Category I in that these characteristics are not uniform throughout the area. Hazardous areas comprise a smaller percentage of the landform. By careful planning to avoid the hazard areas, this category can accommodate a much wider range of activities and development than can the Category I, High Hazard Land areas. This category consists of:

3a. Granitic foothills
4b. Headlands
5a. Moraine land undifferentiated

Category III, Low Hazard Lands, encompasses approximately 14 percent of the Tahoe Basin's land area and includes the least fragile of the geomorphic units. Hazard areas are few and easily avoided. Category III geomorphic units can sustain the widest range of activities, but planning still needs to be done to avoid hazard areas and minimize disturbance of the land. This category consists of:

4a. Toe slope lands.
5b. Outwash, till, and lake deposits.

4. Soils

Soils within the Tahoe Region are highly variable and exhibit a wide range of characteristics. These characteristics are the result of the five basic formative processes of soil: parent material, climate, biosphere, relief, and time.

Parent material in the Region consists of granitic, metamorphic, or volcanic rock, glacial outwashes, and mixed alluvium (Rogers, 1974; Bailey, 1971; Bailey, 1974). This gives the soil its basic chemical and mineralogical composition.

Climate affects soil formation principally by temperature and moisture. Weathering processes that break rock down into soil are both physical and chemical. The chemical reactions are temperature-dependent and often require an aqueous media. In the Tahoe Region, the cool winters and the long, dry summers slow down the chemical weathering process, resulting in coarse, infertile soils. The physical weathering processes include expansion and cooling of rocks and ice formation in the cracks. These weaken the bonds and speed the weathering process.

The biosphere helps to form soils physically and biologically . Plants physically break up the parent rock and help mix the soil layers, and contribute to the organic component of the soil due to decomposition upon death.

Relief affects soil formation primarily due to the effects of water, temperature, and erosion. Steep slopes generally erode easier, have rapid runoff, and shallower soils. The gently sloping areas favor deeper soils, lower erosion potential, and slower runoff.

These four factors are all time dependent and become more pronounced with age. Geologically, the Tahoe Basin is young and has relatively shallow, somewhat sterile soils that lack distinct horizons. In many areas, erosion has progressed at about the same rate as soil formation, maintaining a delicate equilibrium that is easily disrupted if care is not taken in use of these lands.

The Soil Conservation Service (SCS) has mapped and described 47 soil series and 73 soil phases in the Tahoe Basin (Rogers, 1974). They are grouped into three major soil groups and 10 soil associations representing soils with common characteristics and features as described in Table 2.

The SCS has established two basic criteria to rate a soil's ability to withstand impacts. The first is the relative erosion hazard rating, which is the combined effect of length and shape of slope, climate, and erodibility on the soil. Erodibility is a measurement of the ease with which a soil particle is detached and transported and of the infiltration and permeability of the soil. Ratings are established assuming all vegetative cover is removed and the soil is bare.

TABLE 2

Soil Groups and Associations

I. Nearly level to gently sloping soils along streams, on fans and in meadows.

1. Loamy Alluvial Land-Elmira, Wet Variant-Celio Association.

These soils occur mainly between 6,200 to 6,500 feet. Soils are somewhat poorly drained and poorly drained with slopes generally less than 5%. These soils are subject to occasional flooding and ponding. Vegetation consists of lodgepole pine, meadow grasses, perennial grasses, forbs, and brush. This group encompasses approximately five percent of the land area in the Tahoe Basin.

II. Nearly level to steep soils on moraines, glacial outwash terraces, and fans.

2. Elmira-Gefo Association
3. Inville-Jabu Association
4. Meeks-Tallac Association

These soils are moderately well drained to somewhat excessively drained. They are formed in alluvium from granitic and metamorphic rock, and lie on slopes between 0 and 60 percent. They are found between 6,200 and 8,600 feet. Vegetation consists of sagebrush, bitterbrush, conifers, and perennial grasses. This group encompasses approximately 24 percent of the Lake Tahoe Basin's land area.

III. Gently sloping to very steep soils of the mountains.

5. Cagwin-Toem Association
6. Tahome-Jorge Association
7. Umpa-Fugawee Association
8. Waca-Meiss Association
9. Shakespeare-Rock Land Association
10. Rock Land-Stony Colluvial Land Association

These soils are somewhat excessively to moderately well drained and formed from weathered granitic, andesitic, and metamorphic rock. Rock outcrops are numerous and slopes vary from 2 to 70 percent. Vegetation of this group consists of conifers, shrubs, scattered big sagebrush, grasses, and barren areas. This group encompasses approximately 71 percent of the land area in the Tahoe Basin.

The SCS relative erosion hazard ratings fall into three groups:

High Erosion Hazard - Soils are easily eroded to the point where the productivity of the soil is severly limited and there is a high risk of sediment production.

Moderate Erosion Hazard - Soils are resistant to erosion and can tolerate limited exposure during development or use.

Low Erosion Hazard - Soils show no significant surface erosion when exposed during development or use.

The second SCS criteria is a soil's potential for generating surface runoff as indicated by four hydrologic group ratings. Soils are grouped based upon the properties that influence infiltration rates into a bare soil after prolonged wetting. These properties are: depth to seasonal high water table, intake rate, permeability after prolonged wetting, and depth to a very slowly permeable layer. These four hydrologic groups are as follows:

Group A - Soils have high infiltration rates (greater than 0.30 inches per hour) when thoroughly wetted and are deep, coarse textured, and have low runoff potential.

Group B - Soils have moderate infiltration rates (0.15 to 0.30 inches per hour) when thoroughly wetted and are moderately deep to deep and have moderately low runoff potential.

Group C - Soils have slow infiltration rates (0.05 to 0.15 inches per hour) when thoroughly wetted and have moderately high runoff potential.

Group D - Soils have very slow infiltration rates (less than 0.05 inches per hour) when thoroughly wetted and represent a high potential for runoff.

Land Capability Rating System. Bailey (1974) evaluated soil characteristics and geomorphological hazards to develop a land capability rating system for the Tahoe Basin. Bailey developed his system to rate the "level of use an area can tolerate without sustaining damage through erosion and other causes."

To rate an area, Bailey used his own geomorphic hazard rating (Bailey, 1974), the relative erosion hazard rating (erosion potential), and hydrologic group rating (runoff potential) developed for the soils of the Tahoe Basin (Rogers, 1974). Bailey combined these into a single land capability rating system for the Tahoe Basin. Table 3 lists Bailey's land capabilities with their corresponding soil and geomorphic characteristics.

TABLE 3

Land Capability Classifications
With Soil and Geomorphic Characteristics

Capability Levels	Tolerance For Use	Slope Percent[1]	Relative Erosion Potential	Runoff Potential[2]	Disturbance Hazards
7	Most	0-5	Slight	Low to moderately low	
6		0-16	Slight	Low to moderately low	Low hazard lands
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	
1a	Least	30+	High	Moderately high to high	High hazard lands
1b		Poor natural drainage			
1c		Fragile flora & fauna[3]			

[1] Most slopes occur within this range. There may be, however, small areas that fall outside the range given.

[2] Low to moderately low - hydrologic-soil groups A and B; moderately high to high - hydrologic-soil groups C and D.

[3] Areas dominated by rocky and stony land.

The high hazard lands (class 1 and 2) have steep slopes, poor drainage, or fragile flora and fauna. Bailey felt their best use was for: (1) scenic values; (2) wildlife protection; (3) watershed protection; and (4) dispersed recreation; and they should remain in their natural state.

The moderate hazard lands (class 3 and 4) have moderately steep slopes. Bailey felt that their best use was for: (1) recreation, varied and concentrated; and (2) some dispersed low-density housing.

The low hazard lands (class 5 through 7) have gentle to flat slopes with deep soils. Bailey felt that their best use was for: (1) intensive recreation; (2) increased housing development; and (3) limited commercial development.

Once a hazard rating or land capability was assigned, Bailey then attached a numerical value to each of the seven hazard ratings to characterize an area's sensitivity to development. This numerical value is the percentage of the area that can be converted to impervious coverage and still maintain its environmental balance.

Bailey arrived at these coverage figures by analysis of the hazard factors; reviews of erosion, sedimentation, and flooding studies; field observations of land response to past development; conversations with people working on similar studies in the United States; and reviews of the results of studies of impervious surfaces elsewhere.

His recommended land coverage values are:

Land Capability	Allowable Percentage Of Impervious Coverage
1	1
2	1
3	5
4	20
5	25
6	30
7	30

He then assigned a land capability and allowable coverage to each of the mapped soils in the Tahoe Region (Table 4) based upon the soil's geomorphic location and its characteristics.

TABLE 4 Land Capability Classification of the Tahoe Region Soil Type

Map Symbol	Soil Name	Capability Level	Land Coverage
Be	Beaches	1B	1%
CaD	Cagwin-Rock outcrop complex, 5 to 15 percent slope.	4	20%
CaE	Cagwin-Rock outcrop complex, 15 to 30 percent slope.	2	1%
CaF	Cagwin-Rock outcrop complex, 30 to 50 percent slope.	1A	1%
Co	Celio gravelly loamy sand.	1B	1%
EbC	Elmira gravelly loamy coarse sand, 0 to 9 percent slope.	6	30%
EbE	Elmira gravelly loamy coarse sand, 9 to 30 percent slopes.	4	20%
EcE	Elmira stony loamy coarse sand, 9 to 30 percent slopes.	4	20%
EfB	Elmira-Gefo loamy coarse sand, 0 to 5 percent slopes.	7	30%
Ev	Elmira loamy coarse sand, wet variant.	1B	1%
Fd	Fill land.	1B	1%
FuD	Fugawee very stony sandy loam, 2 to 15 percent slopes.	5	25%
FuE	Fugawee very stony sandy loam, 15 to 30 percent slopes.	3	5%
GeC	Gefo gravelly loamy coarse sand, 2 to 9 percent slopes.	6	30%
GeD	Gefo gravelly loamy coarse sand, 9 to 20 percent slopes.	4	20%
Gr	Gravelly alluvial land.	1B	1%
GsF	Graylock extremely stony loamy coarse sand, 30 to 50 percent slopes.	1A	1%
IgB	Inville gravelly coarse sandy loam, 0 to 5 percent slopes.	5	25%
IsC	Inville stony coarse sandy loam, 2 to 9 percent slopes.	6	30%

TABLE 4 (continued)

Map Symbol	Soil Name	Capability Level	Land Coverage
IsD	Inville stony coarse sandy loam, 9 to 15 percent slopes.	4	20%
IsE	Inville stony coarse sandy loam, 15 to 30 percent slopes.	4	20%
JaC	Jabu coarse sandy loam, 0 to 9 percent slopes.	5	25%
JaD	Jabu coarse sandy loam, 9 to 20 percent slopes.	3	5%
JbD	Jabu coarse sandy loam, seeped, 2 to 15 percent slopes.	3	5%
JeB	Jabu coarse sandy loam, shallow variant, 0 to 5 percent slopes.	5	25%
JeD	Jabu coarse sandy loam, shallow variant, 5 to 15 percent slopes.	3	5%
JhC	Jabu stony sandy loam, moderately fine subsoil variant, 2 to 9 percent slopes.	5	25%
JgC	Jabu sandy loam, moderately fine subsoil variant, 0 to 9 percent slopes.	5	25%
JtD	Jorge-Tahoma cobbly sandy loams, 2 to 15 percent slopes.	6	30%
JwD	Jorge-Tahoma very stony sandy loams, 2 to 15 percent slopes.	6	30%
JwE	Jorge-Tahoma very stony sandy loams, 15 to 30 percent slopes.	4	20%
JwF	Jorge-Tahoma very stony sandy loams, 30 to 50 percent slopes.	2	1%
Lo	Loamy alluvial land.	1B	1%
Mh	Marsh.	1B	1%
MkB	Meeks gravelly loamy coarse sand, 0 to 5 percent slopes.	5	25%
MkD	Meeks gravelly loamy coarse sand, 5 to 15 percent slopes.	3	5%

TABLE 4 (continued)

Map Symbol	Soil Name	Capability Level	Land Coverage
MmB	Meeks stony loamy coarse sand, 0 to 5 percent slopes.	5	25%
MsD	Meeks very stony loamy coarse sand, 5 to 15 percent slopes.	3	5%
MsE	Meeks very stony loamy coarse sand, 15 to 30 percent slopes.	1A	1%
MsG	Meeks very stony loamy coarse sand, 30 to 60 percent slopes.	1A	1%
MtE	Meeks extremely stony loamy coarse sand, 15 to 30 percent slopes.	1A	1%
MtG	Meeks extremely stony loamy coarse sand, 30 to 60 percent slopes.	1A	1%
MxE	Meiss cobbly loam, 9 to 30 percent slopes.	1C	1%
MxF	Meiss cobbly loam, 30 to 50 percent slopes.	1C	1%
Px	Pits and dumps.	1C	1%
Ra	Rock land.	1C	1%
RcF	Rock outcrop-Cagwin complex, 30 to 50 percent slopes.	1A	1%
RcG	Rock outcrop-Cagwin complex, 50 to 70 percent slopes.	1A	1%
RtF	Rock outcrop-Toem complex, 30 to 50 percent slopes.	1A	1%
RtG	Rock outcrop-Toem complex, 50 to 70 percent slopes.	1A	1%
Rx	Rock outcrop and Rubble land.	1C	1%
ShE	Shakespeare gravelly loam, 9 to 30 percent slopes.	1A	1%
SkF	Shakespeare stony loam, 30 to 50 percent slopes.	1A	1%
Sm	Stony colluvial land.	1C	1%
TaD	Tahoma stony sandy loam, 2 to 15 percent slopes.	6	30%

TABLE 4 (continued)

Map Symbol	Soil Name	Capability Level	Land Coverage
TbD	Tahoma very stony sandy loam, 2 to 15 percent slopes.	6	30%
TcB	Tallac gravelly coarse sandy loam, seeped, 0 to 5 percent slopes.	5	25%
TcC	Tallac gravelly coarse sandy loam, seeped, 5 to 9 percent slopes.	5	25%
TdD	Tallac stony coarse sandy loam, 5 to 15 percent slopes.	5	25%
TeE	Tallac very stony coarse sandy loam, 15 to 30 percent slopes.	3	5%
TeG	Tallac very stony coarse sandy loam, 30 to 60 percent slopes.	1A	1%
TkC	Tallac very stony coarse sandy loam, seeped, 2 to 9 percent slopes.	5	25%
TmE	Tallac gravelly coarse sandy loam, shallow variant, 9 to 30 percent slopes.	1A	1%
TmF	Tallac gravelly coarse sandy loam, shallow variant, 30 to 50 percent slopes.	1A	1%
TrE	Toem-Rock outcrop complex, 9 to 30 percent slopes.	1A	1%
TrF	Toem-Rock outcrop complex, 30 to 50 percent slopes.	1A	1%
UmD	Umpa very stony sandy loam, 5 to 15 percent slopes.	5	25%
UmE	Umpa very stony sandy loam, 15 to 30 percent slopes.	3	5%
UmF	Umpa very stony sandy loam, 30 to 50 percent slopes.	1A	1%
WaE	Waca cobbly coarse sandy loam, 9 to 30 percent slopes.	3	5%
WaF	Waca cobbly coarse sandy loam, 30 to 50 percent slopes.	1A	1%
WcE	Waca-Rock outcrop complex, 9 to 30 percent slopes.	3	5%
WcF	Waca-Rock outcrop complex, 30 to 50 percent slopes.	1A	1%

5. Vegetation

Vegetation of the Tahoe Basin is dominated by a mixed conifer association which occupies approximately 85 percent of the Basin's land area. This association is composed of three principal plant communities. The yellow pine forest community grows in the Basin between Lake level and 6,400 feet. The red fir community extends from 6,400 feet to approximately 9,000 feet, and the subalpine community grows above this elevation. The other 15 percent of the land area is composed of five other plant associations, as follows:

The cushion plant association is an assemblage of low growing shrub-type plants that grow on the highest mountain peaks. This association is noted for its ability to survive the harsh conditions of this environment.

The shrub association is a seral plant stage that has invaded an area opened up by past logging, fire or other activity that results in large areas of forest being removed. This association, if left undisturbed, will eventually be replaced by a mixed conifer association.

The sagebrush association is distinct from the shrub association in that it is often the climax association that will grow in its environment. It is usually found on the drier south and east facing slopes in the Carson Range.

The meadow association is dominated by grasses and forbs that need the openness and higher water availability that a meadow provides. This association is found at all elevations.

The riparian deciduous association is located in the wet-moist soils along streams, creeks, and lakes. This association is dominated by willows, alders, and aspen and is often found in close proximity and sometimes intermingled with the meadow association.

In addition to these six plant associations, there is also an aquatic association composed of marsh vegetation and open water vegetation. The marsh vegetation is found in the shallow water areas of lakes and streams, while the open water vegetation refers to the plant communities within Lake Tahoe. This is composed of the free floating algae (phytoplankton), the attached algae (periphyton), and beds of large plants found at depths up to 500 feet in the Lake (Frantz and Cordone, 1967).

Attachment 1 lists the environmental thresholds established by TRPA for five species of plants within the Basin that have been classified as rare or endangered by the California Native Plant Society, the Smithsonian Institute, or under the Endangered Species Act of 1973. These species are:

Sierra sedge (Carex paucifructus), once found in the high meadow areas of the Desolation Wilderness, is endemic to only three counties of the Sierra Nevada: El Dorado, Sierra, and Tuolumne.

Long-petaled Lewisia (Lewisia pygmaea longipetala) is found at high elevations in moist cracks of exposed granite or in moist, gravelly volcanic soils.

Two species of Draba, family Cruciferae, are found in high mountain meadows. Draba asterophora v. macrocarpa has been found only in the Desolation Wilderness and is restricted to the areas of lake margins. Draba asterophora v. asterophora is found on Freel Peak, Jobs Sister, and Mount Rose. Its niche is sandy areas between rocks or in crevices.

Tahoe yellow cress (Rorippa subumbellata) is listed as endangered by the State of California. This species only grows in the moist backshore areas and dry sandy soils on backshore bluffs around the edge of Lake Tahoe.

6. Land Use

The development and urbanization of the Tahoe Region is generally recognized as occurring during and following the Squaw Valley Olympics in 1960. Since this time, the population of the Region has increased over five times, with about 80 percent of the population living in California and 20 percent in Nevada (TRPA, 1982b).

The land use pattern of the Tahoe Region is already established, with little likelihood of major modifications occurring in the future. There are currently 20-25 developed towns and communities in the Tahoe Region. The major population centers are Incline Village, Kings Beach, Tahoe City, Tahoma, and the South Lake Tahoe/Meyers area. Development is predominantly in the area adjacent to Lake Tahoe and in the wide, gently sloping valleys in the south (Figure 3). The existing level of development in the residential, commercial, tourist, public service, and recreation sectors is shown below:

Single-Family Homes	24,500 units
Multi-Family Units	14,100 units
Commercial Floor Area	
Retail	800,000 sq. ft.
Service	800,000 sq. ft.
Office	400,000 sq. ft.
Gaming	500,000 sq. ft.
Tourist Accommodations	12,000 units
Campground	2,000 units

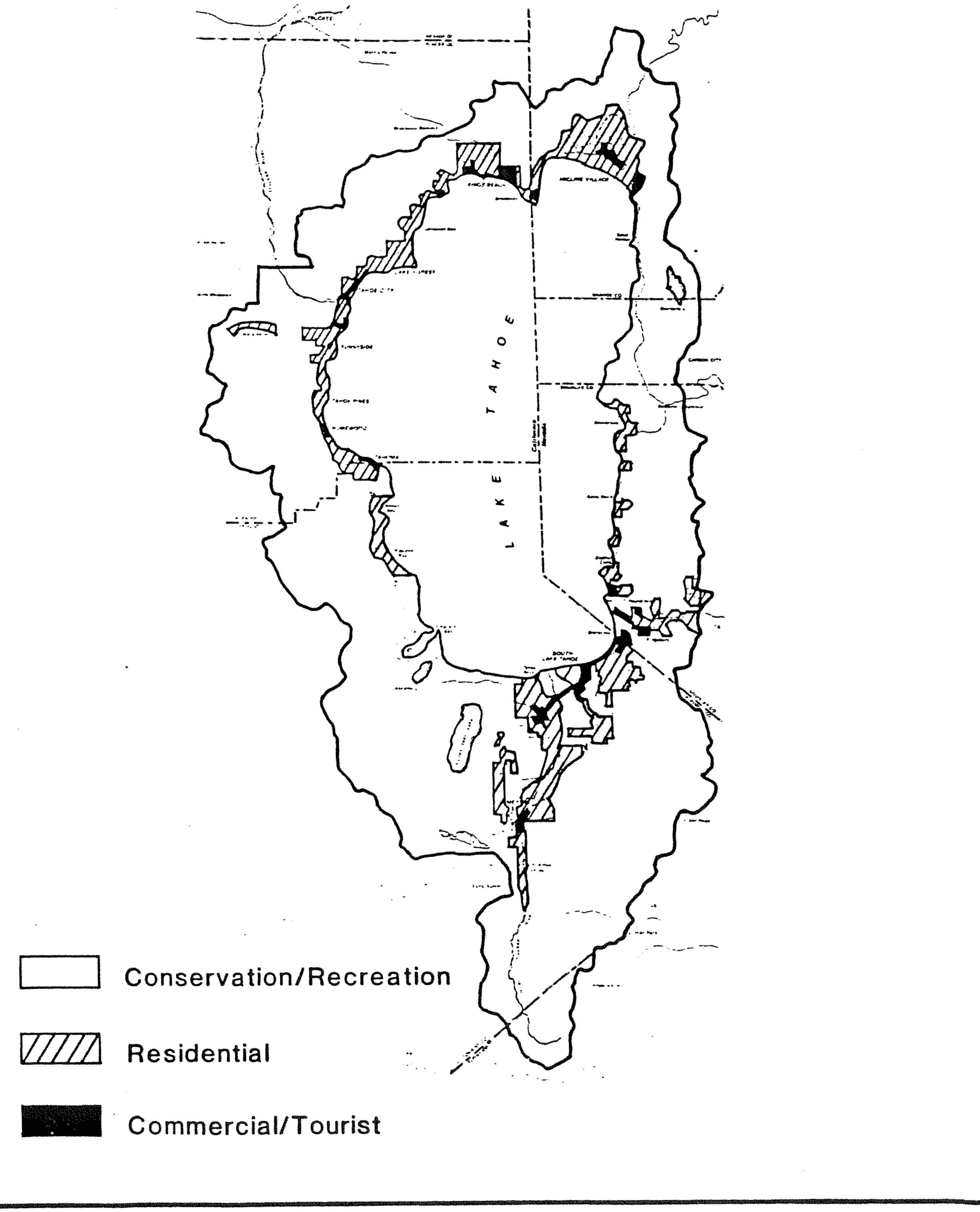


FIGURE 3 Land Use Map, Tahoe Region

Casino gaming areas are located at the north stateline area and at south stateline. In addition, Incline Village has a casino within its commercial area. These areas provide tourist accommodations, commercial facilities, and indoor entertainment and recreational facilities

The undeveloped areas of the Tahoe Region are predominantly publicly owned. The United States Forest Service manages over 70 percent of the land within the Region. California, Nevada, the counties, the City of South Lake Tahoe, and the utility and improvement districts manage and own their own parks.

Public ownership is increasing. There are three active land acquisition programs at work within the Tahoe Region purchasing environmentally sensitive lands and other lands. The USFS purchases land in both Nevada and California, while both Nevada and California have acquisition programs for purchasing land in their respective states.

Outdoor recreational use of the Tahoe Region is extensive and includes water skiing, snow skiing, camping, hiking, boating, sight seeing, fishing and other activities.

For the snow skier, the Region offers five downhill ski areas with many others just outside the Region. In addition, many opportunities exist for those interested in cross-county skiing.

Backcountry use is popular, providing hiking, camping, and solitude. The Desolation Wilderness area has approximately 21,300 acres within the Tahoe Region (TRPA, 1983). There are also many other areas with trails surrounding the Lake. The Tahoe Rim Trail, a trail encircling the Region, is due for completion in the 1990s.

Seasonal use of campgrounds is estimated at 71 percent of capacity. The United States Forest Service considers a campground to be heavily used when it's at 50 percent capacity (TRPA, 1983).

Day use facilities accommodate a wide variety of facilities for picnicking, swimming, hiking, and sightseeing, and urban facilities such as ballfields and playgrounds. While the urban activities attract mainly the local population, the other day use facilities attract both local and tourist use.

Beach use is one of the major day use activities in the Tahoe Region. There are approximately 22 miles of beach open to public use (TRPA, 1983). These areas experience extensive use during the summer and are often at or near capacity.

Boating on Lake Tahoe is limited by the number of mooring and launching facilities. As of 1983, there were 134 multiple use piers and 25 launching/marina facilities.

The dominant transportation system in the Basin is the highway system. There are seven highways that traverse the crest to allow access to the Tahoe Basin, four in California side and three in Nevada. The dominant form of transportation is the personal motor vehicle, with secondary dependence upon buses, taxis, and other modes of transportation. The Basin is serviced by an airport located in the Meyers area. For more detail, the TRPA Regional Transportation Plan (1988c) should be consulted.

B. HYDROLOGY AND WATER QUALITY

1. Lake Tahoe

Lake Tahoe is approximately 12 miles wide by 22 miles long. Maximum depth is 1,645 feet with an average depth of 1,027 feet. The Lake holds about 126 million acre-feet of water. The top 6.1 feet or 720,000 acre-feet of water is regulated by the dam at Tahoe City, California. The average annual outflow over the dam is 181,500 acre-feet (TRPA, 1982d).

Lake Tahoe is considered to be ultra-oligotrophic: it has very low concentrations of nutrients, high oxygen content, and exceptionally clear waters. The clarity of the waters is largely due to low algal productivity and represents a system that is naturally low in nutrients.

The Tahoe Research Group (TRG) has conducted a variety of limnological and water quality studies at Lake Tahoe since 1959. As part of these studies, TRG has measured the primary productivity rate (PPR) of algae and water clarity. They have collected data from an index station and a mid-lake station (Figure 4) since 1968 and 1973, respectively.

Both stations are located in the deep water or pelagic zone of Lake Tahoe, where water depth exceeds 100 meters. The littoral or near-shore zone is the water area around the perimeter of the Lake that is less than 100 meters deep. The pelagic zone accounts for approximately 80 percent of the surface area of Lake Tahoe, while the littoral zone accounts for the other 20 percent (Goldman, 1974).

Most algae in Lake Tahoe are restricted to the euphotic zone, the zone where enough light penetrates the water to allow photosynthesis and growth to occur. The depth of this zone is variable, but is generally accepted as being up to 105 meters (330 feet) deep. The waters in excess of 105 meters (the aphotic zone) generally do not receive enough light to allow photosynthesis and growth to occur although some algal populations have been found at depths in excess of 500 feet (TRPA, 1982d).

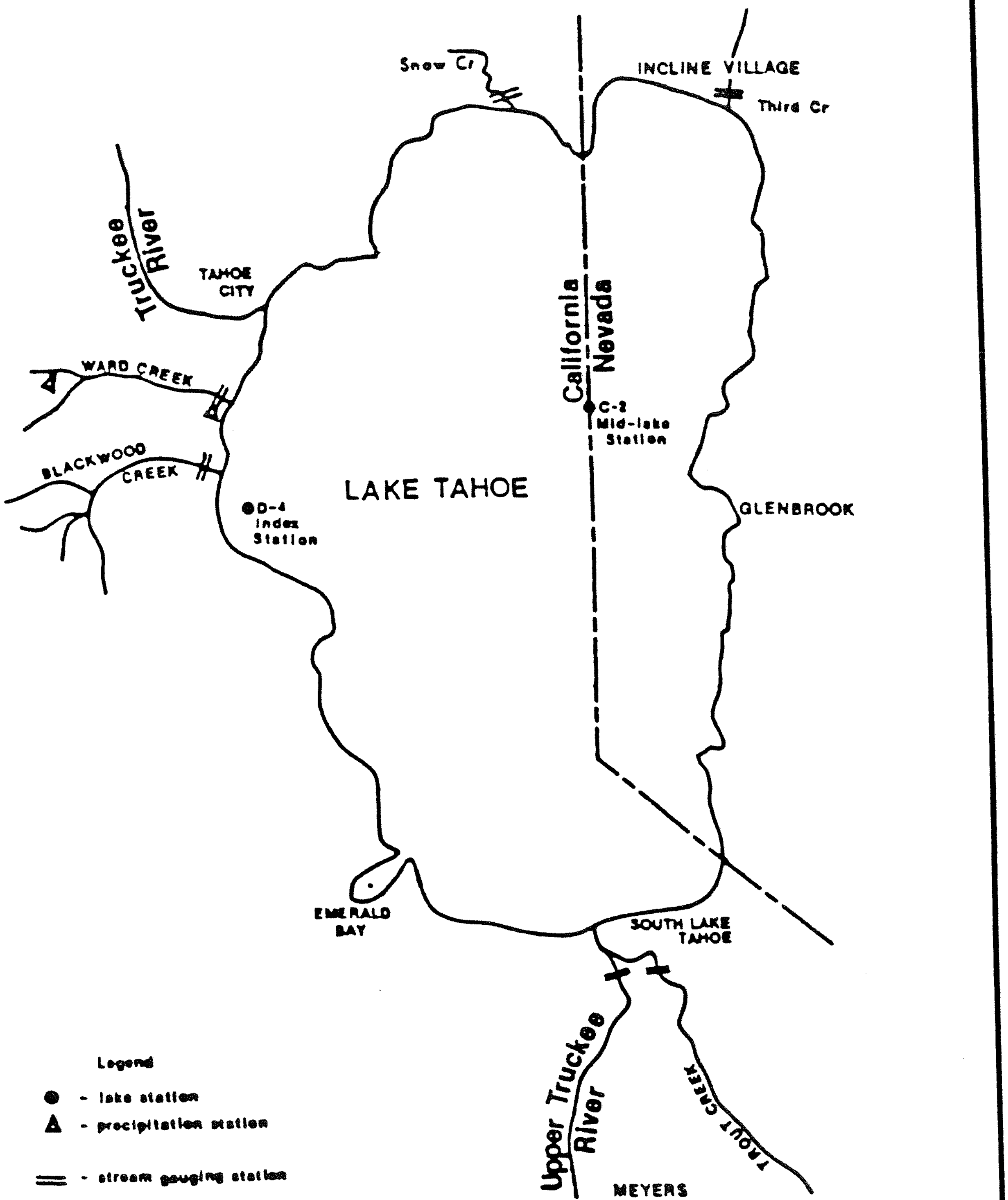


FIGURE 4

Locations of TRG's Index and Mid-Lake Monitoring Stations

Primary Productivity Rates. At TRG's index station, primary productivity (PPR) has increased approximately 150 percent since 1968 (Figure 5). In 1976, 1977, 1981, 1982, 1984, and 1986, PPR declined from the previous year's rate (Byron and Goldman, 1986), while 1975, 1980, 1983, and 1985 represent years when PPR experienced a sharp increase from the previous year's rate. This year-to-year variability appears to be largely influenced by annual precipitation and the degree of mixing (Byron and Goldman, 1986).

Water Clarity. TRG measures the clarity of Lake Tahoe by using a 20 cm. diameter, solid white disc called a Secchi disc. This disc is lowered into the water until it can no longer be seen and then raised until it is just visible. The average of these two readings is the Secchi depth.

Clarity of Lake Tahoe shows an overall decreasing trend with similar year-to-year variability as the PPR data (Figure 6). Since 1968, clarity of Lake Tahoe has declined by approximately 20 percent.

Littoral Zone. There have been several studies of water quality in the littoral waters of Lake Tahoe, mostly between 1965 and 1980. (For details, see TRPA, 1982d.) In a study of turbidity at 14 locations in the littoral zone, one group of investigators found turbidity values between 0.1 and 1.6 JTU (Jackson turbidity units). TRPA's turbidity standard is either 1 or 3 JTU, depending upon location. There are no more-recent data on turbidity, but TRPA started turbidity monitoring at selected locations in the littoral zone in 1988.

There is evidence that primary productivity and periphyton (attached algae) biomass in the littoral zone are related to nutrient inputs and land development (TRPA, 1982d). Synoptic primary productivity studies in 1968 to 1971 showed the greatest productivity occurs in Crystal Bay, near Incline and Third Creeks; in the south shore near Trout Creek and the Upper Truckee River; and near Tahoe City. Periphyton biomass data collected in 1980 and 1981 indicated that the greatest biomass occurs off developed areas.

2. Tributaries

The United States Geological Survey (USGS) has conducted a detailed survey of the tributary areas of the Tahoe Basin. In 1978, they prepared a map showing 63 individual watersheds that contribute flow to Lake Tahoe (Jorgensen, 1978). Table 5 summarizes some of the pertinent hydrologic data for the 63 watersheds and the intervening areas (small areas between watersheds that flow directly into the Lake).

Tributary data relating primarily to water quality has been collected by the USGS, TRG, USFS, UNR, NDEP, EPA, LRWQCB, Joint Studies Group, and private researchers.

FIGURE 5 Algal Primary Productivity v. Time, Lake Tahoe

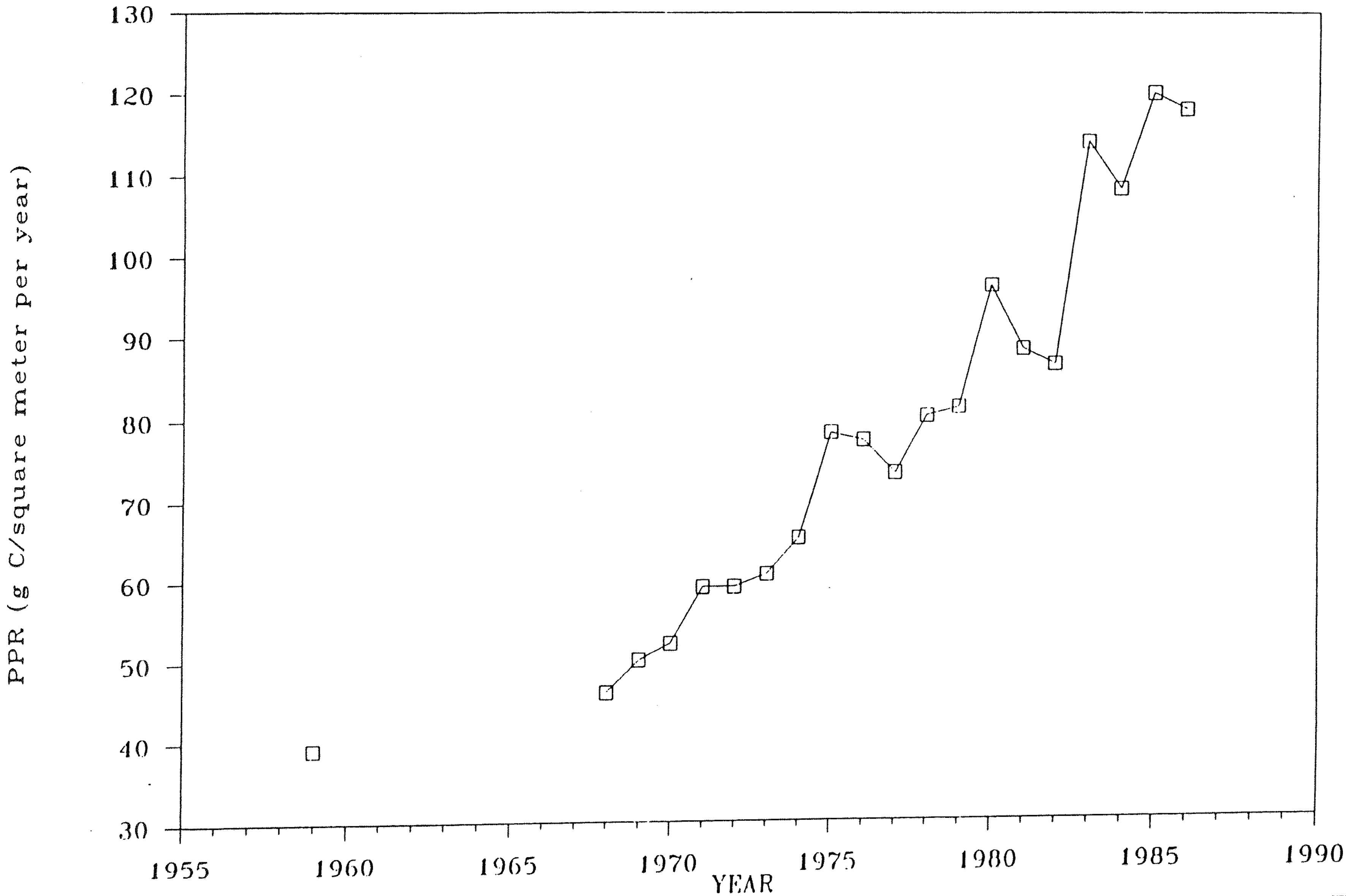


FIGURE 6 Secchi Disk Depth v. Time, Lake Tahoe

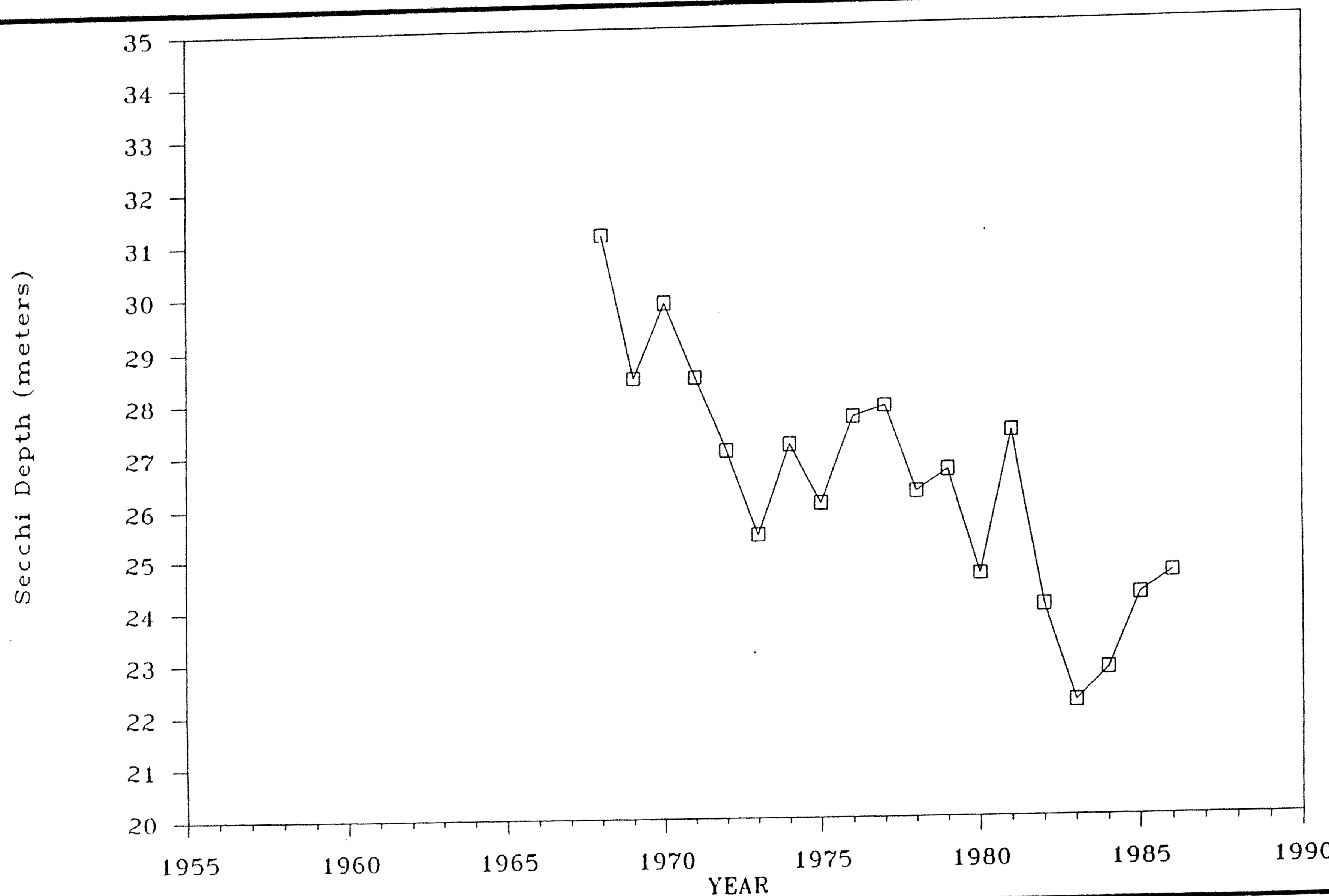


TABLE 5 Watershed Summary Table

Watershed Number	Name and Reference Point	Drainage Area, mi^2	Channel Length, mi.	Channel Elevation Ft. Lower[1]	Upper[1]	Maximum Basin, ft.	USGS Gaging Station
1	Area between Truckee River and Site 2	0.15					
2	Lake Tahoe tributary at mouth at Tahoe City	1.11	2.55	6300	7200	7572	
2A	Lake Tahoe tributary at Tahoe City	1.08	2.40	6340	7235	7572	10336680
3	Intervening area	0.40					
4	Burton Creek at mouth	5.22	4.47	6350	7200	8424	
5	Intervening area	0.05					
6	Unnamed creek at mouth near Lake Forest	1.13	3.07	6280	7460	8410	
7	Intervening area	0.03					
8	Unnamed creek at mouth at Lake Forest	0.60	2.00	6245	6745	7050	
9	Intervening area	0.76					
10	Dollar Creek at mouth	1.11	2.88	6340	7580	7925	
10A	Dollar Creek near Tahoe City	1.07	2.68	6440	7600	7925	10336684
11	Intervening area	0.10					
12	Unnamed creek at mouth near Cedar Flat	0.06	0.57	6260	6605	6680	
13	Intervening area	1.72					
14	Watson Creek at mouth	2.42	3.32	6440	7660	8615	
15	Intervening area	0.10					
16	Unnamed creek at mouth near Carnelian Bay	0.77	1.94	6320	7160	7640	
17	Intervening area	0.50					
18	Carnelian Canyon Creek at mouth	2.94	2.80	6255	7010	8250	
19	Intervening area	1.41					
20	Snow Creek at mouth	4.49	3.66	6235	6920	8440	
21	Intervening area	0.09					
22	Griff Creek at mouth	4.62	4.03	6270	8100	9200	
23	Intervening area	0.14					

Jorgensen et al. (1978)

TABLE 5 (continued)

Watershed Number	Name and Reference Point	Drainage Area, mi^2	Channel Length, mi.	Channel Elevation Ft.[1] Lower	Upper	Maximum Basin, ft.	USGS Gaging Station
24	Baldy Creek at mouth	0.63	1.67	6250	6885	7350	
25	Intervening area	1.77					
26	Unnamed creek at mouth near Crystal Bay	0.67	1.88	6380	8540	9000	
27	First Creek at mouth	1.06	2.34	6350	8480	9270	
27A	First Creek near Crystal Bay	1.06	2.26	6450	8500	9270	10336688
28	Intervening area	0.47					
29	Second Creek at mouth	1.31	3.04	6415	8840	9610	
29A	Second Creek near Crystal Bay	1.26	2.74	6555	8920	9610	10336690
30	Intervening area	0.96					
31	Wood Creek at mouth near Crystal Bay	1.95	3.94	6385	8080	9610	10336694
31A	Wood Creek near Crystal Bay	1.70	2.58	6890	8440	9610	10336693
32	Intervening area	0.41					
33	Third Creek at mouth	6.06	7.05	6360	9170	10338	
33A	Third Creek near Crystal Bay	6.05	6.92	6375	9175	10338	10336698
33B	Third Creek at Incline Village	4.39	4.53	7420	9330	10338	10336696
34	Incline Creek at mouth	6.76	4.66	6385	8400	9225	
34A	Incline Creek near Crystal Bay	6.74	4.49	6330	8420	9225	10336700
35	Intervening area	0.20					
36	Mill Creek at mouth	1.95	2.63	6270	8080	8520	
37	Intervening area	0.25					
38	Tunnel Creek at mouth	1.27	2.04	6400	7855	8703	
39	Intervening area	0.18					
40	Unnamed creek at mouth near Sand Harbor	1.03	1.96	6540	8040	8850	
41	Intervening area	2.02					
42	Marlette Creek at mouth	4.94	3.44	6305	8015	9010	

Jorgensen et al. (1978)

TABLE 5 (continued)

Watershed Number	Name and Reference Point	Drainage Area, mi^2	Channel Length, mi.	Channel Elevation Ft. Lower[1]	Upper[1]	Maximum Basin, ft.	USGS Gaging Station
42A	Marlette Creek near Carson City	2.86	1.73	7830	8090	9010	10336715
42B	Marlette Lake near Carson City	2.86					10336710
43	Intervening area	0.80					
44	Secret Harbor Creek at mouth	1.94	2.45	6400	8080	8738	
45	Intervening area	0.08					
46	Bliss Creek at mouth	0.57	1.52	6360	7115	7810	
47	Intervening area	1.33					
48	Slaughterhouse Canyon Creek at mouth	6.42	7.00	6270	7715	9214	
49	Intervening area	0.96					
50	Glenbrook Creek at mouth	4.09	3.92	6280	7710	8810	10336730
51	Intervening area	0.97					
52	North Logan House Creek at mouth	1.08	2.53	6510	7880	8560	
53	Intervening area	0.02					
54	Logan House Creek at mouth	2.18	3.30	6540	8240	8818	
55	Intervening area	0.65					
56	Unnamed creek at mouth near Lincoln Park	0.58	1.32	6350	7580	7928	
57	Intervening area	0.32					
58	Lincoln Creek at mouth	2.53	4.14	6360	8275	9150	
59	Intervening area	0.80					
60	Unnamed creek at mouth near District Courthouse	2.62	3.75	6300	8010	8610	
61	Intervening area	0.21					
62	Unnamed creek at mouth near Zephyr Cove	1.63	4.04	6280	8230	8863	
63	Intervening area	0.38					
64	McFaul Creek at mouth	3.64	5.05	6280	7680	8900	
65	Intervening area	0.32					

Jorgensen et al. (1978)

TABLE 5 (continued)

Watershed Number	Name and Reference Point	Drainage Area, mi^2	Channel Length, mi.	Channel Elevation Ft. Lower[1]	Channel Elevation Ft. Upper[1]	Maximum Basin, ft.	USGS Gaging Station
66	Burke Creek at mouth	4.72	4.35	6240	7680	8450	
67	Intervening area	0.10					
68	Edgewood Creek at mouth	6.59	5.53	6239	7830	9590	10336760
69	Intervening area	2.91					
70	Bijou Creek at mouth	1.97	3.33	6235	7040	8371	
71	Intervening area	0.97					
72	Trout Creek at mouth	40.97	12.20	6225	7760	10881	
72A	Trout Creek at South Lake Tahoe	40.40	10.70	6245	7790	10881	10336790
72B	Heavenly Valley Creek at mouth	3.12	4.85	6265	8580	10067	
72C	Trout Creek near Tahoe Valley	36.70	9.45	6265	7860	10881	10336780
72D	Cold Creek at mouth	12.70	7.95	6300	9100	10881	
72E	Saxon Creek at mouth	8.21	6.54	6300	8580	9520	
73	Upper Truckee River at mouth	56.64	21.45	6235	7920	10060	
73A	Upper Truckee River at South Lake Tahoe	54.80	19.68	6240	8260	10060	10336610
73B	Upper Truckee River near Meyers	33.10	11.35	6370	8325	10060	10336600
73C	Angora Creek at mouth	5.99	4.45	6270	7390	8895	
73D	Echo Creek at mouth	5.47	5.60	6460	7830	9235	
73E	Echo Creek near Meyers	5.42	5.40	6520	7830	9235	
73F	Echo Lake near Phillips	4.84	4.06	7414	7950	9235	
	Echo Lake conduit near Phillips (diversion)						11434500
73G	Grass Lake Creek at mouth near Meyers	6.99	5.45	6980	8780	9600	10336591
74	Intervening area	4.06					
75	Taylor Creek at mouth	18.34	11.00	6320	7960	9856	
75A	Taylor Creek near Camp Richardson	16.70	9.27	6377	8110	9856	10336626

[1] Jorgensen et al. (1978)

TABLE 5 (continued)

Watershed Number	Name and Reference Point	Drainage Area, mi^2	Channel Length, mi.	Channel Elevation Ft.[1] Lower	Channel Elevation Ft.[1] Upper	Maximum Basin, ft.	USGS Gaging Station
75B	Glen Alpine Creek near Meyers	10.80	6.26	6530	8140	9856	10336615
76	Tallac Creek at mouth	4.50	3.66	6235	8120	9735	
77	Intervening area	0.08					
78	Cascade Creek at mouth	4.71	4.73	6450	7690	9735	
79	Intervening area	1.08					
80	Eagle Creek at mouth	6.66	5.82	6650	8670	9974	
80A	Eagle Creek near Camp Richardson	6.38	5.47	6860	8700	9974	10336630
81	Intervening area	2.28					
82	Rubicon Creek at mouth	2.89	2.40	6235	8460	9269	
83	Intervening area	0.04					
84	Lake Tahoe tributary at mouth at Paradise Flat	0.64	2.05	6235	8280	9180	
85	Intervening area	0.46					
86	Lonely Gulch Creek at mouth	1.08	2.18	6270	7670	9183	
87	Intervening area	0.01					
88	Lake Tahoe tributary at mouth near Meeks Bay	0.87					
88A	Lake Tahoe tributary near Meeks Bay	0.64	1.35	6400	7560	8200	10336635
89	Intervening area	0.30					
90	Meeks Creek at mouth	8.16	7.20	6232	7810	9310	
90A	Meeks Creek at Meeks Bay	8.08	6.96	6235	7810	9310	10336640
91	Intervening area	0.23					
92	Unnamed Creek at mouth near Meeks Bay	0.28	1.45	6280	6710	7037	
93	Intervening area	0.12					
94	General Creek at mouth	7.56	9.17	6280	7680	8721	
95	Intervening area	1.38					
96	McKinney Creek at mouth	5.29	4.50	6260	7055	8650	

Jorgensen et al. (1978)

TABLE 5 (continued)

Watershed Number	Name and Reference Point	Drainage Area, mi^2	Channel Length, mi.	Channel Elevation Ft. Lower[1]	Upper[1]	Maximum Basin, ft.	USGS Gaging Station
97	Intervening area	0.10					
98	Quail Creek at mouth	0.95	1.85	6240	7440	8110	10336650
99	Intervening area	0.14					
100	Homewood Canyon Creek at mouth	0.84	2.10	6320	7960	8416	
101	Intervening area	0.44					
102	Madden Creek at mouth	2.07	3.07	6400	8075	8740	10336658
102A	Madden Creek near Homewood	1.40	2.30	6900	8140	8740	10336655
103	Intervening area	0.82					
104	Blackwood Creek at mouth	11.18	6.20	6260	7140	8878	
104A	Blackwood Creek near Tahoe City	11.16	6.12	6270	7140	8878	10336660
105	Intervening area	1.78					
106	Ward Creek at mouth	9.74	5.90	6290	7040	8878	
106A	Ward Creek at Highway 89 near Tahoe Pines	9.70	5.65	6315	7070	8878	10336676
106B	Ward Creek Loop Road tributary near Tahoe	0.48	1.20	6750	7440	8289	10336673
106C	Ward Creek tributary near Tahoe Pines	0.91	1.57	6780	7920	8637	10336672
106D	Ward Creek near Tahoe Pines	2.03	1.82	6790	7760	8878	10336670
107	Intervening area	1.67					
108	Lake Tahoe (surface area only)	192.14					
109	Lake Tahoe at Tahoe City (at lake outlet)	505.69					
	Intervening area (not tributary to Lake)	1.01					
110	Truckee River at Tahoe City	506.70					10337500

Jorgensen et al. (1978)

[1] Lower channel elevation is at a point 10 percent of the distance along the channel from site to the crest of the divide; upper channel elevation is at a point 85 percent of the distance.

The USGS routinely collects data on First Creek, Second Creek, Third Creek, Incline Creek, Glenbrook Creek, the Upper Truckee River, and Blackwood Creek. In addition, it maintains stream gauging stations on most of the major tributaries to Lake Tahoe.

Beginning in water year 1988, the USGS expanded its water quality monitoring program, with assistance from TRPA. Table 6 lists the site locations for the tributaries to be monitored. In California, the sites will be operated by the USGS and TRG, while in Nevada the sites will be operated solely by the USGS.

Sampling will vary with flow regime from approximately once per month during low-flow conditions to daily or more often during runoff and snowmelt events. Approximately 150 samples per site will be collected each year. Table 7 lists the water quality parameters for each sample collected.

The Tahoe Research Group (TRG) has monitored water quality for a number of tributaries in the Lake Tahoe Basin beginning in 1973 with Ward Creek. Table 8 lists the tributaries TRG has monitored and the years for which data is available.

Sampling of these tributaries has been intensive. Under low-flow conditions, sampling occurred every five to ten days. During spring runoff and high-flow conditions, sampling occurred every day or more often. Samples were analyzed for suspended sediment and various nutrient species. Tables 8 and 9 summarize that data.

The United States Forest Service (USFS) has conducted monitoring programs on various tributaries in the Basin and has extensive data for them (Table 10). This data was gathered primarily to indicate the impacts that various land uses have on water quality.

Brown and Skau (1975 and 1978) investigated the chemical composition of snow at several sites in the Region and developed equations for predicting nutrient and sediment loads based on analysis of 40 variables for 23 tributaries.

The Nevada Division of Environmental Protection (NDEP) has collected extensive data on creeks in the Incline Village area.

The United States Environmental Protection Agency (EPA) sampled Lake Tahoe and several of its tributaries during 1975. Water samples were collected from 15 tributaries and sampled for Kjeldahl nitrogen, ammonia, nitrate, nitrite, total phosphorus, and dissolved orthophosphorus. Three samples were collected at each site.

TABLE 6 USGS Stream Monitoring Stations

Location	Stream Site	Drainage Area (sq mi)	Channel Length (mi)	% of Stream Basin Monitored	Operating Agency Q	Operating Agency S	Operating Agency N
California	Trout C Basin, total	40.97	12.20	100%			
El Dorado	at Highway 50	40.40	10.70	98.6%	--	USGS	TRG
	at Black Bart Road	36.70	9.45	89.6%	USGS	--	--
	Heavenly Valley Creek tributary inflow	--	--	--	USGS	--	--
California	U. Truckee R. Basin, total	56.64	21.45	100%			
El Dorado	at Highway 50	54.80	19.60	96.8%	USGS	USGS	TRG
California	General Crk. Basin, total	7.56	9.17	100%			
Placer	at Highway 89	7.44	9.13	98.4%	USGS	USGS	TRG
California	Blackwood Crk. Basin, total	11.18	6.20	100%			
Placer	at Highway 89	11.16	6.12	99.8%	USGS	USGS	TRG
California	Ward Crk. Basin, total	9.74	5.90	100%			
Placer	at Highway 89	9.70	9.70	99.6%	USGS	USGS	TRG
Nevada	Third Crk. Basin, total	6.06	7.05	100%			
Washoe	at Highway 89	6.05	6.94	99.8%	USGS	USGS	USGS
Nevada	Incline Crk. Basin, total	6.76	4.66	100%			
Washoe	at Highway 89	6.74	4.55	99.7%	USGS	USGS	USGS
Nevada	Glenbrook Crk. Basin	4.09	3.92	100%			
Douglas	below Highway 50	4.08	3.83	99.8%	USGS	USGS	USGS
Nevada	Logan House Crk. Basin	2.18	3.30	100%			
Douglas	above Highway 50	2.08	3.00	95.4%	USGS	USGS	USGS

Lake Tahoe Basin	Sq. Mi.	% of Total	Monitored in WY 1988 Sq. Mi.	Monitored in WY 1988 %
Lake Tahoe Drainage:	506.69	100%		
Lake Surface:	192.14	38%		
Tributary Basins:	314.55	62%	142.45	45%
Nevada:	77.91	25%	18.95	24%
California:	236.64	75%	123.50	25%

TABLE 7 Water Quality Parameters Sampled

Field Data:	Minimum Reporting Level
Gage Height	.01 ft.
Rated streamflow (cfs) [a]	3 significant figures
Air temperature	.5 C
Water temperature	.5 C
Specific conductance	1 umho
pH [1]	.1 unit
Oxygen, dissolved	.1 mg/L
Ambient barometric	
pressure	5 mm Hg
percent saturation	1%
Lab Data:	
Nitrogen:	
Kjeldahl, total	0.2
Organic, total	-
Ammonia, dis.	0.002
Nitrite + Nitrate, dis.	0.01
Total N [c]	-
Phosphorus:	
Ortho-P, dis. (SRP)	0.001
Total P	0.001
Iron, total recoverable	0.01
Sediment concentration:	
Suspended	-
or total	-

Notes:

[1] pH and DO will be measured monthly at Nevada sites. Barometric pressure required for calculation of DO saturation.

Calculated and estimated parameters:

[a] Instantaneous rated discharge will be calculated from the gage height at time of sampling and the current rating curve at the gage. Initial discharge values will be noted as estimates and will be revised during the annual review of discharge records at the gage.

[b] Estimated total organic = total Kjd - dis. ammonia.

[c] Estimated total N = total Kjd + dis. ammonia + dis. nitrite + nitrate.

[d] Current TRG lab methods determine "hydrolyzable + ortho" phosphorus, equivalent to STORET parameter codes 00677 (dissolved) and 00678 (total).

TABLE 8 Tahoe Research Group Stream Monitoring Stations: Mean Annual Loading Values

Parameter	Tributary	1973	1974	1975	1976	1977	1978	Water Year 1979	1980	1981	1982	1983	1984	1985	1986
	Trout									181	2652	3290	1917	494	
	Upper Truckee									992	7288	4422	6522	1859	6277
Suspended Sediment	Blackwood			2184	31	5			7005	217	9979	2456	1294	354	6305
metric tons/year	Ward	914	2119	1043	0	2			2032	90	8940	1603	655	117	1815
	General									20	1303	243	165	46	579
	Third								1159	52	1258	602	288	183	
	Snow									3	77	154	23	16	
	Trout					309	460		940	512	1043	1199	896	800	
	Upper Truckee					411	2020			984	4279	4801	2750	1897	2911
Nitrate	Blackwood			1756	820	204	1652		1090	509	1773	1508	1018	952	1098
Kg/Year as N	Ward	538	561	680	300	60	142		290	124	605	665	350	316	249
	General									38	231	235	156	112	124
	Third									38	247	299	182	146	
	Snow									3	54	91	17	12	
	Trout								431	155	3052	4258	2073	874	
	Upper Truckee								894	1064	5032	6442	4735	1724	5008
Total P	Blackwood								752	318	3372	2952	1037	371	2664
Kg/Year as P	Ward			2358					474	308	2298	1342	964	285	1109
	General									86	708	603	276	132	371
	Third								425		1146	807	364	163	
	Snow										118	393	74	34	
	Trout								6840	2528	37,019	90,698	22,733	7629	
	Upper Truckee								10,710	11,629	108,595	96,464	49,780	21,512	67,199
Biologically	Blackwood								4512	1848	45,105	32,347	9,362	2398	37,038
Available Iron	Ward								1732	1051	37,997	17,097	4,129	1121	9609
Kg/Year as Fe	General									434	2,499	3153	1,354	756	4398
	Third								10,822		19,645	11,755	5,842	2671	
	Snow										446	1546	737	542	

TABLE 9 Tahoe Research Group Stream Monitoring Stations: Mean Annual Concentration Values

Parameter	Tributary	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
								Water Year							
Suspended Sediment mg/1	Trout								48	5	44	43	34	20	
	Upper Truckee								49	24	42	24	40	31	55
	Blackwood			67	2	2			85	14	152	38	26	15	125
	Ward	41	63	42	1	1			16	9	171	30	18	8	55
	General									4	42	8	8	4	25
	Third								135	13	105	48	28	27	
	Snow									11	18	20	10	20	
Nitrate ug N/1	Trout					72	22		14	15	18	16	16	32	
	Upper Truckee					26	23		12	24	25	26	20	32	25
	Blackwood			54	60	36	46		17	32	27	24	21	41	22
	Ward	24	17	27	29	14	14		5	12	12	13	10	20	8
	General									6	8	8	7	11	5
	Third								10	10	21	24	18	22	
	Snow									9	13	12	8	16	
Total P ug P/1	Trout								25	30	51	56	37	35	
	Upper Truckee								21	40	29	36	35	29	44
	Blackwood								31	32	51	45	21	16	51
	Ward			95					27	36	44	26	27	18	34
	General									19	23	20	13	13	16
	Third								74	36	96	64	35	24	
	Snow									39	28	51	32	41	
Biologically Available Iron ug Fe/1	Trout								387	426	619	1192	405	308	
	Upper Truckee								246	449	622	530	366	359	584
	Blackwood								187	173	688	493	189	102	734
	Ward								103	119	728	324	119	71	292
	General									97	80	103	63	74	192
	Third								1944	706	1646	936	564	395	
	Snow									342	107	464	320	667	

TABLE 10 U.S. Forest Service Stream Monitoring Stations: Mean Parameter Concentration Values

Parameter	Tributary	Water Year 1980	1981	1982	1983	1984	1985	1986	1987
	Wildwood Keller					40	4	12	1
	Heavenly Valley								
	Above	22	12	27	7	12	4	23	4
	Below	47	139	54	173	96	65	83	103
	Saxon	12	4	18	23	15	6	16	
	Snow							14	19
Suspended	Griff						11	10	
Sediment	South Zephyr						13		
mg/l	Burke			4	6	14	14		
	Marlette	15	5	14	28	9	5	18	10
	Big Meadow	9	5	5	10	4	3	9	4
	Grass Lake	24	6	12	18	6	3	10	4
	Meeks	3	6	2	1	1	4	2	4
	Trout			19	60	10	5	24	7
	Blackwood	7	5	5	2	13	3	3	5
	Wildwood/Keller					8	3	3	3
	Heavenly Valley								
	Above	7	12	6	5	11	29	10	48
	Below	40	36	45	86	119	159	173	164
	Saxon	8	8	4	6	7	16	5	
	Snow							11	7
	Griff						16	7	
Nitrate/Nitrite	South Zephyr						5		
ug N/l	Burke			1	3	3	5		
	Marlette	63	67	70	57	52	87	98	90
	Big Meadow	6	6	3	13	12	19	7	14
	Grass Lake	22	24	8	15	12	24	9	20
	Meeks	16	28	10	17	16	17	10	13
	Trout			5	9	8	15	8	10
	Blackwood	14	40	18	23	34	51	14	25

TABLE 10 (continued)

Parameter	Tributary	Water Year 1980	1981	1982	1983	1984	1985	1986	1987
	Wildwood/Keller					195	23	38	22
	Heavenly Valley								
	Above	41	24	24	21	22	20	24	32
	Below	50	47	42	92	60	178	72	78
	Saxon	29	15	17	21	14	14	17	
	Snow							20	35
Total Phosphorus ug P/l	Griff						18	13	
	South Zephyr						48		
	Burke			8	11	20	17		
	Marlette	27	20	17	34	17	16	19	20
	Big Meadow	20	10	9	12	9	11	13	18
	Grass Lake	30	14	11	15	14	10	13	18
	Meeks	11	4	5	4	4	4	5	9
	Trout			16	20	14	14	19	17
	Blackwood	44	7	13	5	8	5	5	15

The Joint Studies Group collected data between 1965 and 1975. Various data on physical, chemical, and biological parameters were collected. In 1968 they began sampling the Upper Truckee River, Taylor Creek, General Creek, and Incline Creek. In 1971, they added Trout Creek, Madden Creek, Ward Creek, Burton Creek, Third Creek, and Edgewood Creek to their sampling program. Samples were generally collected twice a year.

The Lahontan Regional Water Quality Control Board (LRWQCB) staff does periodic sampling to determine compliance with Waste Discharge Requirements (WDRs). In addition, the Lahontan Board samples to detect potential violators of discharge standards.

Other sampling has been done in the Basin. Brown and Skau (1978) did extensive sampling on 23 tributaries in the Tahoe Basin.

A variety of water quality parameters provide insight into the water quality of Lake Tahoe and its tributaries. For the tributaries, researchers and regulatory agencies have chosen to focus on nitrogen, phosphorus, iron, and suspended sediment as the water quality parameters of primary interest in controlling the eutrophication of Lake Tahoe (Goldman, 1981; Leonard and Goldman, 1981; TRPA, 1981; Goldman et al., 1982; Loeb, 1983; Axler et al., 1983; Byron et al., 1984; and Byron and Goldman, 1985, 1986).

Despite the numbers of agencies involved in tributary sampling, and the number of samples taken over the last 20 years, there is much that is not known about tributary quality trends and attainment of applicable standards. In California, there are state standards for total nitrogen, phosphorus, and iron in tributaries. It is not known whether streams in the TRG/USGS monitoring program meet the total nitrogen standard, since data for total nitrogen have not been reported. For all other streams in California, it is not known whether they attain the total nitrogen standard.

California-side streams in the TRG/USGS monitoring program do not attain the state standards for total phosphorus. Total phosphorus concentrations for monitored streams generally exceed the state standard by a factor of about 2. Likewise, California-side streams in the monitoring program do not meet the total iron standard, generally exceeding the standard by an order of magnitude. For all other streams in California, it is not known whether they attain the total phosphorus and iron standards.

In Nevada, there are state standards for soluble phosphorus and total soluble inorganic nitrogen. Based on a short period of record on streams in the TRG/USGS monitoring program, streams appear to be at or near attainment of the standards, although additional monitoring is necessary to confirm this. For all other streams in Nevada, it is not known whether they attain the state standards.

TRPA set a threshold standard for suspended sediment in tributary streams in 1982. Although streams in the TRG/USGS monitoring program generally have annual average suspended concentrations which meet the threshold, it is not known whether those streams attain the threshold or not, since the threshold is a 90th-percentile standard. For all other streams, there is no data on suspended sediment concentrations which would allow a comparison with the TRPA standard.

3. Groundwater

Until recently, little was known about the quality of groundwaters in the Tahoe Region. Recent research, however, has shed additional light on the subject. For a summary of the findings of recent research into groundwater quality, see the systems model, below. There are no state or TRPA standards for the quality of groundwaters in the Tahoe Region.

4. Surface Runoff

Surface runoff is localized surface flow from rainfall and snowmelt draining small sub-watersheds. There has been little monitoring of the quality of surface runoff in recent years. In four studies from 1969 to 1982, observed 90th percentile concentrations of nitrate, dissolved phosphorus, and dissolved iron equalled or exceeded the TRPA and state guidelines for discharges of runoff to surface waters. Urban runoff exceeded the TRPA and state guidelines for discharges to surface waters in greater than 90 percent of the samples taken. The 90th percentile concentrations for dissolved phosphorus exceeded the guidelines for discharge to surface waters by a factor greater than 10.

In the same four studies, 90th percentile concentrations of surface runoff generally met the TRPA and state guidelines for discharges of runoff to groundwater, with the exception of runoff from urbanized areas, which exceeded the dissolved phosphorus guideline by a factor of about 2. (For details on available surface runoff data, see TRPA, 1982d.)

5. Other Lakes

Monitoring of the water quality of the other lakes in the Tahoe Region is very limited. The largest of these lakes are Cascade, Upper and Lower Echo, Marlette, and Fallen Leaf. There are more than 170 ponds and lakes within the Tahoe Region. Clarity measurements in Fallen

Leaf Lake in 1975 showed lower clarity than Lake Tahoe for the same period (TRPA, 1982d). In recent years, residents of the Fallen Leaf Lake area have complained of taste and odor problems in drinking water withdrawn from Fallen Leaf Lake. These problems have been attributed to blooms of the colonial algae, volvox.

6. Applicable Standards

The adoption of Public Law 96-551 (The Tahoe Regional Planning Compact) authorized the TRPA to establish environmental threshold carrying capacities to protect the resources of the Tahoe Region. These threshold carrying capacities were to be the standards necessary to maintain the significant scenic, recreational, educational, scientific, natural, and public health and safety values in the Lake Tahoe Region.

Environmental threshold carrying capacities ("thresholds") were adopted by the TRPA in 1982 (Attachment 1). These established standards in the areas of water quality, soil conservation, air quality, vegetation preservation, wildlife, fisheries, noise, recreation, and scenic resources.

Under the provisions of state and federal law, California and Nevada have also set water quality standards for the waters of the Tahoe Region. The State water quality standards are listed in Attachment 2.

C. A SYSTEMS MODEL

1. Overview and Introduction

The many individuals and agencies who work with water quality and land use planning in the Tahoe Region have desired, for many years, to have an integrated predictive mathematical model of the watershed-airshed-Lake system. To date, no such model exists, although the Tahoe Research Group of the University of California at Davis, with assistance from TRPA, is conducting research and beginning to develop such a model at this time.

In the past 15 years, planners have developed approximate models to relate land coverage and land capability to sediment and nutrient yields; to relate annual loads of nutrients and sediments to Lake Tahoe with algal productivity and clarity; and to investigate other relationships of interest. While these models provide some insight into cause-and-effect relationships, they have not achieved the level of conceptual and mathematical advancement necessary to accurately predict future water quality conditions.

Development of any predictive water quality model must start with a firm understanding of the mechanisms at work in the watershed, the airshed, and Lake Tahoe itself which dictate water quality conditions at any given time. The following pages summarize the current understanding--and uncertainties--regarding these mechanisms and, where possible, describe those mechanisms in quantifiable terms. While this systems model does not allow one to predict numerical descriptors of future water quality, it does provide a level of understanding necessary to comprehend and evaluate these amendments to the water quality management plan for the Tahoe Region.

2. The Watershed of Lake Tahoe

a. Sediment Generation and Transport

The total sediment load that a stream carries is composed of two parts: the bedload component and the suspended sediment component. Bedload is that portion moved downstream along the stream's bottom. Although bedload may occasionally be bounced or skipped such that it loses contact with the streambed, its weight is substantially supported by the bottom of the stream channel. The suspended portion of the sediment load is the sediment that is lifted off the streambed and moved for long distances without contacting the bed. The suspended sediment portion is supported by the water.

Sediment transport is dependent upon a stream's energy or capacity to move material. Energy within a stream is represented by the potential energy of the water before it begins its flow downhill. As water loses elevation, potential energy is changed to kinetic energy. Some kinetic energy is dissipated through heat loss and frictional loss. Left-over energy is used to transport sediments. This available energy is dependent on streamflow and the gradient or slope of the water.

Streams need a source of sediments to move once sufficient energy is present to transport sediments (Glancy, 1981). Since overland flow and its subsequent surface erosion is uncommon in undisturbed Sierra watersheds, this source is largely within the stream channel itself. Sediments in the channel build up with time until a large enough flow occurs to clear the sediment out. Sediment production is related to the amount or length of stream channels in a watershed (drainage density) since as drainage density increases, more sources of sediments are contacted and sediment yield increases.

The TRPA (1977) estimated sediment loading to Lake Tahoe at 64,000 metric tons per year. In 1980, the California State Water Resources Control Board (SWRCB, 1980) estimated the suspended sediment load at 60,800 metric tons per year. Both of these estimates appear to be high, given the levels of suspended sediments measured in the tributaries (see data in Tributary section). TRPA's more recent estimate of 27,000 metric tons per year is probably much closer to the actual loading value than the earlier estimates (TRPA, 1982d).

Increased sediment production of a watershed has impacts on both the tributaries and Lake Tahoe. In the tributaries, sediment silts over spawning areas, causes the water to be turbid, destabilizes channels, is aesthetically displeasing, and is a general indicator of poor health and instability of the watershed. In Lake Tahoe, sediments also degrade fisheries, contribute to loss of clarity (especially in the littoral zone), and are aesthetically displeasing.

As shown below, soil particles are classified by their diameter size:

Particle	Diameter Range (mm)
very coarse sand	2.0 - 1.0
coarse sand	1.0 - 0.5
medium sand	0.5 - 0.25
fine sand	0.25 - 0.10
very fine sand	0.10 - 0.05
silt	0.05 - 0.002
clay	less than 0.002

Dunne and Leopold (1978) concluded that the suspended sediment portion of the total sediment load is typically composed of soil particles 0.5 mm or smaller. The contributions of the various size fractions to turbidity are not the same. The smaller silt and clay fractions contribute the most to increasing the turbidity of water. This is due to the relatively large surface area to volume ratio that these small soil particles have. This surface area refracts and absorbs light, thereby decreasing the clarity of the water.

b. Runoff Processes

Tributary flow is a dynamic process and responds to the availability, quantity, and delivery mechanisms of water. An understanding of the runoff processes is useful in recognizing those areas of the watershed that are contributors of storm runoff or groundwater recharge. Areas that produce runoff also deliver sediment and nutrients to the streams (Dunne and Leopold, 1978). Through an understanding of these processes, management techniques can be developed to minimize the delivery of nutrients and sediments.

Dunne and Leopold (1978) describe the four basic ways that precipitation and snowmelt reach a stream. These are:

Hortonian overland flow, which is the flow of water over the land surface when delivery exceeds the infiltration rate.

Unsaturated or subsurface flow, which is the flow of water through the unsaturated zone of the soil.

Groundwater flow, which is the flow of water in the saturated zone of the soil, and

Saturated overland flow, which is a combination of direct precipitation onto a saturated area and infiltrated water that has returned to the surface.

The importance and contribution of each of these processes to streamflow is affected by the climate, geology, topography, soil characteristics, vegetation, and land use. These processes contribute to the runoff characteristics of a stream. When runoff is plotted against time, a hydrograph is formed (Figure 7).

In a hydrograph, flow is divided into two quantities. The first is the storm or snowmelt runoff portion. This is the part of the runoff that quickly reaches a stream and accounts for the rapid rise in streams and peak discharges associated with storms and snowmelt. The other component is the base flow. This is the contribution from the groundwater. It too rises in response to storms, but the base flow generally contributes little to peak flow discharges and recedes slowly. The time between the center of mass of the rainfall and the peak of the discharge is the "lag to peak" time. This is a function of the efficiency of the delivery network to the stream.

A discussion of the four runoff processes is important to an understanding of how a watershed functions in its response to a rainfall or snowmelt event:

i. Hortonian Overland Flow

Soils have a maximum rate at which they can absorb or infiltrate water. This infiltration rate declines with time as a storm or melt continues and the soil becomes more saturated. If the rainfall or snowmelt rate exceeds the infiltration rate of the soil, the water becomes overland flow, which is often referred to as Hortonian overland flow in honor of Robert E. Horton, who described this process. This flow will either directly contribute to streamflow or will re-infiltrate in areas where infiltration rates are higher.

A number of factors influence an area's infiltration rates. Of primary importance is the soil type. Coarse-textured soils derived from granite have been found to have six times the infiltration capacity of fine textured soils derived from andesite (DeByle, 1970). Other soil characteristics that affect infiltration rates are depth of soil, depth to an impermeable layer, depth to water table, percolation rate of subsurface soil, and inherent structure of the soil. Land use also affects infiltration rates. Vegetation removal, soil compaction, and soil removal decrease a soil's capacity for infiltrating water (Bailey, 1974; Dunne and Leopold, 1978).

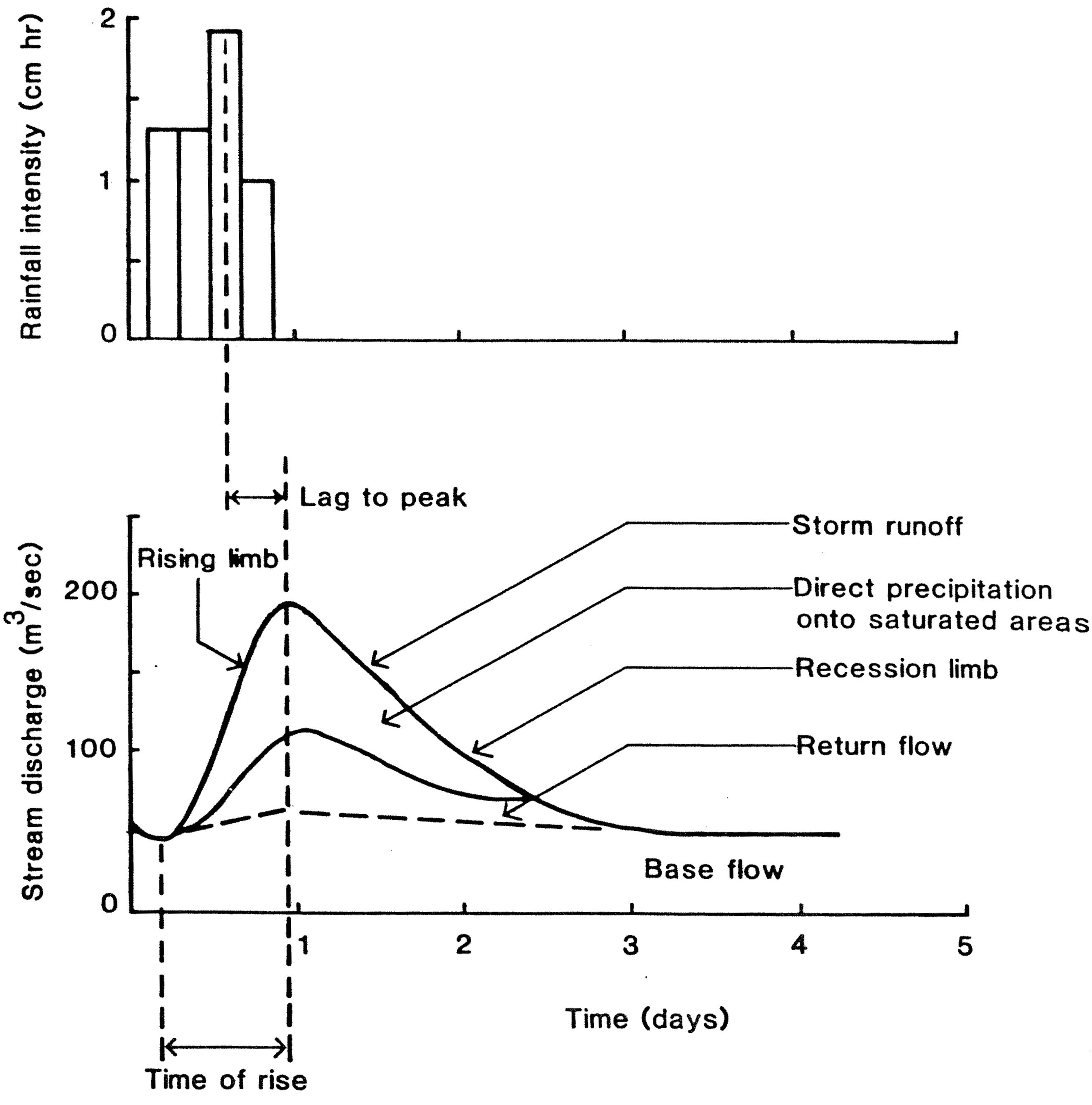


FIGURE 7 Example Hydrograph

The removal of vegetation exposes the soil to the full impacts of the water drops. This breaks up soil aggregates, compacts the surface, and allows less water to infiltrate into the soil. Soil compaction forms a firm surface on the soil and fills in the void spaces between the soil particles. This creates a surface that is impenetrable by water.

Removal of soil can affect infiltration rates two ways. It physically reduces the amount of soil that can hold water. The soil becomes saturated much faster and infiltration rates decline quicker. Also, by removing the top layers, the risk of exposing a less permeable layer such as a fragipan or duripan is increased.

ii. Unsaturated Flow

Unsaturated flow occurs when water penetrates the soil surface and moves through the unsaturated portion of the soil. As the water moves downhill, it follows two pathways. One is down through the soil to the water table. The other is a downward and lateral flow path directly discharging into a stream without ever reaching the groundwater. Contributions to streamflow by this pathway are relatively small, while contributions to the groundwater are substantial and represent the only local recharge source.

iii. Groundwater

The groundwater system of a watershed is recharged during snowmelt and storm events. This recharge causes the water table to rise. If the water table was shallow prior to the snowmelt storm event, this response would be quicker than for a water table at greater depths, assuming all other factors are constant.

The contribution of groundwater to peak streamflows is relatively small. As can be seen from Figure 7, groundwater contributions increase slightly as the result of a storm. The main contribution of groundwater is the maintenance of the base flow of a stream. It is this process that keeps a stream flowing between storms and during the summer.

iv. Saturated Overland Flow

Saturated overland flow is the combination of infiltrated water that returns to the surface and direct precipitation onto a saturated area of soil. The distinction between this flow path and Hortonian overland flow becomes blurred since a saturated area has an infiltration rate of zero and creates overland flow due to its inability to infiltrate water.

When a rainstorm or snowmelt event is long enough or intense enough, recharge will cause the water table to rise to the surface, creating areas of saturated soil that extend along the sides of streams and into ephemeral channels and gullies, thereby increasing the drainage network.

The expansion and contraction of these water-saturated areas is very dynamic and responds quickly to changing climatic conditions. As a storm or melt continues, these saturated areas expand uphill. As a storm or melt tapers off and stops, these areas contract and move downhill as the water table and zones of saturation decrease.

Precipitation or snowmelt contacting these saturated areas does not infiltrate into the soil. Instead, the water flows off these saturated areas directly into the streams or into another area for re-infiltration.

Hewlett and Hibbert (1967) have described the expanding and contracting areas of saturated overland flow as the "variable source concept." These variable source areas provide a direct path for precipitation and snowmelt, with their nutrient loads, to reach a stream. The contributions to stream runoff from saturated overland flow can be substantial.

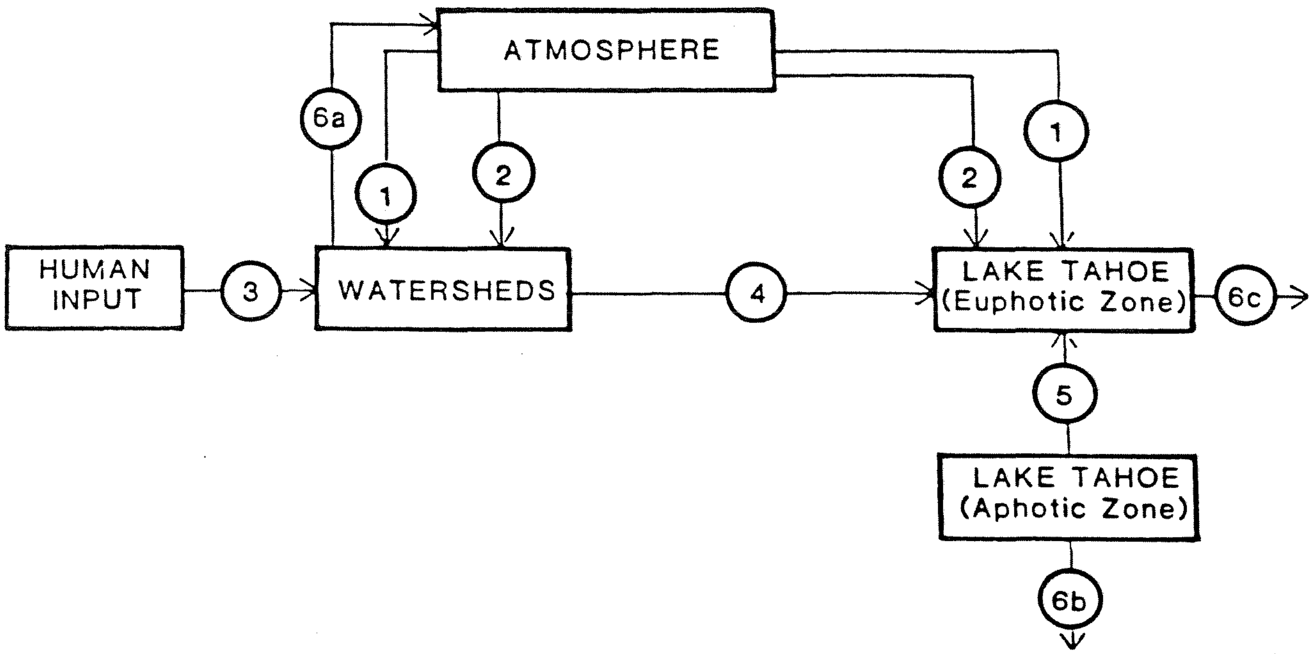
c. Nutrient Inputs and Outputs in the Watershed

The addition of nutrients to Lake Tahoe waters containing algae has been found to be highly stimulatory to the algae. Most research work in the Tahoe Basin has focused on nitrogen since that is believed to be the limiting nutrient for algal growth in Lake Tahoe (TRPA, 1982d; Goldman, 1974; Unsicker, 1984). Recently, Byron and Goldman (1986) have found that other nutrients, phosphorus and iron, are also growth limiting factors. This has led to increased attention to tracking and controlling these nutrients.

i. Nitrogen

Figure 8 depicts the main sources and losses of nitrogen to the Lake Tahoe watershed. As shown, the principal new sources of nitrogen to the watershed are atmospheric deposition (both wet and dry), nitrogen fixation, fertilizer application, exfiltration from sewage lines, and leachate from abandoned septic systems. The pathways that nitrogen follows from the watershed to the euphotic zone, where algal growth occurs, are groundwater recharge, tributary flow, and direct urban runoff. Losses of nitrogen in the watershed occur by denitrification.

Nitrogen deposition from the atmosphere includes both wet and dry deposition of nitrate and ammonia. These two nutrients are readily available for use by the plants of the watershed, but if transported to surface waters without contacting vegetation, they are also readily available for use by algae.



LEGEND:

1. Precipitation (wet and dry) falling on both the watershed and directly onto the lake.
2. Biological nitrogen fixation occurring in both the terrestrial and aquatic environments.
3. Human inputs such as leaching of fertilizer, sewage line exfiltration, and sewage spills.
4. Tributary and groundwater inputs.
5. Vertical mixing of aphotic waters into the euphotic zone.
6. Ecosystem losses including:
   a. Denitrification
   b. Permanent sedimentation
   c. Tributary outflow

FIGURE 8 Sources and Losses of Nitrogen, Lake Tahoe

Sources of nitrogen deposition are both local (within the Basin) and distant (outside of the Basin and upwind). These sources include vehicle emissions of oxides of nitrogen (NO_x), agricultural particulates and volatilization from fertilizers, industrial sources, and N_2 fixation by lightning (TRPA, 1982b).

In addition to deposition, the biological fixation of nitrogen gas (N_2) to organic nitrogen is an important source of nitrogen to the watershed (Leonard et al., 1979). A wide variety of organisms can fix N_2 gas. These include bacteria, microorganisms on or associated with the root system of plants, and blue-green algae. These N_2 gas fixing organisms are found in both the terrestrial and aquatic components of the watershed (Fleschner, 1975 and Loeb and Reuter, 1981).

Fertilizer applications, exfiltration from sewage lines, and leachate from old septic tank systems represent the predominant human inputs of nitrogen to the watershed. Little data is available to determine the exact magnitude of these sources, but they represent a substantial source of nitrogen to Lake Tahoe.

The tributaries and groundwater are important pathways of nitrogen to Lake Tahoe. To the extent that urban runoff reaches Lake Tahoe directly, rather than discharging to a tributary stream, it should also be considered an important pathway. Nitrogen loading from each watershed is dependent on a number of factors, but appears to be primarily dependent upon atmospheric inputs, soil characteristics, geology, and land use.

TRPA (1982b) estimated DIN loading rates for tributaries and groundwater recharge. Tributary loading was estimated at between 2 to 17 metric tons per year with an average of 10 metric tons per year. Groundwater loading for DIN was estimated by TRPA (1982b) to vary between 2 and 17 tons per year with an average of 10 tons per year, the same as for tributary loading.

Nitrate is highly mobile in soils, with little adsorption occurring. Loeb and Goldman (1979) have demonstrated this mobility by showing that the rate of nitrate movement through soils is about the same as the rate of water movement. Nitrate will continue to migrate through the soil until it is biologically removed or until it reaches the groundwater.

The groundwater reaches Lake Tahoe either by being discharged at the shoreline-water interface or by discharging into a stream flowing into Lake Tahoe.

Denitrification is a process that converts nitrate and nitrite into N_2 gas and nitrous oxide gas (N_2O). This process removes nitrogen from the Tahoe Basin. Denitrification is performed by a number of faculative bacteria. Anaerobic conditions are necessary for denitrification to occur.

Anaerobic conditions are found in saturated soils such as meadows and riparian areas and in areas where oxygen is used faster than it can be replaced by diffusion. Inadequate replacement rates can create microsites of anaerobic conditions in an otherwise aerobic soil (Currie, 1961; Smith, 1977). Denitrification rates have been found to be dependent upon temperature, degree of anaerobisis, carbon availability and nitrate concentration (Payne, 1981; TRPA, 1982; Greenlee, 1985).

Greenlee (1985) investigated denitrification rates of a mountain meadow at a site located just outside the Tahoe Basin in the Carson Range. Elevation was approximately 6,600 feet. Greenlee (1985) reported nitrogen loss due to denitrification as being approximately double the addition rate of nitrogen due to precipitation. Nitrogen loss rates averaged 1.13 gN/ha/hr for 1983 and 1.26 gN/ha/hr for 1984. This represents a substantial loss of nitrogen for the watershed sampled.

Denitrification was also found to occur in soils under a forest canopy. Greenlee (1985) collected six samples during a one-day sampling run. At the time the samples were collected, the forest soil was dry, as determined by coring to a depth of one meter, and the day was overcast and cold. For the forest site denitrification rates varied between 0.48 and 0.55 gN/ha/hr. This indicates that denitrification may be widespread throughout a watershed and not confined to the seasonally saturated riparian and wetland areas.

ii. Phosphorus

Phosphorus is another essential nutrient for algal productivity. In Lake Tahoe, phosphorus is often at or below the limits of analytical detection, but it frequently can be the limiting nutrient for algal productivity (TRPA, 1982d). Phosphorus differs from nitrogen in three important ways:

- Phosphorus does not have a gas phase and has no cycle that is comparable to nitrogen fixation, denitrification, or ammonia gas volatilization, but does go through biological cycling.

- The inorganic phosphate ion has a high adsorptivity. It is readily bound to both inorganic and organic particles. As opposed to nitrate, phosphate is not a mobile ion and is readily adsorbed onto soil particles. Its delivery is closely associated with the processes affecting sediment delivery.

- Inorganic phosphorus forms complexes, chelates, and insoluble salts with many metal ions (Wetzel, 1975). The concentration of phosphorus in water is complicated by the water chemistry in addition to biological assimilation and transformation.

Atmospheric sources of phosphorus are from agriculture (fertilizers), dust from soil erosion and construction sites, and urban and industrial contaminants. The majority of phosphorus deposition occurs in the particulate form. TRPA (1982b) estimated the atomospheric phosphorus load to Lake Tahoe at between 0.9 to 1.2 metric tons per year.

Phosphorus sources within the watershed are mainly from erosion (both natural and man-caused) that release free phosphorus and clay bound phosphorus into the watershed. Phosphorus is also released upon the death and decomposition of the biota. This phosphorus input tends to be taken up quickly by the other biota or adsorbed onto the soil as it is leached down through the soil column.

Fertilizer applications, exfiltration from sewage lines, leachate from abandoned septic tanks, and pet excrement are the direct inputs of phosphorus to the watershed from man and his friends. Little data are available to determine the exact magnitude of these sources, but they are substantial.

Tributary flow and groundwater contribute phosphorus to Lake Tahoe, as does urban runoff to the extent that it discharges directly to Lake Tahoe. The majority of the phosphorus in the tributaries is in particulate form (greater than 80 percent) while phosphorus in groundwater is mostly in the dissolved form (Leonard et al., 1979; Leonard and Goldman, 1981; Goldman et al., 1982). TRPA (1982b) estimated tributary total phosphorus loading at 7 metric tons per year, with groundwater contributing 2 metric tons per year. Due to the adsorptivity and common particulate form of phosphorus, phosphorus loading is closely tied to sediment loading (TRPA 1982).

The clay particles of soil, which adsorb phosphorus, appear to be the primary carrier (TRPA, 1982d). This clay fraction is deposited in the deltas that form at the mouths of streams in Lake Tahoe.

iii. Iron

Iron is also an essential nutrient for algal productivity. Goldman et al. (1982) found iron to be highly stimulatory to algae growth and reproduction in Lake Tahoe.

Relatively little is known about iron transformations in iron-deficient watersheds. Studies by the TRG (Elder, 1974; Elder et al., 1976; Leonard et al., 1979; Leonard and Goldman, 1981; and Goldman et al., 1982) have shown that iron is even more closely associated with sediment production than phosphorus. TRPA (1982d) summarized their findings as follows:

-- Most of the iron transported into the euphotic zone is in the form of particulates suspended in stream water (approximately 98 percent).

- -- Daily and seasonal discharge patterns correlate well with those for suspended sediments. Maximum sediment discharge occurs during periods of maximum stream flow.

- -- Differences in areal loading rates between watersheds are in part due to geological differences. These effects are likely to be minor relative to the differences associated with soil and vegetation disturbance.

- -- Soluble iron in streams is probably from biological sources. Its magnitude is small compared to particulate iron, but is much more available to algae.

- -- Lake concentrations of soluble iron are also low relative to particulate iron. Total amounts of iron are low and relatively uniform in distribution over lake water depth.

- -- Most of the iron suspended in streams probably falls out of the water rapidly. However, Elder et al. (1976), suggested that a considerable fraction of this particulate iron was convertible to soluble, available forms after reaching Lake Tahoe. Organic chelation and rapid mineralization by bacteria are possible mechanisms for this conversion.

d. Drainage Density

Drainage density is a measure of watershed dissection. It is a numerical measure of the length of drainage channels divided by the area of the watershed. A watershed exhibits both high-flow and low-flow drainage density. As discussed above, saturated areas expand and contract during storm events and snowmelt. Expansion extends the length and numbers of flowing streams within a watershed.

A number of characteristics are associated with drainage density. A watershed with a high drainage density represents an area that has relatively shorter flow paths and shorter retention times for surface and subsurface flow. In addition, higher drainage densities are associated with steeper terrain, higher floodpeaks, higher sediment production, higher nutrient production, higher flow velocities, and decreased lag time (Brown et al. 1983; Skau et al. 1980; Dunne and Leopold, 1978; Brown et al. 1973).

Of importance to the Tahoe Region is the impact that drainage density and saturated overland flow have on nutrient and sediment delivery to Lake Tahoe. For the undisturbed portions of the Tahoe Region, Hortonian overland flow rarely exists (Rhodes et al., 1985). Therefore, the natural flow characteristics of the tributaries in the Tahoe Basin follow the variable source concept with its expanding and contracting drainage network. Increases in variable sources areas and increases in drainage density are associated with increases in sediment and nutrient yield.

The variable source areas represent saturated soils that act as impervious surfaces. These prevent precipitation from entering the soil and quickly transmit the rainfall nutrients into the drainage channel network.

Coats, et al. (1976) and Melgin (1985) concluded that nutrient removal mechanisms are short-circuited when these saturated areas prevent the water from coming into contact with the soil-biological complex. These areas decrease the residence time for water and limit the ability of a watershed to incorporate and remove nutrients.

Sediment yield is affected two major ways. As peak flows are increased, sediment yields also increase (Dunne and Leopold, 1978). In addition, as the drainage density increases, new sources of sediment are encountered.

e. Stream Environment Zones

SEZs are biological communities that owe their characteristics to the presence of surface water or a seasonal high groundwater table. SEZs are capable of rapid nutrient uptake and incorporation into the dense vegetation, while the moist to saturated soils are conducive to dentrification. In general, the terms "variable source area" and "stream environment zone" refer to the same portions of the watershed.

Morris et al. (1980) in a limited study found that up to 83 percent of the dissolved nitrates introduced into meadows was removed if the water moved as sheet flow over the meadow so that slow flow rates were maintained and sediments settled out. A portion of this nitrate was removed by the process of dentrification while the rest is incorporated into the plant material or leached into the soil.

In a study developed for TRPA (1977), natural processes were found to remove almost 75 percent of the dissolved nitrogen and iron and 86 percent of the dissolved phosphates entering an SEZ. The sediment load was reduced by 94 percent (Table 11). Additional research by Morris et al. (1980) into nutrient and suspended sediment removal capacities of SEZs concluded that:

-- Sheet flow across SEZs provides the most effective treatment of water,

-- The natural treatment capability of SEZs is destroyed where development causes channelization, and

-- Channelized SEZs may actually increase sediment and nutrient loading in areas where erosion is caused by concentrated flow.

Table 11 SEZ Removal Rates For Nutrients, Sediment

Station Location	Suspended Solids (mg/l)		Total Nitrogen as N (mg/l)		Phosphate as PO_4 (mg/l)	
	n	x	n	x	n	x
Above	30	493	18	1.424	28	.982
Midway	8	162	6	.300	8	.019
Below	20	29	16	.395	18	.141
Percent Reduction in Concentration	94%		73%		86%	

mg/l = milligrams per liter
n = number of samples
x = mean concentration

(TRPA, 1977)

While SEZs have been found to be very effective in removing nutrients and sediments, during certain rainfall and snowmelt episodes and following the fall die-off of vegetation, SEZs can also act as a source of nutrients and sediments, especially if they are disturbed. Nevertheless, the effectiveness of an undisturbed SEZ as a sink for nutrients and sediments remains.

Additional benefits of maintaining and protecting existing SEZs and restoring disturbed ones are their ability to reduce flood peaks, diffuse flow, increase evapotranspiration, and increase the retention times of surface water.

f. Groundwater

Groundwater contributions to Lake Tahoe and the role of groundwater within the Basin are not well understood. This is due to the scarcity of data and research concerning this issue. Although data are limited, research to date indicates that groundwater loading represents a substantial contribution to Lake Tahoe.

Research by the TRG includes two reports detailing nutrient contributions from groundwater sources to Lake Tahoe. Loeb and Goldman (1979) investigated groundwater transport in Ward Valley for the 1975 water year. Groundwater was estimated to contribute 49 percent of the total nitrate load from the watershed to Lake Tahoe.

Loeb and Goldman (1979) also reported on groundwater phosphorus loading to Lake Tahoe. Since particulate phosphorus is effectively filtered out during the percolation to the groundwater, groundwater phosphorus ís largely in dissolved form. Loeb and Goldman (1979) reported groundwater loading rates for soluble phosphorus as being between 80 and 120 percent of the soluble phosphorus tributary loading for water year 1975. The groundwater contribution of approximately 251 kg of soluble phosphorus per year represents approximately 10 percent of the total phosphorus load to Lake Tahoe from the Ward Valley watershed.

Loeb (1987) also investigated groundwater contributions to Lake Tahoe from three watersheds: Upper Truckee River, Trout Creek and Ward Creek. Groundwater was sampled approximately once a month from January, 1986 through August, 1987.

Loeb found that in all three groundwater systems groundwater concentrations of nitrate were the lowest in those areas furthest upgradient or furthest away from Lake Tahoe and increased down-gradient toward the Lake. This corresponds to the magnitude of disturbed land, which also increases down-gradient toward the Lake.

For the Trout Creek aquifer, concentrations ranged from .023 mg/liter of nitrate in the upgradient areas to 1.528 mg/liter of nitrate in the down-gradient areas. Upper Truckee aquifer nitrate concentrations ranged from 0.006 mg/l to 2.548 mg/l. Ward Valley aquifer concentrations ranged from 0.027 mg/l to 0.264 mg/l.

Soluble phosphorus concentrations were found to be consistently low in the three aquifers. Average concentrations for soluble phosphorus were 0.020 mg/l for the Trout Creek aquifer, 0.029 mg/l for the Upper Truckee River aquifer, and 0.045 mg/l for the Ward Valley aquifer.

Loeb (1987) found groundwater loading rates to be a greater proportion of the total loading for the Ward Valley watershed than for the Upper Truckee-Trout Creek watershed. For Ward Valley, the groundwater contributed 60 percent of the total nitrate loading and 44 percent of the total soluble phosphorus loading (groundwater and surface water contributions) to Lake Tahoe from Ward Valley.

For the Upper Truckee-Trout Creek watershed, Loeb (1987) used two models to calculate nitrate loading. These models show that 5 to 20 percent of the total nitrate loading (surface and groundwater together) from the Upper Truckee-Trout Creek watershed enters Lake Tahoe by groundwater. Groundwater contributions of soluble phosphorus were estimated at 2 percent of the total loading from this watershed.

Additional data on groundwater loading is not available at this time. The USGS is planning further groundwater research in the Tahoe Basin, which will consist of trying to model nutrient loading to Lake Tahoe from the major aquifers within the Basin. In addition, attempts will be made to date the groundwater to try and and determine the sources of the nutrients to the groundwater system.

g. Impacts of Development on the Watershed

Natural System. A natural, undisturbed watershed is very efficient and conservative in its treatment of nutrients. Studies have found that undisturbed, alpine watershed are capable of removing approximately 100 percent of the incoming nitrogen that is deposited on a watershed (Hemond and Eshleman, 1984; Rhodes *et al.*, 1985, 1986). This removal is thought to be largely due to bacterial dentrification and plant uptake and incorporation.

Rhodes *et al.*, (1986) reported a weighted mean nitrate concentration of 0.037 mg/l in precipitation at a study site in the Carson range, immediately adjacent to the Tahoe Basin. Concentrations of nitrate in the stream water at the outlet remained low, with one-third of the samples collected containing less than 0.001 mg/l. Peak concentration was 0.007 mg/l, sampled during the peak snowmelt period. Mean groundwater nitrate concentration was found to be 0.001 mg/l, with concentrations in the unsaturated zone being highly variable (ranging from less than 0.001 mg/l to 1.06 mg/l). Samples with high concentrations in the unsaturated zone were always restricted to areas with bare soils.

Hortonian overland flow seldom occurs in the Sierra Nevada since infiltration capacities of the soils exceed rainfall and snowmelt rates (Rhodes *et al.*, 1985). The runoff process most affecting the watershed is the variable source area concept. Saturated overland flow generated by these areas is the main contributor to streamflow during storms and snowmelt periods. These saturated areas also act as conduits that rapidly transmit the nutrients in the rainfall and snowmelt into the stream (Rhodes et al., 1985). They expand and contract in response to climatic variations and are temporally and spatially variable in their influence on streams.

The importance of these saturated wet areas is their capability for nutrient and sediment removal. Although saturated riparian and wetland areas can act as a source during specific rainfall and snow melt periods, their net efficiency at removing nutrients and sediments exceeds their capacity as a source. Both extensive wetland and riparian areas and extended water residence times are important in nutrient removal within a watershed.

Development Impacts. As discussed previously, drainage density and the variable source concept of expanding and contracting saturated soil areas influence streamflow characteristics, sediment production, and nutrient production (Dunne and Leopold, 1978; Skau et al., 1980; Brown et al., 1983; Rhodes et al., 1985; Coats et al., 1976; and Melgin, 1985).

As drainage density and areas of saturated soils increase:

1. Sources of sediment increase;
2. Sediment yield increases;
3. Nutrient yield increases;
4. Peak flow increases;
5. Flow velocities increase;
6. A stream's energy and its ability to transport sediment increase;
7. Lag time decreases;
8. Flow time decreases; and
9. Part of the system becomes short-circuited in its ability to remove nutrients.

Removal mechanisms for sediments and nutrients depend upon a healthy vegetative cover for nutrient uptake and incorporation; dentrification for nitrogen removal; adsorptivity, mainly for phosphorus removal; and filtration and sedimentation for sediment and particulate phosphorus and iron removal. Riparian and wetland areas are critical to good water quality due to their high rates of removal in comparison to the surrounding vegetative community types, but the large areal extent of the non-riparian areas also makes them critical factors in a watershed's ability to remove sediments and nutrients. (Rhodes et al., 1986, 1985; Greenlee, 1985; Coats et al., 1976; Melgin, 1985; TRPA 1982b, and Hemond and Eshleman, 1984).

Development of a watershed increases sediment and nutrient yields by providing new sources of sediments and nutrients and interfering with a watershed's nutrient and sediment delivery and removal mechanisms. Development of the watershed of Lake Tahoe has led to six new direct sources of nutrients and sediment. These are:

1. Fertilizers: Fertilizers are used on golf courses, home landscaping, and business landscaping. Nutrients in the fertilizer not taken up by the vegetation are likely to leach down into the groundwater system and become a source of increased nutrients to the streams and Lake Tahoe.

2. Exfiltration: Exfiltration from sewer lines and sewage spills represent a source of nutrients. Although exact quantities are unknown, leakage and spills occur.

3. Leachate: Leachate from abandoned septic tanks contributes nutrients to the groundwater. Quantities, residence times, and flow rates into tributaries and Lake Tahoe are unknown.

4. In-Basin Emissions to the Air: In-basin contributions of nitrogen and phosphorus to the atmosphere exist. Phosphorus is mainly contributed in the particulate form as the result of dust and erosion from development sites. Nitrogen sources include dust, vehicle emissions, and combustion heaters.

5. Increased Erosion: Erosion and sediment yields are substantially increased because of development. Glancy (1981) found that development can increase sediment yields up to 100 times.

6. Roads. Roads and their associated cut and fill areas provide new sources of sediment and interrupt groundwater flows.

Development involves the disturbance and removal of vegetation and soil and the creation of impervious coverage. In addition, bare dirt areas are exposed and soil compaction occurs. This creates an area devoid of vegetation, provides a potential source of sediments, and creates an area of water runoff.

Removal of the vegetation and coverage of the soil interferes with nutrient removal mechanisms. Uptake of nutrients is decreased by removal of the vegetation, while coverage of the soil reduces or eliminates the removal of nitrogen by dentrification. In addition, the exposed areas provide a new source of sediments to the watershed.

Compacted areas and impervious surfaces prevent rainfall and snowmelt from infiltrating into the soil. They can then form a direct conduit for the delivery of water and nutrients to the tributary and drainage system. These areas effectively act as saturated soil areas and short circuit a watershed's treatment mechanisms for nutrient removal.

Development of the Tahoe Region has resulted in an extensive network of roads requiring ditches to collect and drain water away from the roads and developed properties to prevent flooding and property damage. Houses, parking areas, and other buildings contribute to this water conveyance problem by concentrating runoff from their impervious surfaces and creating overland flow down their driveways or over the soil surface to connect with the roadside drainage system. This effectively results in increasing the watershed's drainage density and provides new sources of sediment. In addition, subsurface flow is interrupted at road cuts and contributes to surface flow and water quality problems.

The developed drainage network responds to storm events and snowmelt just as the natural drainage network does. The combined effects of soil and vegetation disturbance, creation of coverage, and increased developed drainage density increase the watershed's water, sediment, and nutrient yields.

3. The Airshed and Atmospheric Deposition

Deposition of chemical species from the atmosphere occurs as both wet deposition and dry deposition. Wet deposition occurs when snow or rain scavenges ions from the air and deposits them on the watershed and Lake Tahoe. The ions are deposited either in dissolved form or as suspended particles.

Dry deposition is the deposition of chemical species onto the watershed and Lake Tahoe in the absence of precipitation. This is done through the settling of particulate material and the absorption of gases onto the watershed or the Lake. Absorption of gases is strongly dependent on the amount and type of surface available.

Sources of airborne nutrients are local (within the Basin) and distant (outside of the Basin, principally from the upwind areas in California). Sources include vehicle emissions, combustion heaters, fertilizer volatilization, lightning, and industrial by-products.

The USGS, TRG, Desert Research Institute (DRI), Appel and Tokiwa, Brown and Skau, State of California Air Resources Board (CARB), U.S. Forest Service, and others have collected data on atmospheric deposition in the Tahoe Basin.

The Radian Corporation (Balentine *et al.*, 1985) prepared a report that analyzed the existing data on nitrate deposition in the Tahoe Basin (Table 12). Their study consisted of integrating and summarizing data collected by the TRG (Byron and Goldman, 1984), DRI (Owens, 1984), and Appel and Tokiwa (1984). Radian estimated that local sources of nitrogen account for 20 to 40 percent of the total atmospheric loading in the Tahoe Basin. Additional work by DRI (Mitchell, 1987) contributed to the conclusion that local enrichment of atmospheric nitrate is occurring in the Tahoe Region.

Brown and Skau (1975) sampled seven sites in the Tahoe Region between January and April, 1975. Their data indicated that nitrogen concentrations for both the nitrate and organic species were higher in the eastern parts of the Region than the west, while loading rates were higher in the west due to the greater snow depths (Table 13).

Acid deposition studies in California by CARB (1986, 1988) refer to modeling which indicates that nitrogen compounds are generally deposited soon after they are emitted, and that long range transport (greater than 300 miles) of nitrogen is of lesser importance than local emissions (less than 300 miles). For the Tahoe Basin, the implications of transport would nevertheless be significant, since vast urbanized portions of California are well within the 300 mile range of local emissions. CARB also reported on nutrient deposition at the City of South Lake Tahoe, California for the three years of record.

Additional research by TRG (Byron and Goldman, 1988) has included deposition sampling at their mid-lake station. For wet deposition periods, nitrate-nitrogen loading and concentrations were consistently less at the mid-lake station than the Ward Valley station. For the mid-lake station, nitrate concentrations ranged between approximately 0.075 mg/l and 0.175 mg/l. For the Ward Valley site, nitrate varied between approximately 0.050 mg/l and 0.350 mg/l. The combined effects of lower nitrogen concentrations and less precipitation result in reduced loading at the mid-lake site versus the Ward Valley site.

Dry deposition data showed higher loading at the mid-lake site for both nitrate and ammonium (Figure 9). TRG concluded that the decrease in nitrogen loading at the mid-lake site was due to canopy uptake of nitrogen onshore.

Phosphorous deposition in the Tahoe Basin has also been studied. Owens (1984) sampled three storms occurring between March 12 and March 17, 1984. He reported an average concentration of phosphorus in snow of 3 ppb with a range between 1 and 13 ppb. Phosphate concentrations were variable for the 18 sites sampled in the Basin, but were found to be slightly higher toward the east and around areas of human activity.

TABLE 12 Summary of Radian Report on Atmospheric Deposition

Topic	Conclusion	Discussion
Deposition Estimates	The most representative estimate of dry nitrate-nitrogen deposition in the Tahoe Basin is 45-115 metric tons/year.	The estimated dry deposition is highly uncertain due to uncertainty in the deposition velocity of nitric acid and in the TRG measured dry deposition.
	The most representative estimate of wet nitrate-nitrogen deposition is 90 plus/minus 23 metric tons/year.	This estimate computed using the TRG wet deposition data.
	The most representative estimates of total nitrate-nitrogen deposition is 135 to 225 metric tons/year.	This estimate computed using the TRG deposition data.
Comparison of Wet and Dry Deposition	Deposition amounts of nitrate in snow storms are a function of anion concentration, elevation and duration of snowfall.	Result reported by DRI.
	Dry deposition is much more seasonally uniform than wet precipitation.	Result reported by TRG.
	In wet deposition, the concentration of nitrate in snowfall water is generally less than in rain water.	Result reported by TRG.
	Dry deposition is lower in magnitude than wet deposition.	Result reported by TRG.
	Nitric acid is present as a significant proportion of atmospheric nitrate (approximately 40%) and is the main source of dry nitrate deposition onto Lake Tahoe.	Result reported by Appel and based upon Radian analysis.

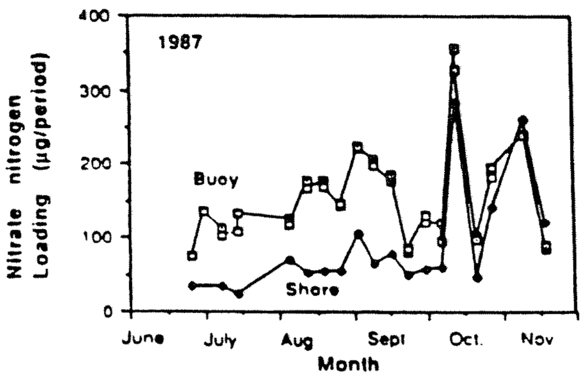
TABLE 12 (continued)

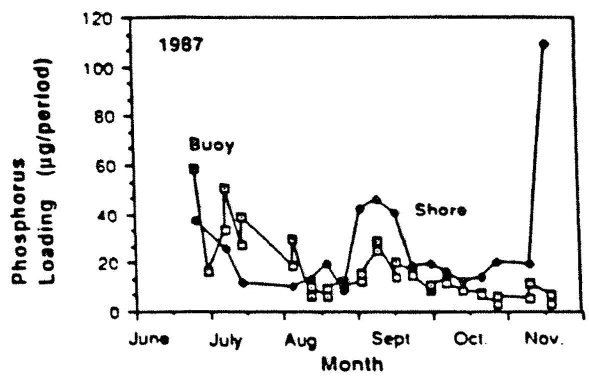
Topic	Conclusion	Discussion
	Total ionic concentrations in all precipitation appear to be strongly positively correlated (e.g., nitrate is always high when total ionic concentrations are high).	Result reported by TRG.
Contribution of Nitrate-Nitrogen Loading Due to Automobile Emissions	Less than 25% of the atmospheric nitrate-nitrogen loading is the result of NO_x emissions from automobiles.	Result computed by Radian and based upon Appel data.
Pollutant Gradients Within the Basin	South Lake Tahoe has significantly higher pollutant levels than elsewhere in the Basin. Conditions in South Lake Tahoe are not representative of conditions throughout the Basin. The rest of the Basin, however, appears to be relatively uniform in pollutant loadings.	Result based upon review and analysis by Radian of TRG and Appel data.
Nitrogen Transport into the Basin	Approximately 60 to 80% of the atmospheric nitrogen loading in the Tahoe Basin is the result of transport into the Basin. Appel estimated 78% of nitrogen burden is transported.	Result computed by Radian and based upon Appel data. Appel's results are based upon summertime measurements only. Radian reanalysis based upon all Appel data. Uncertainty in transport estimates is high.

TABLE 13 Nitrogen and Phosphorus Loading Estimates For Seven Sites in the Tahoe Region

Site	PPM			Kg/Km^2		
	NO_3-N	Organic N	Extractable P	NO_3-N	Organic N	Total P
Luther Pass	.03	.12	.003	34	139	4
Meyers	.02	.12	.003	9	78	2
Kingsbury Grade	.05	.16	.008	20	69	3
Spooner	.07	.15	.003	19	72	1
General Creek	.03	.16	.003	14	50	2
Brockway	.03	.20	.006	42	305	8
Incline Village	.06	.10	.003	28	90	2

(Brown and Skau, 1975)





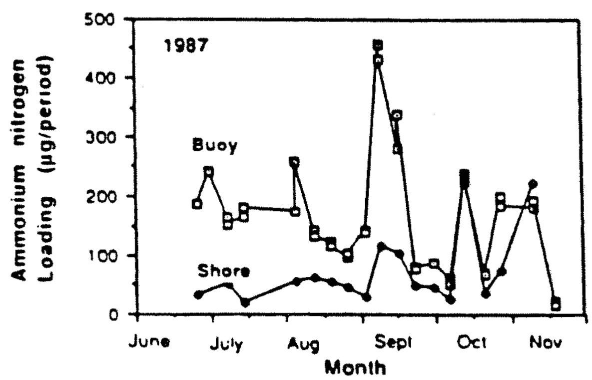


FIGURE 9 Dry Atmospheric Loading Estimates for Nitrogen and Phosphorus

Byron and Goldman (1986) sampled phosphorus deposition rates at their Ward Valley Lake-level sampling site. Figure 10 shows a summary of phosphorus loading rates for the years 1980 to 1984. Additional work by Byron and Goldman (1988) included phosphorus deposition sampling at the mid-lake site. During the study period, they found similar loading values for both sites.

Brown and Skau (1975) reported phosphorus loading values for seven sites within the Region. No discernible pattern was exhibited. Extractable P concentrations ranged from 0.003 mg/l to 0.008 mg/l while loading estimates were from 1.6 kg/km^2 to 7.9 kg/km^2.

The U.S. Forest Service (USFS) is currently sampling water quality at Lake Le Conte in the Sierra Nevada on the west rim of the Tahoe Basin. Data is being collected to show this lake's changing water chemistry and its ability to recover from acid precipitation events. No atmospheric deposition data is being collected at this time. Only limited data exist. A more detailed data profile is expected in the near future.

4. Lake Tahoe

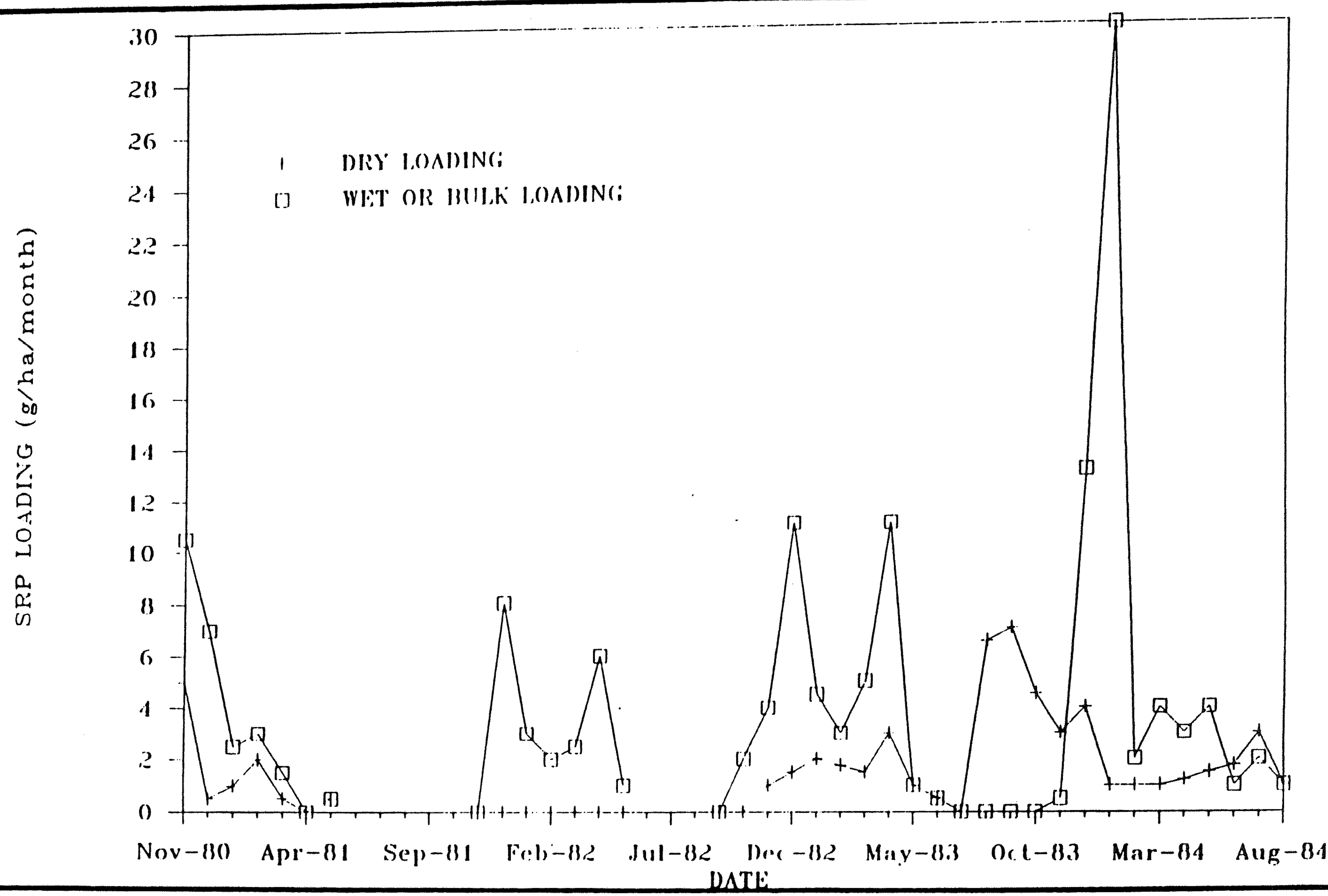
a. Basic Relationships

The discussion of Hydrology and Water Quality, above, identifies the water quality trends scientists have observed in Lake Tahoe for the last three decades. Since 1968, algal productivity has increased 150 percent and clarity of the deep (pelagic) waters of Lake Tahoe has decreased 20 percent. Waters of the shallower (littoral) zone of Lake Tahoe also show evidence of increasing algal productivity and decreasing clarity.

Despite its outstanding quality, Lake Tahoe is undergoing a phenomenon known as cultural eutrophication, a common problem in lakes throughout the world. Cultural eutrophication occurs when the influences of civilization result in imbalances in a lake's nutrient budget, accelerating natural increases in algal productivity.

Away from the influence of modern civilization upon its ecology, Lake Tahoe would be expected to change so slowly that the changes would be imperceptable over a normal human lifespan. Over geologic time (i.e., millions of years) the Lake would experience a natural increase in algal productivity and a loss of clarity--eutrophication--and slowly fill with sediment and debris.

FIGURE 10 Atmospheric Phosphorus Loading, 1980-1984



Because of its large size compared to its small watershed, Lake Tahoe has a very long residence time. The typical drop of water resides in Lake Tahoe for about 700 years (Byron and Goldman, 1986). Thus, those who are concerned about preserving the exceptional quality of Lake Tahoe cannot rely on the flushing action of precipitation and runoff that benefits many other lakes. As a reasonable rule of thumb, one may employ the approximation that sediments and nutrients discharged to Lake Tahoe remain there forever, either suspended in the water column or settled on the bottom.

Like all plants, algae require sunlight and nutrients from their environment to flourish and grow. The main nutrients they require are nitrogen and phosphorus, but they also require many other micro-nutrients, including iron. Because they require sunlight, algae in lakes are limited to the euphotic zone, the zone that is penetrated by sunlight. In Lake Tahoe, the euphotic zone is about 100 meters deep. The zone where light does not penetrate is known as the aphotic zone.

When nutrients are available, algae will exploit those nutrients, often rising in number until they have scoured the available nutrients and a rapid die-off occurs. As more nutrients become available, higher rates of growth occur and the clarity of the water decreases.

At any given time and place in Lake Tahoe, the availability of either nitrogen or phosphorus limits the growth of algae. Thus, either nitrogen or phosphorus may be the "limiting nutrient." Algae require nitrogen and phosphorus in a ratio of about 15:1. Historically, nitrogen limitation (i.e., a shortage of nitrogen for algal growth) has been the rule in Lake Tahoe. However, algal growth in the Lake is becoming more sensitive to the availability of phosphorus.

In laboratory experiments in which nitrogen, phosphorus, and other nutrients are added to samples of Lake Tahoe water to investigate their effects on algal growth, water from Tahoe's tributaries has been found to be biostimulatory in excess of what would be predicted by its individual nutrient concentrations (Byron and Goldman, 1988). This indicates that, in general, Lake Tahoe's algae are nutrient starved, with the limiting nutrient fluctuating between nitrogen, phosphorus, iron, other micro-nutrients, or a combination.

b. Nutrient Cycling and Transformations

There are many chemical forms of nitrogen and phosphorus found in Lake Tahoe, and they follow complex cycles, changing from one form to another with the assistance of bacteria, algae, fish, other animals, and physical stresses. It is important to understand these cycles and the roles of the different forms of nutrients.

Nitrogen. The nitrogen cycle starts with the simple inorganic form, nitrate (NO_3), which is assimilated by algae in the process of photosynthesis. The algae give up waste products and eventually die, or are eaten by animals who also give off waste products and later die. Their wastes and decay products form dissolved organic forms of nitrogen such as urea, uric acid, and amino acids. Bacteria then convert these dissolved organic forms to ammonia, an inorganic form, then back to nitrate, and the cycle starts again.

In Lake Tahoe, the atmosphere is a major source of nitrate-nitrogen, as discussed under The Airshed and Atmospheric Deposition. Streams contribute not only nitrate-nitrogen, but also ammonia-nitrogen and both dissolved and particulate organic nitrogen. Groundwaters contribute mostly nitrate-nitrogen. Although only the nitrate-nitrogen is immediately available to algae, all these forms can eventually be transformed to nitrate-nitrogen through the nitrogen cycle and, therefore, they are all important with respect to water quality. Additional research is needed into the rates at which the transformations occur from one form to another and the relative contributions of the various forms to the growth rate of algae. The Tahoe Research Group (UC-D) is conducting such research at this time.

Phosphorus. The phosphorus cycle is not as complex, but does involve several forms. Inorganic phosphorus, typically orthophosphate, is assimilated by algae and thus converted to particulate organic phosphorus--the algae. As with nitrogen, the algae excrete wastes, are eaten, and die, and the waste and decay products form dissolved organic phosphorus compounds. Through bacterial action, the dissolved organic compounds are then converted back to orthophosphate and the cycle starts over.

Although dust particles deposited upon Lake Tahoe by the wind can go into solution and contribute dissolved inorganic phosphorus to the Lake, the main source of phosphorus is the tributary streams, which contribute all three forms: dissolved inorganic, particulate organic, and dissolved organic. As with nitrogen, all three forms are important and additional research is needed into the rates of transformation and the relative contributions of the various forms to algae growth.

Unlike nitrate-nitrogen, dissolved inorganic phosphorus has a high propensity to adsorb onto the surface of soil particles as it travels through the watershed either in surface waters or the groundwater. Normally, one would expect the contribution of inorganic phosphorus from groundwater to be relatively low, but Loeb (1987) found fairly high concentrations in groundwater in the Ward Creek watershed. (See the discussion of Groundwater, above.)

It is not certain to what extent inorganic phosphorus adsorbed on soil particles which reach Lake Tahoe through tributary flows is available to algae. Although it is possible for bacteria to colonize the soil particles and cause the release of dissolved phosphorus for eventual use by the algae, many soil particles settle out quickly and do not contribute greatly to Lake Tahoe's phosphorus budget. (See TRPA, 1982d; Paerl et al., 1972; Goldman et al., 1982.) As discussed under Sediment Generation and Transport, the fine clayey particles have the highest adsorption potential due to their large surface area, and these particles tend to settle near the mouths of tributary streams.

Uptake and recycling times for orthophosphate are very rapid relative to nitrogen. In the euphotic zone, most dissolved inorganic phosphorus is immediately taken up by the algae and incorporated into their structure.

c. Nutrient Budgets

When evaluating the relative inputs, outputs, sinks, and storage of nutrients in a lake, it is useful to consider a nutrient budget. Lake Tahoe's cultural eutrophication is the result of unbalanced nutrient budgets, in which inputs of nutrients which stimulate algal growth exceed the outputs, resulting in increased storage of those nutrients in the water column.

At this time there are still too many unknowns to allow TRPA to exactly describe the budgets for nitrogen and phosphorus. Although inputs from several important tributary streams have been fairly well documented, inputs from groundwater are not well quantified, and atmospheric inputs have only recently been studied or measured at all. With respect to outputs, the output via the Truckee River can be accurately estimated, but the main output, settling to the bottom of Lake Tahoe or "sedimentation," is difficult to measure and is still being studied.

Without more precise nutrient budgets, it is impossible to create accurate predictive models of the future water quality of Lake Tahoe. However, TRPA and others have described approximate nitrogen and phosphorus budgets in recent years (TRPA, 1982d; SWRCB, 1980; Western Federal Regional Council, 1979). The following paragraphs summarize available information on nutrient budgets:

Nitrogen Budget. There is great uncertainty regarding the magnitude of atmospheric inputs of inorganic nitrogen. TRPA (1982d) estimated the input at 40 to 66 metric tons/year (as N). Pending further study, this is likely to be a reasonable approximation. TRPA (1982d) estimated dissolved inorganic nitrogen (DIN) inputs from tributary streams at 2 to 17 metric tons/year, averaging about 10 metric tons/year. Although TRPA believes this to be reasonably accurate, since it was based on actual monitoring of over 40 percent of the annual inflow to Lake Tahoe, it does not reflect the large contributions of dissolved and particulate organic nitrogen from the tributaries. Recent monitoring by the United States Geological Survey indicates that total nitrogen loads from some streams may be ten times higher than the DIN loads.

TRPA (1982d) estimated nitrate-nitrogen inputs from groundwater at 2 to 17 metric tons/year, averaging 10 metric tons/year. This estimate was based on a study of the Ward Valley (Loeb and Goldman, 1979) which found that surface water and groundwater outputs from the watershed were of about the same magnitude. However, subsequent research (Loeb, 1987) on the Upper Truckee-Trout Creek watershed indicated that surface water outputs of nitrate-nitrogen were five to 20 times higher than outputs of nitrate-nitrogen from groundwater. Thus, the estimate of groundwater loading in TRPA, 1982d, may be too high.

Nitrogen losses from Lake Tahoe via the Truckee River outflow are relatively minor compared to the volume of inflow. TRPA (1982d) estimated the outflow of nitrate-nitrogen at 1 to 5 metric tons/year.

Estimates of nitrogen losses from Lake Tahoe due to sedimentation are very approximate and are the subject of ongoing research. TRPA (1982d) reported sedimentation estimates based on preliminary data from the Tahoe Research Group of 20 to 50 metric tons/year of dissolved inorganic nitrogen and 200 to 500 metric tons/year of total nitrogen. The comments of Dr. Charles Goldman on the draft of this plan state that these estimates now appear to be too high. (See Volume VI, the response to comment A-341.)

Although there are many unknowns and uncertainties, all of the data and analysis point to an imbalance in the nitrogen budget of Lake Tahoe favoring inputs over outputs. TRPA (1982d) estimated that DIN was accumulating in Lake Tahoe at a rate between 7.5 and 63.5 metric tons/year, with a pool of about 2000 metric tons of DIN already in the Lake. Recent monitoring indicates that the higher, rather than the lower, estimate is closer to the truth. Considering the many different forms of nitrogen in Lake Tahoe's nitrogen cycle, the total annual accumulation of nitrogen in the Lake is undoubtedly much higher than these estimates. If one were to theorize that the increase in algal primary productivity in the Lake is tracking increases in the pool of total nitrogen, then it would appear that nitrogen storage is increasing by about 4 percent annually.

For a graphical representation of the nutrient budget, see Figure 8.

Phosphorus Budget. As with nitrogen, there is much uncertainty regarding atmospheric loads of phosphorus to Lake Tahoe. Although research is currently in progress, TRPA's estimate (1982d) of about 1 to 2 metric tons/year is a reasonable estimate.

According to TRPA (1982d), most of the phosphorus that reaches Lake Tahoe comes in the particulate form and is discharged to the Lake along with the suspended sediment in the streams. The clay fraction of the suspended sediment, which adsorbs phosphorus, is the primary carrier. Most of the particulate phosphorus is deposited at deltas at the mouths of the various streams. Therefore, most of the phosphorus which is available for algal growth is from the dissolved fraction, which is a relatively minor component of the total phosphorus load. TRPA estimated the total phosphorus load at 7 metric tons/year and the dissolved phosphorus load at about 2 metric tons/year (TRPA, 1982d).

Also similar to the situation with nitrogen, TRPA (1982d) estimated that groundwater inputs to Lake Tahoe were about the same as surface water inputs, based on the 1979 study of the Ward Valley. However, the more-recent study of the Upper Truckee-Trout Creek watershed, which found that groundwater contributions of soluble phosphorus were only about 2 percent of the total contribution from the watershed, indicates that that estimate was probably high.

TRPA does not have a good estimate for the rate of phosphorus sedimentation. The close relationship between particulate and adsorbed phosphorus and suspended sediments suggests that much of the phosphorus is quickly incorporated into the sediments. The smaller particles remain in suspension for a considerable time, and the dissolved forms are rapidly assimilated by algae and recycled. The loss of phosphorus from the system via the Truckee River is estimated at less than 1 metric ton/year (TRPA, 1982d).

In summary, the phosphorus budget of Lake Tahoe also appears to be imbalanced, favoring inputs over outputs and resulting in a build-up of phosphorus in Lake Tahoe. However, the unique characteristics of phosphorus--its lack of a gas phase and its tendency to associate with sediments--suggest that management practices may more easily balance the phosphorus budget than the nitrogen budget.

d. Role and Effects of Mixing

Lake mixing brings nutrients from the aphotic zone into the euphotic zone and represents one of the most important mechanisms for making nutrients available for algal growth. Since the retention time of Lake Tahoe is about 700 years, nutrients entering the Lake are conserved and recycled. Scientists have observed that deep Lake mixing is associated with algal blooms.

Mixing of Lake Tahoe is in response to water temperature and wind conditions. Lake Tahoe becomes stratified in the summer with high water temperatures characterizing the epilimnion (upper layer) (Figure 11). Since the density of water decreases with temperature, this layer remains lighter than the deep waters and does not mix. In the thermocline, temperatures decline from top to bottom. The hypolimnion

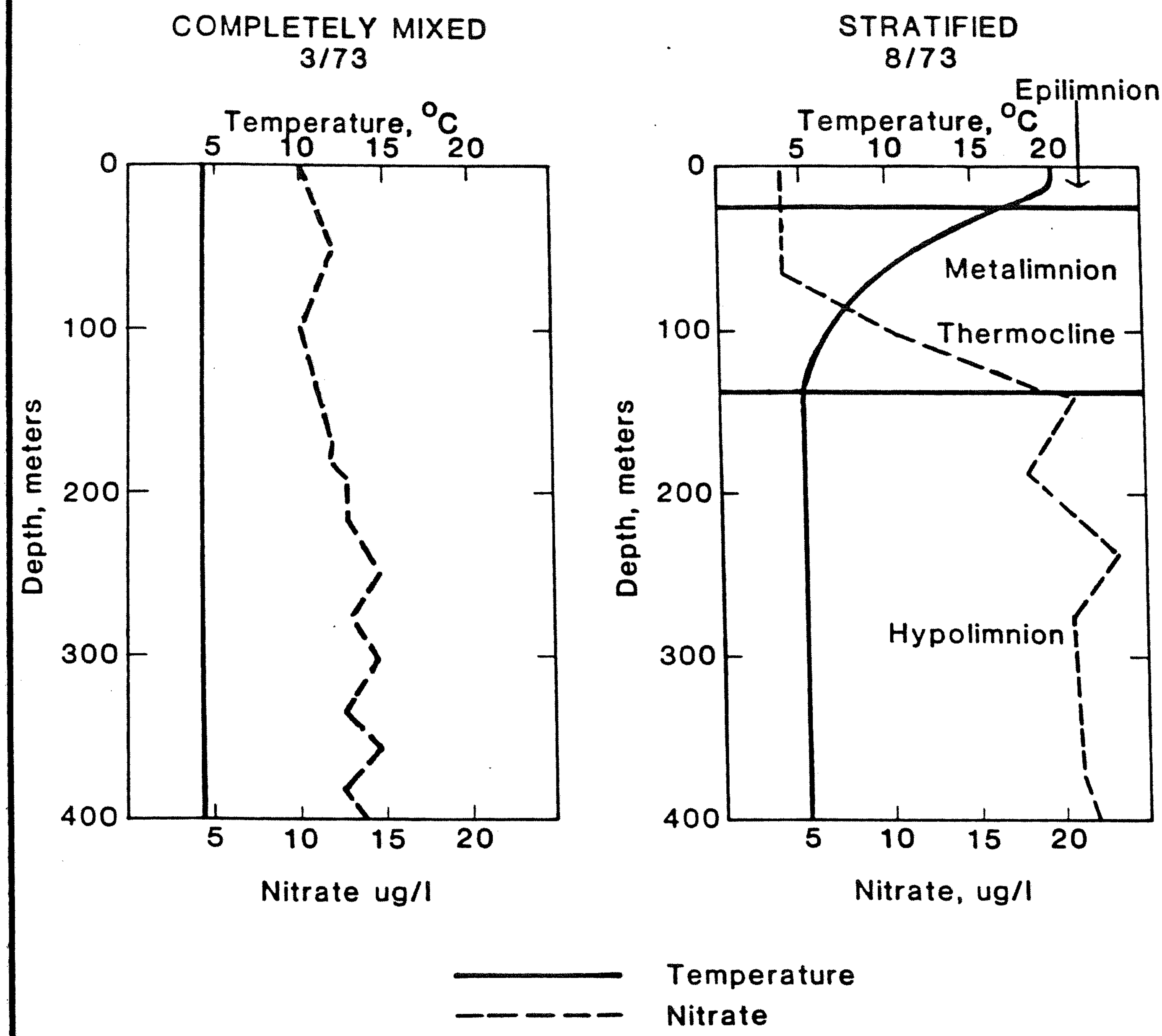


FIGURE 11 Stratification of Lake Tahoe and Related Nitrogen Concentrations

represents the deep waters where temperature is the coldest and most constant. These temperature differences create barriers to Lake water mixing. Algae tie up nutrients in the epilimnion resulting in low nitrate concentrations (Figure 11). These concentrations steadily increase through the thermocline strata and become relatively constant in the hypolimnion.

Winter temperatures cool the waters of the epilimnion and thermocline until water temperatures of the three strata are approximately the same. At this point, the three layers begin to mix. Depth of mixing is determined by the strength of winds and storms. The deeper the mixing, the more nutrients are brought up into the euphotic zone. Figure 11 shows the temperature and nitrate values after the Lake has completely mixed.

Mixing of the waters of Lake Tahoe is highly variable from year-to-year. The Lake is so deep and requires such a large amount of wind energy to mix the deep aphotic waters into the euphotic zone, that complete mixing occurs only during very cold winters with late storms (Byron and Goldman, 1986). During most years only a portion of the Lake's water is mixed.

The consequence of this mixing is the introduction of nutrients from the aphotic zone into the euphotic zone where the algae grow and reproduce. This reservoir of nutrients in the aphotic zone is the storage area for nutrient additions to the Lake from watershed/stream runoff, groundwater recharge, and atmospheric deposition and represents a potent source for the euphotic algae.

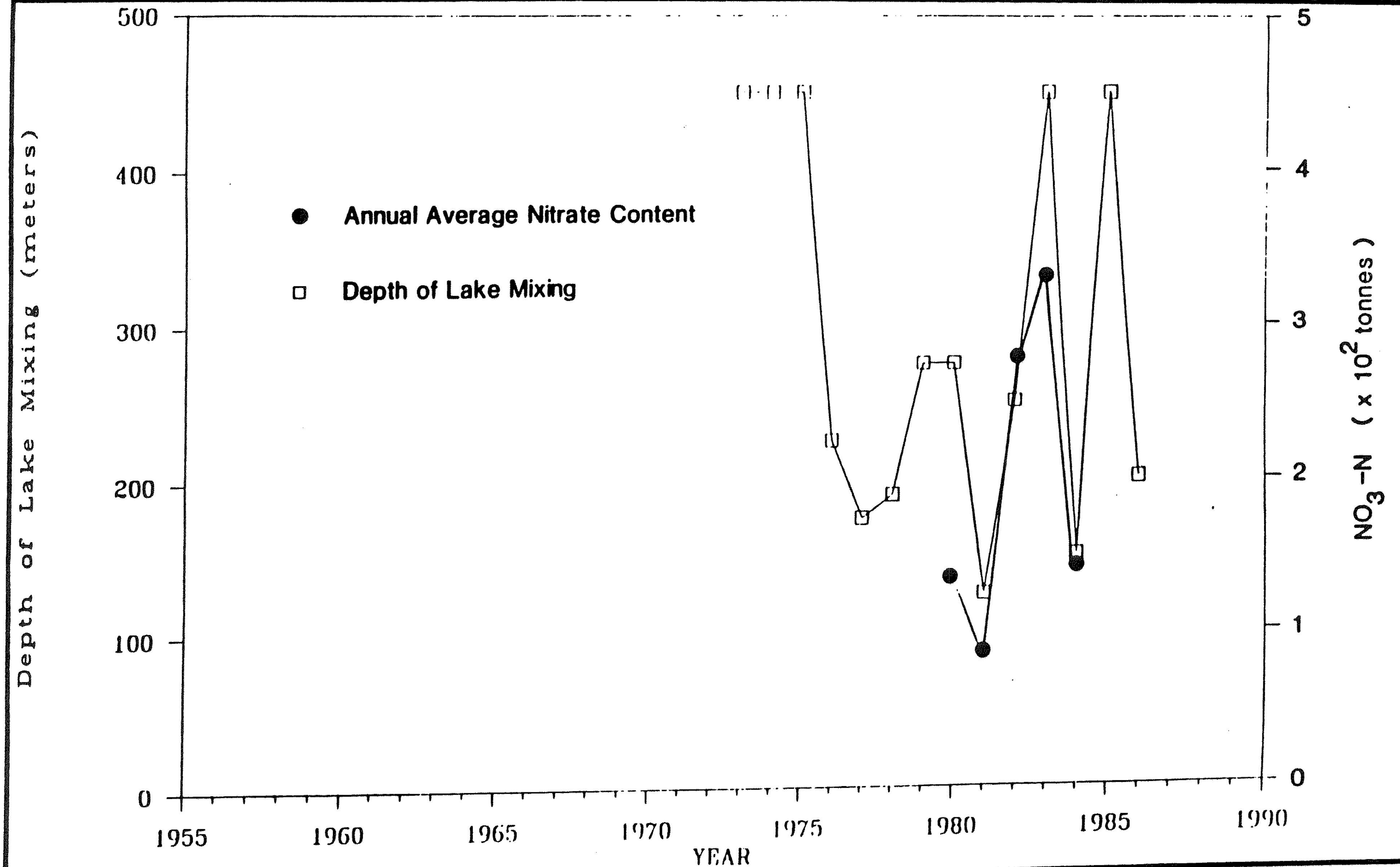
The amount of nitrate-nitrogen that this mixing can contribute to the euphotic zone may in some years be as much as 10 times the input from streams (Goldman, 1981; Byron et. al. 1984). As Figure 12 shows, nitrate concentration in the euphotic zone is highest when the deepest mixing occurs.

As with nitrogen, mixing represents a potential source of phosphorus for the algae in the euphotic zone. However, phosphorus does not show the same increase with depth as nitrate does, due to rapid incorporation by algae.

e. Cause-and-Effect Relationships

Although TRPA and others have not yet developed accurate predictive models of Lake Tahoe's water quality, certain more-or-less quantifiable relationships involving water quality are apparent. The following discussion covers three such relationships: the relationship among primary productivity, precipitation, and mixing; the relationship between primary productivity and clarity; and the relationship between primary productivity and the storage or accumulated load of dissolved inorganic nitrogen in Lake Tahoe.

FIGURE 12 Depth of Lake Mixing and Average Nitrate Content in the Euphotic Zone, Lake Tahoe



Tracking algal primary productivity or PPR (Figure 5), depth of lake mixing (Figure 12), and annual precipitation (Figure 13), it becomes evident that large increases in PRR generally correspond to high annual precipitation, deep lake mixing, or both. Large PPR decreases also generally correspond to low annual precipitation, shallow lake mixing, or both.

Except for year-to-year fluctuations, PPR has been shown to be consistently increasing, while the clarity of Lake Tahoe has been gradually decreasing. This inverse relationship between PPR and clarity is expected. Increased PPR leads to increasing amounts of algae which cause a loss of clarity as shown in Figure 14. Since this loss of clarity is primarily the result of increased algal growth, which in turn depends upon increased contributions of sediment and dissolved nutrients to Lake Tahoe, control of these sources becomes critical in maintaining the exceptional water quality of the Lake.

As discussed in the Environmental Threshold Carrying Capacity Study Report (TRPA, 1982d), the "accumulated load" or storage of dissolved inorganic nitrogen (DIN) in Lake Tahoe was estimated to be increasing between 7.5 and 63.5 tons per year. Recent data indicate that nitrate is accumulating at a rate of 77 tons per year (Goldman, personal communication). As Figure 15 shows, there is a strong relationship between PPR and accumulated load for both the high and low estimates.

5. Systems Model Summary and Conclusions

As the preceding pages show, Lake Tahoe, its watershed, and its airshed represent a complex ecological system. A thorough understanding of this system is necessary to identify appropriate management techniques to control changes in water quality and attain and maintain water quality thresholds and standards. In summary, the systems model reveals the following information:

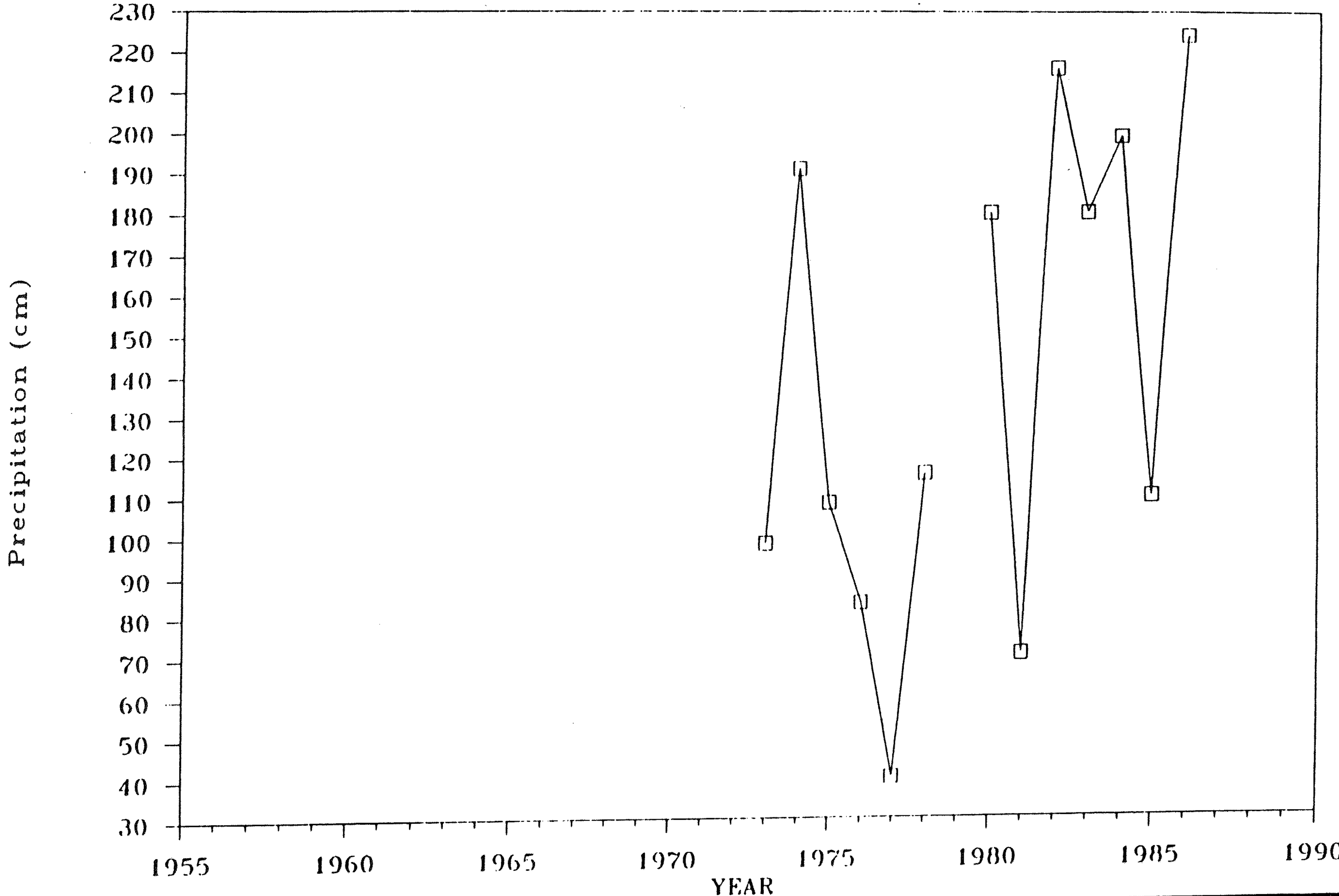
- In the Tahoe Region, sources of stream sediments are largely within the channels themselves. Sediments build up in channels until large-enough flows occur to move them.

- Increased sediment production affects fish spawning, turbidity and clarity of receiving waters, channel stability, aesthetics, fish habitat, and phosphorus loading to Lake Tahoe.

- Storm or snowmelt runoff accounts for the rapid rise in streamflows and peak discharges. Groundwater accounts for base flow.

- If rainfall or snowmelt exceeds a soil's infiltration rate, water will flow overland. Vegetation removal, soil compaction, and soil removal decrease a soil's infiltration capacity. Overland runoff is <u>extremely</u> <u>rare</u> in the natural areas of the Tahoe Region.

FIGURE 13 Annual Precipitation at the Ward Bench Site , Lake Tahoe



-- Expanding and contracting areas of saturated soils, known as "variable source areas," provide a direct pathway for precipitation and snowmelt (and their nutrients) to reach streams. Runoff from these variable source areas can be substantial. To avoid damage to water quality, these variable source areas (generally stream environment zones) must be protected from disturbance.

-- Increases in drainage density, a measure of watershed dissection, are associated with increases in yields of sediment and dissolved nutrients. In a natural area, increasing variable source areas increase the drainage density. In developed areas, man-made conduits and drainageways also increase drainage density. These conduits and drainageways short-circuit the treatment that is normally provided by the soil and vegetation complex.

-- Stream environment zones are capable of rapid uptake and incorporation of nutrients, are conducive to denitrification, and have many other benefits to water quality, such as filtering out sediments and spreading peak flows. Nutrient and sediment removal rates of undisturbed SEZs are high, but when disturbed, they can actually be a source of sediments and dissolved nutrients. SEZs must be protected for these reasons.

-- In some parts of the Tahoe Region, contributions of dissolved nutrients from groundwater to Lake Tahoe are as high as contributions from surface water. Groundwaters have higher nutrient concentrations close to Lake Tahoe, where development is concentrated.

-- Natural undisturbed watersheds are very efficient and conservative in the treatment of nutrients. Removal rates of up to 100 percent have been observed in natural areas.

-- Development of the watershed increases yields of sediments and dissolved nutrients by providing new sources of both and interfering with the natural delivery and removal mechanisms. Typically, development increases sediment sources; increases sediment yields; increases nutrient yields; increases peak flows; increases stream energy and the ability of streams to transport sediments; decreases hydrologic lag time; decreases hydrologic flow time; and short-circuits the ability of the watershed to remove sediments and dissolved nutrients from runoff.

-- Development adds six new sources of sediments and dissolved nutrients: fertilizer, sewage exfiltration, sewage leachate, airborne nutrient emissions, increased erosion, and cuts and fills.

- Local and distant sources of airborne nitrogen and phosphorus contribute inputs to lake Tahoe. Short-range transport (less than 300 miles) involves large urbanized areas of California.

- Lake Tahoe is suffering from cultural eutrophication from an imbalanced nutrient budget. The algae are nutrient-starved, with the limiting nutrient fluctuating between nitrogen, phosphorus, iron, or a combination. The nitrogen and phosphorus budgets are both out of balance; the phosphorus budget may be easier to balance.

- Sharp increases in algal productivity are associated with high annual precipitation and deep mixing of Lake Tahoe. Decreases in algal productivity are associated with low annual precipitation and shallow mixing.

- Increasing algal productivity is a function of increasing storage of dissolved nutrients in Lake Tahoe. As algal productivity increases, clarity decreases.

Based on the systems model, one may arrive at a number of conclusions about water quality management. TRPA expresses these conclusions as a set of six needs for water quality management. All of these needs are important, and a well-balanced management program will address all of them:

- the need to <u>preserve the soil's capacity to infiltrate runoff waters</u>,

- the need to <u>protect variable source areas, stream environment zones, and natural areas in general</u>,

- the need to <u>be aware of changing drainage density, to avoid adding new conduits and channels to the watershed, and to infiltrate runoff wherever possible</u>,

- the need to <u>control nutrients reaching receiving waters from fertilizer use and sewage spills and leaks</u>,

- the need to <u>be aware of atmospheric nutrient loads, and to control them where possible</u>, and

- the need to <u>control erosion, to avoid exposing new sources of sediment and dissolved nutrients to runoff waters</u>.

III. PROBLEM ASSESSMENT AND CONTROL NEEDS

The systems model, above, sets the stage for the problem assessment and determination of control needs. In general, urbanization and development of the Lake Tahoe Region increase drainage density and add impervious coverage to the watershed, increasing loads of sediments and dissolved nutrients to Lake Tahoe and accelerating its eutrophication. Local sources of airborne nutrients enrich the background levels from upwind areas, and contribute to deposition of nutrients on Lake Tahoe.

Fertilizers and losses from sewage collection and treatment systems add nutrients to the system, and such activities as timber harvesting, recreation, off-road vehicle use, grazing, boating, and dredging contribute to the water quality problems.

Table 14, Pollutants in Runoff from Various Activities, while based on a limited number of samples gathered for TRPA's initial 208 plan in the 1970's, gives a general indication of the quality of surface runoff and relative impacts on water quality from various land uses.

A. URBAN EROSION, RUNOFF, AND DISTURBANCE

A primary objective of this 208 plan is to control the elevated loads of sediments and dissolved nutrients to Lake Tahoe which result from erosion, runoff, and disturbance within the Lake Tahoe Basin.

1. Streets, Roads, and Highways

The systems model discusses the importance of drainage density in determining the level of sediment and nutrient loads from a given watershed. In natural conditions, a small network of stream channels drains each watershed, and surface runoff is virtually non-existent. Then, starting with development of a street, road, and highway network, man inadvertently increases the density of drainage conduits, adds surfaces which don't allow infiltration of water to occur, creates surface runoff, and starts the inevitable degradation of runoff water quality.

If the addition of streets and roads is fairly minor, as in the more natural watersheds of the Tahoe Basin (e.g., General Creek), then the increase in drainage density is small and the effects on overall loads of sediments and dissolved nutrients are minor. But when large areas are subdivided, and roads are constructed to serve those subdivisions, sediment loads may increase tenfold or more (Glancy, 1981; White and Franks, 1978; Skau *et al.*, 1980) and nutrient loads also increase (Brown *et al.*, 1983; Byron and Goldman, 1987; Dunne and Leopold, 1978).

TABLE 14 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 & 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

There are approximately 1000 miles of streets, roads, and highways in the Tahoe Region, as follows:

Major Highways	100 miles
Local Streets	600 miles
Dirt Roads	300 miles

In addition to increasing drainage density and impervious coverage, road construction may also result in elevated levels of erosion and runoff from unstable areas such as cut and fill slopes, drainage ditches, and road shoulders. Without proper stabilization, these areas are potential sediment sources that can affect Lake Tahoe by the developed drainage density network. Although it is based on limited data, Table 14 indicates that all components of the highway transportation system have serious impacts on water quality.

Management practices are necessary to control the problems associated with streets, roads, and highways. These practices should be geared toward infiltration of runoff, to negate the increased drainage density, and stabilization of unstable drainages, slopes, and shoulders. The necessary practices include both capital improvements and proper operation and maintenance. The Capital Improvements Program, Volume IV and the BMP Handbook, Volume II, set forth the required program of control. The main implementing agencies are local units of government, improvement districts, state highway departments, and state and federal land management agencies.

Construction of new road networks should also be avoided, such as would be necessary to serve new subdivisions.

TRPA does not have extensive local data on the effectiveness of management practices for streets, roads, and highways. However, studies elsewhere in the country indicate that BMPs can reduce yields of suspended sediment from small urbanized areas by 80 to 100 percent, and yields of phosphorus and nitrogen by 40 to 80 percent (Schueler, 1987). Unfortunately, the costs of applying BMPs retroactively to streets, roads, and highways are quite high; TRPA's Capital Improvements Program for Erosion and Runoff Control on public rights-of-way is estimated to cost approximately $300 million over the next 20 years.

2. Existing Development

The main reason streets, roads, and highways exist in the Tahoe Region is to serve the urbanization of the Region and provide access to development. Existing development can be placed in the following categories: residential, commercial, tourist, recreation, and public service.

Although some types of development are associated with particular pollutants or sources of nutrients (e.g., golf courses and fertilizers), in general all categories of development affect runoff water quality in the same way--they increase drainage density and impervious coverage, thereby increasing loads of sediments and dissolved nutrients to Lake Tahoe.

In combination with the street and road network, existing development within the Tahoe Region represents by far the largest source of elevated sediment and nutrient loads from the watershed. Sediment and nutrient loads from natural portions of the watershed are much lower, on a per-area basis, than from developed areas. In a set of studies of a natural area just outside the Tahoe Region near Spooner Summit, nutrient loads to the stream draining the area were most often below the level of detection (Melgin, 1985; Greenlee, 1985; Rhoades et al., 1985, 1986.) (For more discussion of this topic, see the systems model, above).

Given the harsh climate and relatively fragile ecology of the Tahoe Region, the amount of existing development is extensive. The existing level of development is shown in Figure 3 and Table 6.

As with the existing network of streets, roads, and highways, management practices are necessary to control elevated levels of erosion and runoff from existing development. These management practices should be geared toward erosion control and treatment of runoff waters through the use of natural and artificial wetlands as close to the source of the problem as possible. Management practices should also infiltrate runoff, to negate the effects of increased impervious coverage and drainage density; stabilizing unstable slopes and drainageways; and revegetating denuded areas.

Studies from around the country indicate that application of BMPs can reduce suspended sediment yields from small areas by 80 to 100 percent, and yields of phosphorus and nitrogen by 40 to 80 percent (Schueler, 1987). Where the density of existing development is low, the retroactive application of BMPs is generally inexpensive and cost-effective. However, where the density of existing development is great, retroactive application of BMPs will be expensive, and frequently dictates a community-wide treatment, rather than actions by individual property owners.

One important principle of the 208 plan is that development should fully offset, or mitigate, both the on-site and off-site water quality impacts of that development. Existing development should also offset its impacts by installing on-site management practices, and by contributing to the solution of off-site impacts when making major improvements.

In situations where specific water quality problems can be traced to the actions or inactions of individual persons or entities, the TRPA or another public agency should have the authority to require abatement of the problem.

3. Urban Drainage Systems

As the creation of streets, roads, and various urban land uses creates surface runoff in the watershed, demands for improved drainage systems arise to avoid flooding of, or damage to, roads or other structures. Highway departments, state and federal land managers, local governments, improvement districts, and private individuals construct ditches, culverts, drains, and other devices to convey the runoff away from developed areas.

As shown in Table 14, previous monitoring studies in the Tahoe Region have shown that unstable roadside drainage facilities are significant water quality problems.

These drainage systems further aggravate the impacts of urbanization on the watershed, by short-circuiting the extensive ability of the watershed to cleanse and infiltrate runoff waters. Although the need for properly-designed and maintained drainage systems is undeniable, care must be taken in their design and operation to preserve, as much as possible, the natural attributes of the watershed. Such systems should stress detention, infiltration, and treatment of runoff waters before release to Lake Tahoe or its tributaries.

To the extent that specific drainage systems or devices can be shown to cause specific water quality problems, TRPA or other public agencies should have the ability to require remedial action from the responsible party.

State or federal discharge permits, issued under the authority of the federal Clean Water Act or under state law, should also be used to control the water quality problems associated with urban drainage systems.

4. Additional Development

In the same ways that existing streets, roads, urban land uses, and drainage systems create erosion and runoff problems, additional development in the Tahoe Region will add to the problems. Over the next 20 years, TRPA's Regional Plan will allow additional development in the following categories: residential, commercial, tourist accommodations, recreation, and public service, as described in Section II (see Land Use).

Since existing levels of development are greater than the anticipated additional development; since most additional development will not require construction of new streets or roads (other than driveways); and since management agencies can limit impervious coverage and require application of management practices, the impacts from the additional development should be small, compared to the impacts of the development that exists today. As discussed in Section II, additional development permitted under this 208 plan will increase land coverage by less than five percent. This increase, in turn, should increase drainage density by less than two percent, and since all additional development will incorporate infiltration facilities and other BMPs in infiltrate runoff, the actual increase in drainage density will be less.

Nevertheless, controls on additional development are necessary. Creation of new subdivisions on raw land should be avoided, temporary and permanent management practices should be applied to all new structures, development should be directed to those areas posing the least risk to water quality, impervious coverage should be limited, and the natural attributes of the watershed should be preserved as much as possible. In addition, persons responsible for additional development should offset, or mitigate, the off-site and on-site impacts of that development.

TRPA's analysis of the costs and effectiveness of water quality control measures, conducted pursuant to the requirements of Chapter 32 of the TRPA Code of Ordinances, indicates that the application of preventive BMPs to additional development is one of the most cost-effective control measures available to protect water quality, since the design and the cost of BMPs is easily incorporated into new projects at their inception.

5. Encroachment Upon Stream Environment Zones

As discussed in the systems model, the stream environments of the Tahoe Region are vitally important to the preservation of good water quality. Stream environment zones can filter out large amounts of both particulate and dissolved matter from runoff waters but, when they are disturbed, they represent a potent reserve of sediments and nutrients which is easily transported to Lake Tahoe. SEZs also have many other values related to water quality, such as scenic, wildlife, fishery, and vegetation values.

For more detailed information on the ability of SEZs to remove sediments and dissolved nutrients from runoff and tributary flows, see the systems model, Table 11, and Volume III of this 208 plan.

The Threshold Study Report (TRPA, 1982d) and the 208 plan (TRPA, 1977b) reported that 4,376 of the 9,196 acres of SEZs in the urbanized areas of the Region had been developed, disturbed, or divided. In addition to the 9,196 acres of SEZs in the urbanized areas, the Lake Tahoe Basin Water Quality Management Plan (TRPA, 1981d) reported 15,971 acres of SEZs existing on public lands.

Because of their importance to water quality, encroachment upon SEZs should be severely restricted, and areas of existing encroachment should be restored wherever possible. As noted above under Additional Development, these preventive BMPs are cost-effective ways to protect water quality.

All new development should be set back from the edge of SEZs to buffer the SEZs from erosion, runoff, alteration, and human activities associated with that development. The width of such setbacks should be related to the sensitivity of the SEZ, particularly in terms of channel type and stability. Broad SEZs surrounding meandering streams, for example, require wider setbacks than narrow SEZs adjacent to deeply incised, V-shaped channels.

6. Vegetation Displacement and Alteration

To protect and preserve the natural abilities of the watershed of Lake Tahoe to filter out sediments from runoff waters, to infiltrate runoff water, and to utilize nutrients in the runoff water, it is vitally important to protect and preserve vegetation. Vegetation stabilizes the watershed by helping to physically hold the soil and surface duff layer in place. In addition, vegetation removes nutrients from the water as it percolates down and through the plant's root zone. Considering the cold winters, dry summers, short growing season, and relatively non-productive soils found in the Tahoe Region, it is also important to nurture plant species which are either native to, or adapted to, the Region. Native and adapted plants minimize the need for watering and fertilizing and are more likely to survive in the Tahoe climate than other plants, such as certain ornamentals, which may be imported to the Region.

Programs are needed to protect native vegetation and surface duff from displacement or alteration, and to ensure that revegetation efforts utilize only desirable native and adapted plants. Such programs should cover trees, shrubs, flowering plants, and grasses, and should protect vegetation from disturbance both during the construction phase of projects and during implementation of landscaping programs.

Infiltration of runoff water is an essential part of the control measures needed to preserve water quality in the Tahoe Region. To the extent that infiltration can be accomplished in areas well-vegetated with native and adapted plant species, including both natural and artificial wetlands, the ability of the watershed to cleanse the runoff waters of sediments and nutrients will be more fully realized. Infiltration in soils planted with native vegetation, for instance, is superior to infiltration in infiltration trenches and dry wells because infiltration of runoff water that passes through the biologically active upper one-to-two feet of the soil column and through the root zone of the vegetation will be cleansed of nutrients (Ryden et al., 1979; Hussey et al., 1984; Greenlee, 1985).

7. Fertilizer

Just as it is important to limit alteration or disturbance of vegetation to preserve the natural functions of the watershed of Lake Tahoe, it is also important to limit the addition of fertilizer, which may leach from the soil and become a component of runoff waters. The 1981 problem assessment (TRPA, 1981d) estimated that 3.5 metric tons of nitrogen may be leached into the receiving waters of the Tahoe Basin each year. Golf courses accounted for 2.7 metric tons per year, while home yards accounted for 0.6 metric tons per year. Multiple units and schools each accounted for 0.1 metric tons of nitrogen leached into the groundwater or surface water each year.

While the use of fertilizer may be necessary in some applications, such as establishing erosion-control vegetation, management practices are needed which regulate the amount of fertilizer applied, the methods and rates of application and irrigation, the types of fertilizer utilized, and the locations where fertilizers are used. Since they have negligible capital costs and may actually reduce operating costs, fertilizer management practices are cost-effective means to protect water quality.

B. AIRBORNE NUTRIENTS

The above section, Urban Erosion, Runoff, and Disturbance, discusses the importance of controlling runoff from developed areas of the Lake Tahoe Basin to protect the quality of the receiving waters. However, as discussed in the system model, above, the atmosphere also represents a source of nutrient input to Lake Tahoe, and contributes to the Lake's accelerated eutrophication. (Balentine et al., 1985; Byron and Goldman, 1986; and TRPA, 1987a).

The main nutrient which may become airborne and be deposited on the Lake is nitrate-nitrogen. Nitrate-nitrogen, an aerosol particle, may originate upwind of the Tahoe Basin, or may be generated locally. Modeling performed for the California Air Resources Board (CARB, 1988) indicates that transport of nitrogen compounds is significant over distances of up to 300 miles. Depending upon the exact chemistry found in the atmosphere, this nitrate-nitrogen may readily transform into nitric acid (a gas), and back again to nitrate-nitrogen (Appel and Tokiwa, 1984). Since nitrate is hydroscopic (i.e., water-seeking), and since it is heavier than air, it will tend to deposit on the surface of Lake Tahoe, and be dissolved into the water column, during both dry and wet weather. Although it is difficult to quantify the contribution from atmospheric deposition, it is possible that direct atmospheric deposition is the largest source of inorganic nitrogen reaching Lake Tahoe (Balentine et al., 1985). TRPA has estimated the annual DIN load from this source at 40 to 66 metric tons (TRPA, 1982d).

Airborne nitrate originates from automobile emissions, natural gas combustion, electric power plants, fertilizer volatilization, lightning, and other sources. It should be noted that studies of Lake Tahoe's bottom sediments indicate that pollen fallout does not significantly contribute to atmospheric loading of nitrogen in Lake Tahoe. Although the TRPA can not directly affect the levels of nitrate transport from upwind, controls on auto emissions and emissions from stationary sources both inside and outside the Tahoe Region will help to reduce the amount of direct nitrogen deposition on the Lake. Based on an analysis of the cleaner vehicle fleet and population projections in urban areas upwind of Lake Tahoe, TRPA estimates that upwind emissions of oxides of nitrogen in 2005 will be 13 to 17 percent lower than 1983 emissions. (See the Technical Appendix, Volume VII.)

Although phosphorus does not form a gas or aerosol like nitrate-nitrogen, phosphorus can also become airborne in a particulate form and be deposited on Lake Tahoe, where it can then be dissolved. Atmospheric phosphorus comes from the weathering of soils and rock, either natural or induced by man, which causes dust containing phosphorus compounds to be released to the atmosphere. Researchers estimate that the contribution of atmospheric phosphorus to Lake Tahoe is about 1 metric ton/year, or about 10 percent of the total available phosphorus on an annual basis (TRPA, 1982d). Controls on disturbance to soils, vegetation, or the surface duff layer which may cause dust to be released into the atmosphere are necessary to minimize the nutrient loading from this source.

C. WASTE MANAGEMENT

In addition to erosion and runoff from urbanized areas and deposition of airborne nutrients on Lake Tahoe, the Tahoe Region also experiences water quality problems associated with waste management--wastewater collection and treatment, solid waste management, spills, and snow disposal.

1. Sewage Collection and Treatment

The Winter Olympics, held in Squaw Valley, California in 1960, are often cited as the beginning of rapid urbanization of the Tahoe Region. In the 1960's, concerns grew about the disposal of domestic sewage to the surface and groundwaters of the Region, which were of outstanding quality. After a study of the situation of by California, Nevada, and the Federal Water Pollution Control Administration in 1966, both states prohibited the discharge of wastewaters to the surface or groundwaters of the Region, with limited exceptions. The California Water Code (1969), Section 13950 required the export of all effluent and prohibited septic tanks after January 1, 1972. Nevada Governor Mike O'Callaghan's Executive Order of January 27, 1971 prohibited the use of septic tanks after December 31, 1972.

By the early 1970's, virtually all development within the Region was connected to sewage collection and treatment systems. There are five main systems in existence today:

- -- the South Tahoe Public Utility District (STPUD), which provides sewage collection and treatment for those portions of El Dorado County, California, within the Tahoe Basin and south of Emerald Bay,

- -- the Tahoe City Public Utility District (TCPUD), which provides sewage collection to the California-side of the Basin from Emerald Bay on the south to Dollar Hill on the north, and transmits that sewage to the Tahoe-Truckee Sanitation Agency (TTSA) in Truckee, California for treatment,

- -- the North Tahoe Public Utility District (NTPUD), which provides sewage collection from Dollar Hill to the Nevada stateline in Placer County, California, and also transmits that sewage to TTSA,

-- the Incline Village General Improvement District (IVGID), which provides sewage collection and treatment in Washoe County, Nevada, within the Tahoe Basin, and

-- the Douglas County Sewer Improvement District (DCSID), which collects and treats sewage in Douglas County, Nevada, within the Tahoe Basin, including the casino core area.

STPUD pumps its treated effluent over Luther Pass for ultimate disposal in Alpine County, California. TCPUD and NTPUD untreated sewage flows by gravity to the TTSA plant, where it is treated and discharged to the Truckee River. IVGID pumps its treated effluent over Spooner Summit for ultimate disposal in Carson City and Douglas County, Nevada. And DCSID pumps its treated effluent over Dagget Pass for ultimate disposal in Douglas County, Nevada.

Since virtually all of the domestic wastewater generated within the Region is exported from the Region prior to disposal, water quality problems from wastewater within the Region are related primarily to accidental releases from the major systems, exfiltration from sewer lines, and control of wastewaters generated at sites not connected to the sewer system (e.g., Echo Lakes in El Dorado County).

To control the water quality problems associated with wastewater disposal, the sewage districts must attempt to eliminate accidental releases and sewer line exfiltration through both capital improvements and improved maintenance practices. State regulatory agencies should continue to regulate the activities of and effluents from the sewage districts and also oversee waste disposal practices at sites not connected to the sewer systems.

With the exception of STPUD, all of the sewage collection and treatment systems appear to have adequate capacity to handle existing sewage flows and growth anticipated under the TRPA Regional Plan. STPUD has reached the capacity of its facilities within the Basin, and must expand before it can serve the growth anticipated under the Regional Plan. (For more discussion of this point, see Section II.) Other collection and treatment districts should notify TRPA and the state regulatory agencies when they approach their design capacities, and prepare plans, if appropriate, to increase their capacity.

2. Solid Waste Management

California and Nevada both prohibit the disposal of solid wastes within the Tahoe Region. Solid waste from the South Shore is collected and exported to the Douglas County landfill near Gardnerville, Nevada. Solid waste from the California side of the North Shore is collected and exported to the Eastern Regional Landfill near Truckee, California. Solid waste from the Incline Village area is collected and exported to the Carson City, Nevada, landfill.

Given the state prohibitions on the disposal of solid wastes within the Region, solid waste disposal sites do not pose a threat to water quality. However, the Douglas County landfill is nearing its capacity, necessitating either expansion, siting of a new landfill, or other measures. The remaining capacity of the Eastern Regional Landfill is approximately 15 years.

In addition, solid waste problems related to litter, illegal dumping, disposal of construction wastes, and leachates from closed dumpsites in the Region may contribute to water quality problems and should be studied and controlled.

3. Hazardous Materials Spills

Considering the amount of urbanization that has occurred within the Tahoe Region, and the fact that a major interstate truck route passes through the Region, possible spills of hazardous materials such as gasoline, diesel fuels, fuel oil, aviation fuel, pesticides, solvents, chlorine, and other substances create the potential for serious water quality problems. Spill prevention and abatement programs are necessary to control the risk of spills affecting Lake Tahoe and its tributaries, the groundwaters of the Tahoe Region, and the lands of the Tahoe Region. In addition, hazardous waste management programs are needed to ensure that potentially hazardous substances such as paints, pesticides, household solvents, and waste motor oil are properly managed and disposed of and not discharged to the lands or waters of the Region.

4. Snow Disposal

In the Tahoe Region, 50 to 70 percent of the annual precipitation falls in the form of snow. Whenever snow accumulations in urbanized areas exceed more than an inch or two, snow plowing and disposal operations--both public and private--remove the snow from areas where it is not wanted. In some cases, the snow is stockpiled and left to melt in warmer weather, or it is disposed of by dumping it directly into streams or Lake Tahoe itself. At best, the snow contains nutrients common to all precipitation in the Region which should be prevented from reaching receiving waters without a chance for natural treatment by vegetation and soils. And realistically, snow cleared from urban surfaces contains many other substances, such as salts, metals, and hydrocarbons, which, in large enough concentrations, can be harmful to vegetation, fish, and drinking water supplies.

Management practices are needed to ensure that snow disposal practices do not harm the water quality of Lake Tahoe, its tributaries, and the groundwaters of the Tahoe Region. Management practices should also ensure that snow removal from unpaved areas does not expose soils to runoff and further disturbance, contributing to sediment and dissolved nutrient loads to receiving waters.

D. NATURAL AREA MANAGEMENT

Urbanization of the Tahoe Region, with its attendant effects on erosion, runoff, airborne nutrients, and waste management problems, is responsible for much of the increase in sediment and nutrients loads to Lake Tahoe. However, land use practices not directly related to urbanization also may affect water quality. These practices include timber harvest, outdoor recreation, off-road vehicle use, livestock containment and grazing, and the use of pesticides.

1. Timber Harvesting

During the Comstock mining era in the late 1800's, loggers cleared large portions of the Tahoe Region for timber to be used in the mines in California and Nevada. While the logging of the 1800's undoubtedly had impacts on the watershed and on water quality, and is responsible for the even-aged stand of timber at Tahoe today, the watershed has generally recovered from the disturbance of a century ago. This can be partially attributed to the fewer motorized vehicles in use at that time, and the low need for roads to be established.

Today, Tahoe is not affected by large-scale timber harvest operations. Instead, trees are harvested for sanitation, pest control, fuels management, seral stage management, and firewood sales. In recent years, logging affected about 500 acres per year, with a slight reduction to about 400 acres per year for the next 10 years being predicted by the U.S. Forest Service.

Controls are needed on timber harvesting to ensure that access roads, which increase drainage density, are well-placed and designed, and that skidding and related practices do not significantly disturb soils and vegetation. Since timber harvesting may take place on steep slopes with poor land capability, required management practices should take slope differences into account.

2. Outdoor Recreation (Ski Areas, Campgrounds, Trails, Day-Use Areas, Off-Road Vehicle Use, and Related Activities and Facilities)

With the increased popularity of alpine skiing in the United States after World War II, the Tahoe Region has developed into a winter sports resort area. Today, all or a portion of six alpine ski areas exist in the Region. Ski areas may increase drainage density and impervious coverage by the addition of roads, culverts, lifts, buildings, and parking areas, thereby increasing sediment and nutrient loads to Lake Tahoe. Since alpine ski areas, by their nature, tend to be located on steep, high-elevation lands, ski runs are vulnerable to erosion and runoff problems, and are difficult to revegetate once vegetation is cleared. Also, ski area operators may use chemicals, such as ammonium nitrate or sodium chloride, to harden snow in certain areas for racing events.

Campgrounds, day-use areas, and trails may also contribute to water quality problems by increasing coverage and drainage density, displacing vegetation, creating waste management problems, and exposing soils to disturbance by vehicles and foot traffic. Since campgrounds, day-use areas, and trails are often located near streams or the Lake, the potential for encroachment into stream environment zones or the backshore of Lake Tahoe is great.

Controls are needed on both existing and additional ski areas, campgrounds, day-use areas, and trails to limit soil and vegetation disturbance, control solid wastes and wastewater, limit chemical additions, and control encroachment on sensitive vegetation and areas. Maintenance practices at existing ski areas are important, since they can be a major factor in erosion and runoff problems during the snowmelt season.

Off-road vehicle (ORV) use, which includes operation of motorcycles (two-wheeled, three-wheeled, and four-wheeled), cars, and trucks off paved roads, may also contribute to water quality problems. To the extent that ORV use is confined to existing dirt roads, the water quality impacts can generally be contained by the application of standard BMPs for erosion and runoff control. However, if the ORV use damages the control devices (e.g., waterbars) or aggravates erosion of the road surface, additional controls may be necessary.

When operators of ORV's depart from existing roads and either establish new trails or travel cross-country, there is a great potential for soil disturbance, increased drainage density, and damage to vegetation, all of which contribute to water quality problems. The risk of damage to vegetation is especially great in steep areas, where soils are highly erosive and revegetation difficult, or in SEZs, where ORV use may liberate stored nutrients and sediments while it decreases the cleansing capability of the SEZs. TRPA (1981d) estimated that uncontrolled erosion problems on forest lands account for 15,500 metric tons of sediment reaching Lake Tahoe every year. Of this amount, more than one-third is directly attributable to dirt roads and jeep trails.

3. Livestock Confinement and Grazing

In the early 1900's, the Tahoe Region provided valuable summer range for cattle, sheep, and horses (Scott, 1973). In recent times, grazing is much less prevalent, but still occurs in some meadows adjacent to the Upper Truckee River and in several high-elevation meadows (e.g., High Meadow near Freel Peak). According to the USFS Land and Resource Management Plan (USFS, 1988), 1,400 animal unit months (AUMs) are allowed each year on National Forest lands. Grazing and livestock confinement also occur on private land, especially associated with stables and corrals.

Grazing and livestock confinement may contribute to water quality problems if livestock are allowed to trample seasonally wet areas or stream channels, or if overgrazing causes a loss of native vegetative cover. Controls are needed on grazing and livestock confinement to protect SEZs and seasonally wet soils from trampling, compaction, or storage of animal wastes. In addition, previously disturbed areas should be restored.

4. Pesticides

Because of its harsh climate, short growing season, and high elevation, the Tahoe Region has fewer insect and fungal pests than most other areas in California and Nevada. The need for insecticides and fungicides, therefore, is normally relatively low. When trees are stressed by overcrowding or urbanization, however, insect pests may gain a foothold and damage large tracts of forest. The bark beetle, for example, has been responsible for the death of many trees and the clearing of hundreds of acres in recent years.

There is also relatively little use of herbicides within the Region. The biggest use of herbicides is associated with large areas of turf, such as at golf courses and schools.

Controls are needed on the use of pesticides to ensure that detectable levels of toxic substances do not migrate into the surface or groundwaters of the Region. Exceptions to this policy may be appropriate where carefully-controlled pesticide use (e.g., Rotenone) is recommended to reestablish endangered fish species in the Region. (See also the discussion of tributyl tin, an aquatic pesticide, under Vessel Wastes.)

E. WATER QUALITY PROBLEMS IN LAKE TAHOE AND THE SHOREZONE

Although most of the sources of nutrients and sediments affecting the quality of Lake Tahoe and its tributaries are found in either the watershed or the airshed of Lake Tahoe, some water quality problems may originate in the Lake itself. Shoreline erosion, wastes from boats and other vessels, and dredging may contribute nutrients, sediments, bacteria, solids, or toxic substances to Lake Tahoe.

1. Shoreline Erosion

Erosion of Lake Tahoe's shoreline is, in large part, a natural phenomenon which contributes to the stability of the shoreline and the preservation of water quality. Erosion of backshore bluffs is a major source of beach sand (Moory, 1984) and where the erosion process is interrupted or stopped by human intervention, beach erosion and deep-water beaches will result.

Tributary streams whose channels meander back and forth, forming deltas where they reach Lake Tahoe, create barrier beaches, which protect the backshore areas from wave action. Taylor Creek and the Upper Truckee River are examples of such streams. When development activities encroach on these delta areas (e.g., the encroachment of the Tahoe Keys into the delta of the Upper Truckee River), the natural process of barrier beach formation is interrupted, and severe backshore erosion may occur. The shoreline west of the mouth of the Upper Truckee River has receded several hundred feet since the construction of the Tahoe Keys and the channelization of the River, liberating many thousands of tons of sediments and nutrients which had been stored in the backshore area.

Unnatural fluctuations in the level of Lake Tahoe may also contribute to water quality problems. In a natural setting, free of man's manipulation, shoreline erosion is a natural process which actually contributes to shoreline stability and protects water quality. But when Lake levels rise unnaturally, large quantities of sediments and nutrients may be eroded from backshore areas while the Lake attempts to establish a new equilibrium with its shoreline.

The original dam at Tahoe City was a small wooden structure constructed in 1870 by Alexis Von Schmidt. Work started in 1909 to replace the dam with a larger concrete structure. In 1915, the federal government gained control of the dam and regulated the top four feet, between 6,225 and 6,229 feet, of Tahoe water. After a lengthy dispute, negotiations between California and Nevada resulted in the Truckee River agreement in 1934. This provided for the regulation of the top 6.1 feet, between 6,233.0 and 6,299.1 feet, of the Tahoe water. The regulation of the top 6.1 feet of Tahoe water has persisted since 1934 and is the amount currently regulated.

2. Vessel Wastes

Around the shoreline of Lake Tahoe, there are about 25 launching facilities, 580 single-use piers, 134 multiple-use piers, and numerous mooring buoys. If all facilities were used to capacity, there would be about 6000 boats on Lake Tahoe at a given time (TRPA, 1983). Many of the boats in use on Lake Tahoe have built-in toilets and holding tanks or portable toilets, creating a large potential for intentional or unintentional dumping of wastewaters into the Lake. Public disposal facilities for vessel wastes exist at only five locations: Sunnyside Marina, Ski Run Marina (for large boats), Tahoe Keys Marina, Timber Cove Marina, and Tahoe Boat Company.

Anti-fouling substances painted on the hulls of boats, such as tributyl tin (TBT) may also contribute to water quality problems by adding toxic substances to the Lake. California legislation enacted in 1988 prohibits the use of TBT paints, except on aluminum vessel hulls and vessels 25 meters or more in length. Vessels painted with TBT before January 1, 1988 may still be used, but may not be repainted with TBT, so long as they comply with other applicable requirements. The U.S. EPA has also banned the use of TBT on non-aluminum hulls of vessels less than 82 feet in length and has limited the release rate of TBT from other hulls to 0.4 $ug/cm^2/day$.

To control wastewater releases from vessels, additional pump-out facilities and enforcement programs are needed. Controls on anti-fouling coatings and boat and marina maintenance practices are also necessary to protect Lake Tahoe from the addition of toxic substances from this source.

3. Dredging and Construction Within Lake Tahoe

Construction activities within Lake Tahoe, such as pier construction and dredging of channels to accommodate boat traffic represent a potential source of sediment and nutrients which could affect Lake Tahoe's water quality, and could threaten fish habitat due to excessive turbidity, sedimentation of feeding and spawning grounds, or substrate alteration. Water quality problems may result when dredging or construction resuspend sediments and nutrients which had been deposited on the Lake bottom, or when dredging or construction in backshore lagoons or marinas resuspend sediments and nutrients.

The impacts of construction and dredging operations vary, depending upon the type of practice involved. Suction dredging generally resuspends less sediment than clamshell dredging, and construction of open-piling piers resuspends less sediment than construction of sheet-piling structures.

Controls are needed on dredging and construction within Lake Tahoe to ensure that resuspension of sediments and nutrients is kept to a minimum, to contain resuspended sediments within a short distance of the operation, and to ensure that a suitable location for depositing dredged spoils exists.

F. SUMMARY AND CONCLUSIONS--PROBLEM ASSESSMENT AND CONTROL NEEDS

The systems model resulted in the identification of crucial attitudes and actions needed to preserve and protect the water quality of Lake Tahoe and its tributaries. The problem assessment begins the process of translating those attitudes and actions into control needs, and sets the stage for the program descriptions, which follow. The main conclusions of the problem assessment are as follows:

- -- Streets, roads, and highways represent a major source of water quality problems. Because BMPs and designs which minimize water quality impacts were not incorporated into the transportation network when it was built, retroactive application of BMPs and other controls is expensive.

-- Best Management Practices are needed and can be effective at reducing yields of sediment and dissolved nutrients from existing development, when properly conceived, designed, installed, and maintained. Effectiveness of BMPs on sediments is generally higher than effectiveness on dissolved nutrients. In intensively developed areas, community-wide approaches to BMP implementation may be necessary.

-- Effluent limits on discharges of urban runoff, administered and enforced by state regulatory agencies, are an essential tool for controlling loads of sediment and dissolved nutrients to the surface and groundwaters of the Tahoe Region.

-- The contribution of additional development to the water quality problems of the Tahoe Region will be relatively small, compared to the existing backlog of problems, especially since BMPs can be incorporated into project design and implementation. There is a need to focus more attention on the existing backlog of water quality problems.

-- Protection and restoration of SEZs and native vegetation are crucial to water quality management.

-- Nutrient loads to receiving waters from fertilizer use are easily controlled. Management of this source of dissolved nutrients is a cost-effective control practice.

-- Upwind reductions in emissions of oxides of nitrogen (NOx) over the next two decades will help control atmospheric deposition of airborne nutrients on Lake Tahoe, but local controls on NOx emissions are needed as well.

-- All of the sewage collection and treatment entities in the Region should strive to eliminate sewage spills and chronic leaks from their systems; STPUD will need to expand its facilities in the short-term to accommodate additional development consistent with TRPA's Regional Plan and the 208 plan.

-- Management practices and other controls to minimize the impacts of outdoor recreation activities and other activities in the natural areas of the Region on water quality are important.

-- Construction and dredging within the waters of Lake Tahoe represent a potential water quality problem for which controls are necessary. Care should be taken to avoid interruption of the natural processes of beach formation and littoral drift, in order to avoid the unfortunate consequences of altering this important natural system.

IV. PROGRAM DESCRIPTIONS

This chapter describes the control programs of the water quality management plan (208 plan). The programs respond to the control needs identified in Chapter III. They are a combination of regulatory, voluntary, and capital improvement programs and planning processes designed to protect water quality in the Tahoe Region. For each component of the control programs, the plan identifies the pertinent citation from the federal regulations governing development of water quality management plans.

Chapter V, Plan Implementation, identifies the management agencies responsible for each control program, and the authority under which each agency will carry out its responsibilities. Many of the control programs are regulatory programs which TRPA is already carrying out under the Code of Ordinances. Units of federal, state, and local government are generally responsible for implementing the capital improvement programs, including the SEZ Restoration Program, with assistance and oversight from TRPA.

A. URBAN RUNOFF AND EROSION

1. Existing Streets, Roads, and Highways

a. Best Management Practices (BMPs) for erosion, runoff, and operations and maintenance (regulatory/voluntary/remedial) [40 CFR 130.6(c)(4)(i), (ii), (iii)(G)]

Chapter III, Problem Assessment and Control Needs, identifies many situations in which management practices are necessary to control a particular water quality problem. These various practices are known collectively as Best Management Practices or BMPs, and are described in detail in Volume II, Handbook of Best Management Practices. The Handbook describes the appropriate BMPs for streets, roads, and highways, along with many other BMPs for other settings.

Although the selection and application of a BMP must be specifically tailored to the given problem and project site, there is a general program of BMP application set forth in the Goals and Policies and the Code of Ordinances. The Goals and Policies require all persons who own land, and all public agencies which manage public lands in the Tahoe Region, to put Best Management Practices (BMPs) in place and maintain the BMPs to protect water quality (Goals and Policies, p. II-41).

The implementation program for installation of BMPs on streets, roads, and highways involves both regulatory and voluntary aspects. When the owner or operator of a street, road, or highway applies to TRPA for approval of a project, TRPA shall require application of BMPs to the project as a condition of approval. When the project involves modification of an existing street, road, or highway, TRPA shall also require preparation of a plan and a schedule for retrofit of BMPs to the entire project area. The proportion of retrofit work required at the time of project implementation is a function of the cost and the nature of the project in question (Goals and Policies, p. II-41).

If the owner or operator of the existing street, road, or highway has no cause to come to TRPA for a project approval, TRPA will rely initially on voluntary compliance with the recommendations of the BMP Handbook. According to the Goals and Policies, TRPA shall undertake a public education program as part of an effort to obtain voluntary action and, if implementation does not proceed on schedule, TRPA shall enact additional regulations to obtain compliance (Goals and Policies, p. II-41).

If TRPA identifies a significant environmental problem resulting from a lack of BMPs on streets, roads, or highways, TRPA may also request or require a remedial action plan to correct the problem. According to Chapter 9 of the Code of Ordinances, TRPA shall develop problem assessments in consultation with affected local, state, and federal agencies.

Upon completion of a problem assessment, TRPA may request voluntary preparation of an action plan, require a mandatory action plan, or prepare an action plan itself. Action plans shall be approved by the TRPA Board and, once approved, the affected parties must comply with all provisions, including the schedule for implementation (Code, Chapter 9).

b. Capital Improvements Program (CIP) for erosion and runoff control [40 CFR 130.6(c)(4)(i), (iii)(G)]

Since there are hundreds of miles of streets, roads, and highways already existing in the Tahoe Region, few of which were built with erosion and runoff control in mind, it is necessary for the 208 plan to include a Capital Improvements Program (CIP) for erosion and runoff control on public rights-of-way. Over the next 20 years, the water quality CIP is estimated to cost about $281 million (1988 dollars). The CIP is found in Volume IV of this plan.

Federal, state, and local units of government and other land management agencies shall be responsible for carrying out the water quality CIP, with oversight from TRPA (Goals and Policies, p. VII-20).

Memoranda of Understanding (MOUs) or other agreements between TRPA and the implementing agencies will provide the necessary coordination to ensure implementation. Appropriate roles and responsibilities of the involved agencies will be identified and verified through these agreements (Goals and Policies, p. VII-2).

TRPA shall consult with the responsible agencies and establish regional water quality priorities consistent with the Regional Plan. Public agencies require flexibility in scheduling capital improvements. TRPA, after consultation with those agencies, will provide guidance on priorities and, through project review, ensure that all capital improvements are consistent with the Regional Plan. The detailed CIP will be reviewed and revised periodically in cooperation with the affected agencies. TRPA will also consult with the responsible agencies on the development and implementation of long-term revenue programs (Goals and Policies, p. VII-19). Minor changes in project descriptions or revenue programs shall not require state certification and federal approval before they take effect, but shall be included in periodic updates of the CIP submitted to the states and EPA.

For more detailed information on the CIP, see Volume IV, Capital Improvements Program.

2. Other Existing Urban Development

a. Best Management Practices (BMPs) for existing uses (voluntary/regulatory/ remedial)
[40 CFR 130.6(c)(4)(i), (ii), (iii)(G)]

Just as BMPs are needed to control urban runoff and erosion from streets, roads, and highways, they are needed to control runoff and erosion from other existing urban uses--residential, commercial, tourist accommodation, and public service. Thus, the Goals and Policies require all persons who own land, and all public agencies which manage public lands, to install and maintain BMPs; protect vegetation from damage, and restore the disturbed soils. The BMP Handbook identifies the required BMPs; however, application of BMPs involves site-specific considerations (Goals and Policies, p. II-41).

Since existing development represents a large backlog of erosion and runoff problems, the application of BMPs, including restoration of disturbed areas, is expected to significantly reduce nutrient loads from surface runoff (Goals and Policies, p. II-41). It is TRPA's intent to have at least 80 percent of the disturbed lands (i.e., vegetation lost, soil exposed) restored to a natural or near-natural state by the application of BMPs (Goals and Policies, p. II-42).

The program of BMP implementation for existing land uses is the same as for streets, roads, and highways, above, and involves both voluntary and regulatory aspects. TRPA shall undertake a public education program as part of an effort to obtain voluntary action. If installation of BMPs does not proceed on schedule, TRPA shall enact regulations to obtain compliance (Goals and Policies, p. II-42).

New projects which modify structures or establish land coverage shall require application of BMPs to those areas affected by the project. TRPA shall require the preparation of a plan and schedule for retrofit of BMPs to the remainder of the parcel. The amount of retrofit required at the time of project approval is based on the cost and nature of the project (Goals and Policies, p. II-42).

b. Excess Coverage Mitigation (regulatory) [40 CFR 130.6(c)(4)(ii), (iii)(G)]

Where projects are approved for modification or rehabilitation of facilities on parcels with existing coverage in excess of the Bailey coefficients ("excess coverage"), a land coverage mitigation program shall provide for the reduction of coverage in an amount proportional to the cost of the project and the extent of excess coverage. To accomplish these reductions, property owners may (1) reduce coverage on-site, (2) reduce coverage off-site within the hydrologically-related area, (3) in lieu of coverage reduction, pay an excess coverage mitigation fee to a land bank established to accomplish coverage reductions, (4) consolidate lots or adjust lot lines, or (5) any combination of the above (Goals and Policies, pp. II-16, 17). These programs are expected to achieve significant reductions in existing coverage, as discussed in Section II.

Certain types of projects are exempt from excess coverage mitigation requirements, including: projects on parcels where the coverage has already been mitigated; repair and reconstruction of buildings damaged by fire or other calamity; installation of erosion control facilities; restoration of disturbed areas; SEZ restoration; underground storage tank removal, replacement, or maintenance; hazardous waste spill control or prevention facilities; sewage pump-out facilities; and repairs to linear public facilities (Code, Subsection 20.5.B).

The Goals and Policies set forth procedures for establishing the excess coverage mitigation fee schedule referred to in (3), above. TRPA set an interim fee in Subsection 20.5.A of the Code and convened a special task force to report on the costs and mechanisms involved in establishing an effective land bank program. According to the Goals and Policies, the fee schedule shall: (1) provide a reasonable level of funding for the land bank, (2) not unduly restrict or deter property owners from undertaking rehabilitation projects, and (3) carry out an effective coverage reduction program (Goals and Policies, p. II-17). TRPA has not yet revised the interim fee schedule, and has extended the interim schedule to December, 1988.

3. Existing Urban Drainage Problems

a. Best Management Practices (BMPs) for maintenance and design of urban drainage systems (voluntary/regulatory/remedial)
[40 CFR 130.6(c)(4)(i), (ii), (iii)(G)]

Chapter III, Problem Assessment and Control Needs, identifies the need for management practices to control runoff and erosion caused by, or aggravated by, urban drainage systems. The implementation program for these BMPs is the same as for existing streets, roads, and highways. The BMP Handbook describes the specific BMPs which should be applied to urban drainage problems.

b. Effluent Limitations and Discharge Permits (regulatory)
[40 CFR 130.6(c)(2); 130.6(c)(4)(ii), (iii)(G)]

Since urban drainage systems typically discharge runoff waters to Lake Tahoe or its tributaries at discrete points, it is also appropriate to regulate those discharges through the establishment of effluent limitations and the issuance of discharge permits. State basin plans under section 303(e) of the Clean Water Act, the 1981 208 plan, and the TRPA thresholds, all establish quality standards for the discharge of runoff waters. (For details, see Attachments 1 and 2.)

To help control water quality problems resulting from discharges from urban drainage systems, California and Nevada have set effluent limitations and issued discharge permits under their statewide authorities, and shall continue to issue and administer effluent limitations in accordance with the Clean Water Act and, in California, the Porter-Cologne Act. NDEP has set effluent limits and issued NPDES permits to private dischargers within Nevada, and the California Regional Water Quality Control Board--Lahontan Region has set effluent limits and issued state waste discharge requirements (WDRs) to the three local jurisdictions on the California side of the Tahoe Region: the City of South Lake Tahoe, El Dorado County, and Placer County. (See, for example, Board Order No. 6-84-75, Waste Discharge Requirements for El Dorado County Erosion and Stormwater Runoff Control.)

Each WDR begins with a set of findings which establish that the city or counties discharge stormwater runoff to Lake Tahoe and its tributaries at discrete points; that state water quality standards apply to both the discharge and the receiving waters; that the discharge standards are exceeded on a routine basis; that BMPs and capital improvements are reasonable and necessary to control these problems; that the discharger should make every reasonable effort to bring its stormwater discharges into compliance with the discharge limits; and that the discharger should commence funding efforts to achieve compliance, such as taking advantage of grant programs, levying assessments in specific areas, and collecting discharge fees from property owners.

The WDRs require that stormwater runoff discharged to Lake Tahoe or a tributary at a discrete location shall meet the state standards no later than 20 years from the adoption of the order. They also require development in the area contributing to the drainage system to comply with all provisions of the 208 plan.

Each WDR requires the application of BMPs, sets time schedules for planning and compliance, and requires that the dischargers comply with a monitoring and reporting program. This program covers monitoring locations, sampling protocols, and reporting requirements.

TRPA considers large parking areas, the South Tahoe airport, golf courses, and ski areas high priorities for retrofitting with BMPs because of their potential for significant water quality impacts from runoff. The states are encouraged to issue WDRs or NPDES permits to these facilities. If, following TRPA's comprehensive review of progress under the 208 plan in 1991, facilities in those categories have not established retrofitting schedules, TRPA, in conjunction with the states, will require such schedules to be established.

4. Additional Development

a. Temporary and Permanent Best Management Practices (BMPs) (regulatory) [40 CFR 130.6(c)(4)(ii), (iii)(E) and (G)]

For all additional (i.e., new) development in the Tahoe Region, application of BMPs shall be required as a condition of approval. All projects shall be required to apply BMPs to the project area during construction, as specified in the Handbook of Best Management Practices (Goals and Policies, p. II-42).

b. Limitations on New Subdivisions (regulatory) [40 CFR 130.6(c)(4)(ii), (iii)(E) and (G)]

To prevent the creation of new water quality problems resulting from the subdivision of additional areas in the Tahoe Region, no new divisions of land shall be permitted within the Region which would create new development potential inconsistent with the Goals and Policies (Goals and Policies, p. II-9). This policy does not consider the following divisions of land to be inconsistent when the result does not increase the development potential permitted by TRPA's Regional Plan:

-- division of land for purposes of conveyance to a government agency, public entity, or public utility,

-- division of land for cemetery lots,

-- divisions ordered by a federal or state court as a result of an adversary legal proceedings involving TRPA,

-- certain modifications or lot-line adjustments to existing subdivisions,

-- certain conversions of existing structures to stock cooperatives, community apartments, condominiums, or other form of divided interest,

-- redivision, adjustment, or consolidation within an existing urban area as part of a TRPA-approved redevelopment plan, or

-- division of land through condominiums, community apartments, or stock cooperatives within an existing urban area in conjunction with a project involving transfer of development rights or otherwise in accordance with the Regional Plan, provided the project is approved prior to the approval of the division. (Goals and Policies, pp. II-9, -10)

Only very limited subdivisions will be allowed under the 208 plan. TRPA's intent is to avoid the impacts of new lot and block subdivisions while using mechanisms such as resubdivision to lessen the potential impacts of existing approved but unbuilt subdivisions.

c. Land Use Planning and Control (regulatory) [40 CFR 130.6(c)(4)(ii), (iii)(E) and (G)]

The Tahoe Regional Planning Compact requires, in Article V(c), that TRPA prepare and implement an integrated land use plan for the Tahoe Region. The resulting land use plan, as set forth in the Goals and Policies and the Plan Area Statements and maps, assists TRPA in meeting its water quality objectives by directing development to already-urbanized areas of consistent land use, instead of undeveloped areas of the Region.

Specific land use policies shall be implemented through the use of Plan Area Statements (PASs) for each of 175 plan areas. Areas have been categorized within five land use classifications: conservation, recreation, residential, commercial/public service, and tourist. The classifications shall dictate permissible uses. More-detailed plans, called community plans, may be developed for designated commercial areas. Other detailed plans, such as the Lake Tahoe Airport master plan, ski area master plans, and redevelopment plans, may also be developed (Goals and Policies, pp. II-2, 3).

Conservation areas are non-urban areas with value as primitive or natural areas, with strong environmental constraints on use, and with potential for dispersed recreation or low-intensity resource management (Goals and Policies, p. II-3).

Recreation areas are non-urban areas with good potential for developed outdoor recreation, parks, or concentrated recreation (Goals and Policies, p. II-3).

Residential Areas are urban areas having the potential to provide housing for the residents of the Region, including areas now developed for that purpose, areas of moderate to good land capability, areas within urban boundaries and served by utilities, and areas in close proximity to commercial services and public facilities (Goals and Policies, p. II-3).

Commercial/Public Service areas are urban areas designated to provide commercial and public services to the Region, or that have the potential to do so. The purpose of this classification is to concentrate such services, to separate incompatible uses, but to allow other noncommercial compatible uses (Goals and Policies, p. II-3).

Tourist areas are urban areas that have the potential to provide intensive tourist accommodations and services or intensive recreation (Goals and Policies, p. II-4).

In addition to the land use classification, each PAS shall also identify the management theme for each plan area as (1) maximum regulation, (2) development with mitigation, or (3) redirection of development. Maximum regulation applies primarily to conservation areas, development with mitigation is the predominant management theme in the Region, and redirection of development is designed primarily to improve environmental quality and community character (Goals and Policies, p. II-4).

To be responsive to the needs and opportunities of various areas, specific community plans may be developed for designated commercial areas. These plans shall guide development in specified areas for at least ten years and shall be kept current. TRPA shall actively encourage completion of community plans for all designated areas by December, 1989. Designated areas shall be those where commercial uses are concentrated, or should be concentrated. They shall be easily served by transit, shall have adequate highway access, shall have or provide employee housing in the vicinity, and shall be suitable for continued or increased levels of commercial activity (Goals and Policies, p. II-6).

Before initiating work on the community plan, TRPA and the appropriate unit of local government shall approve a preliminary plan and work program which set targets for reductions in vehicle trips and land coverage and other threshold-related targets (Code, Subsection 14.6.B).

Each community plan shall include (1) an assessment of needs, opportunities, limitations, and existing features, (2) goals and objectives, (3) maps, and (4) an integrated plan addressing land use, transportation, traffic, parking, public service, housing, recreation, implementation, consistency with the Plan Area Statements, coordination with monitoring, and other programs. Each plan shall also set forth a schedule showing how development is to be coordinated with public projects, including water quality improvements and other remedial projects, so that applicable goals and standards are achieved (Goals and Policies, p. II-7).

The Plan Area Statements and community plans will assist the TRPA in carrying out its programs to protect water quality by directing additions and changes in land use to the most appropriate areas. There are also other land use plans which help to attain the same goals, including the Forest Service's draft Land and Resource Management Plan (USFS, 1985).

d. Residential Development Priorities (regulatory) [40 CFR 130.6(c)(4)(ii), (iii)(E) and (G)]

One method available to TRPA to help protect water quality in the Region is to direct all residential development first to those areas most suitable for development in accordance with the thresholds and other considerations, such as infrastructure capacity and progress toward completing water quality capital improvements (Goals and Policies, p. VII-3). To accomplish this goal for new single-family development, TRPA will utilize the Individual Parcel Evaluation System (IPES).

TRPA began the evaluation and ranking of vacant residential parcels under IPES in 1987, and will complete these tasks by December, 1988. Commencing January 1, 1989, all new single-family construction will be evaluated in accordance with IPES, which will rank vacant parcels with respect to their relative suitability for development (Goals and Policies, p. VII-3).

IPES is an objective and scientific system which evaluates a parcel with respect to the following criteria: (1) relative erosion hazard, (2) runoff potential, (3) degree of difficulty to access the building site, (4) water influence areas, (5) condition of the watershed, (6) ability to revegetate, and (7) the need for water quality improvements in the vicinity of the parcel (Goals and Policies, p. VII-4).

IPES includes an element, separate from the criteria used to rate parcels, which encourages physical mitigation of existing water quality problems by individual property owners. The rating of a parcel may be increased, to a limited and finite degree, by the property owner constructing off-site water quality improvements (Goals and Policies, p. VII-4). According to Chapter 37 of the TRPA Code, TRPA must approve any such water quality improvement projects; the project must be located off-site; and the project must be completed prior to the construction of the single-family dwelling under IPES (Code, Subsection 37.2.I).

IPES shall be implemented as follows (Goals and Policies, pp. VII-4 through 7):

-- A team of experts shall evaluate each parcel using a standardized approach.

-- For parcels of 1/3 acre or less, the team shall evaluate the entire parcel, except that SEZs shall be excluded from the area evaluated. For parcels with less than 5000 square feet outside an SEZ, the IPES rating shall be reduced by a factor equal to the ratio of square feet of land available for construction to 5000 square feet.

-- For parcels greater than 1/3 acre, but less than five acres, the IPES team shall select and evaluate the 1/3 acre portion that results in the highest rating. If the selected area contains an SEZ, the rating shall be reduced as set forth above. If the property owner desires to locate the residence outside the area evaluated, a reevaluation shall be required.

-- For parcels of five acres or greater, the property owner shall be notified and asked to identify the desired building site. Once a building site is identified, the IPES team shall evaluate the best 1/3 acre portion containing the identified building site. If the selected area contains an SEZ, the rating shall be reduced as set forth above.

-- Ratings of parcels may change, subsequent to the initial rating, as a result of installation of water quality improvements in the vicinity of the parcel or changes in the condition of the watershed.

-- Property owners may appeal their parcel's rating to an independent body of qualified experts not involved in the initial field evaluation of that parcel. These independent experts shall apply the IPES criteria, and their decision shall be final unless the property owner appeals to the TRPA Governing Board. The Board may change a rating only upon finding that the IPES criteria were not applied correctly.

TRPA shall rate all vacant residential parcels numerically and rank them from most suitable to least suitable, by jurisdiction. TRPA shall also establish a level in the ranking immediately above the most sensitive parcels, based on recommendations from the IPES technical committee. Only parcels above this level, as it may be subsequently adjusted, comprise the "top rank" and may pursue a building permit (Goals and Policies, p. VII-6).

The numerical level defining the top rank for any jurisdiction shall be lowered annually by the number of allocations utilized in that jurisdiction during the previous year, provided that the following conditions are met (Goals and Policies, pp. VII-6, -7):

-- all parcels in the top rank are otherwise eligible for development under state water water quality plans and other legal limitations,

-- a monitoring program for that jurisdiction is in place as set forth in the Monitoring and Evaluation Subelement of the TRPA Goals and Policies,

-- demonstrable progress is being made on the Capital Improvements Program for water quality within that jurisdiction,

-- there is a satisfactory rate of reduction in the inventory of vacant parcels; the IPES line shall not move down in any jurisdiction unless the number of parcels below the line in that jurisdiction, compared to the number deemed sensitive on January 1, 1986, does not exceed 20 percent in El Dorado and Placer Counties, or 33 percent in Washoe and Douglas Counties, and

-- the level of compliance with conditions of project approvals within that jurisdiction is satisfactory.

With respect to the requirement that a monitoring program be in place in a given jurisdiction, the Goals and Policies require TRPA to monitor representative tributaries to provide a basis for evaluating the relative health of the watershed within which development is contemplated and progress toward meeting thresholds. The monitoring program will monitor stream flows and concentrations of sediments and dissolved nutrients to determine annual pollutant loads. This monitoring program shall be in place in a local jurisdiction, and shall establish baseline water quality conditions, before the numerical level defining the top rank for the jurisdiction is lowered (Goals and Policies, p. VII-25). The term "in place" means that a TRPA-approved monitoring system, with established procedures and responsibilities, is physically located on the selected tributaries, and samples have been collected and analyzed for at least one representative water year.

The location of sampling sites, frequency of sampling, and financial responsibilities for monitoring will be set forth in TRPA's Monitoring Program pursuant to the Goals and Policies (p. VII-25) and the TRPA Code of Ordinances (section 32.10), based on the recommendations of the TRPA Monitoring Committee. The objectives of the monitoring program are to:

(1) Characterize the water quality of streams draining affected residential areas in relationship to the overall water quality observed in the watershed,

(2) Identify short-term changes in water quality from affected residential areas, and

(3) Ensure that TRPA and state water quality standards are being attained and maintained.

The monitoring program will include quality control and quality assurance (QA/QC) procedures to ensure that the data accurately represent the actual water quality conditions.

Monitoring will normally occur not only at the mouths of streams, but also at locations in closer proximity to residential subdivisions. While the stream mouth monitoring will generally cover the entire year, monitoring at other locations higher in the watershed will be geared toward the spring snowmelt period and the fall storm season to contain costs. In addition to the presently established monitoring stations, TRPA estimates that 30 to 40 additional stations will be required throughout the Region to support the IPES conditions.

With regard to the requirement that demonstrable progress is being made on the Capital Improvements Program within a given jurisdiction, TRPA's evaluation will be based on the programs adopted in Volumes III and IV of the 208 plan, including lists of SEZ restoration and capital improvement projects for erosion and runoff control, with priority designations, for each jurisdiction. Pursuant to the Goals and Policies, TRPA has established benchmarks against which the progress can be evaluated (Goals and Policies, p. VII-26). These benchmarks are found in Section I, Chapter VII of this volume, Plan Evaluation and Revision.

To make a finding of demonstrable progress in a local jurisdiction, TRPA will review the progress of that jurisdiction over a three-year period covering the previous year, the current year, and the upcoming year. For the demonstrable progress criteria to be met, TRPA must make one of the following findings: (1) funding is committed and there is a strong likelihood that construction will commence on one or more high priority watershed improvement projects in the current or upcoming year and construction of one or more high priority projects has taken place in the previous or current year, or (2) the performance of the local jurisdiction on implementation of SEZ restoration and capital improvement projects is consistent with progress necessary to meet the benchmarks established on pp. 183 and 184. In this context, the term "high priority project" means a project with a substantial water quality benefit.

To determine whether the level of compliance in a jurisdiction is satisfactory, TRPA will evaluate: (1) the percentage of projects which commenced construction three or more years earlier but which have not had their securities returned for water quality-related practices, (2) the number of projects which are behind approved schedules in project approvals for BMP retrofit, compared to those on schedule, (3) the number of projects which required TRPA issuance of cease and desist orders for failure to observe conditions of approval within the previous fiscal year, as compared to the number of projects inspected, and (4) the number of projects on which violations remain unresolved, compared to the number resolved. TRPA will review compliance data at the end of the 1989 building season, and will then set specific numerical performance standards for the four criteria above. The specific numerical performance standard shall reflect TRPA's goal of achieving a very high level of compliance with conditions of project approval.

Since it is possible (though unlikely) that individual appeals of IPES scores may result in a significant shift in the number of single-family parcels eligible to pursue construction permits by virtue of being in the top rank, TRPA shall, in a given local jurisdiction, and provided that IPES appeals increase the size of the top rank in that jurisdiction by three percent or more, subtract the number of parcels added to the top rank by appeals during the first year from the number of parcels which would be added to the top rank any year that the IPES line is lowered, until the number of parcels added to the top rank by appeals equals the number of parcels which would have been added to the top rank due to the lowering of the IPES line.

For TRPA to approve a project on a parcel rated and ranked by IPES, the parcel must be served by a paved road, water service, sewer service, and electric utility. However, Chapter 27 of the TRPA Code of Ordinances sets forth provisions for waiver of the paved road requirement, as provided for in the Goals and Policies (p. VII-8).

e. Limits on Land Coverage (regulatory)
[40 CFR 130.6(c)(4)(ii), (iii)(E) and (G)]

To protect water quality and other important values of the Tahoe Region, TRPA's goal is that all new development shall conform to the coefficients of allowable land coverage set forth in the Bailey Report. In some instances, provisions are made to allow additional coverage on a given parcel by transfer programs, which are based on a direct offset method (Goals and Policies, p. II-12).

Allowed base land coverage for all new projects and activities shall be calculated by applying the Bailey coefficients to the applicable area within the parcel boundary, or:

-- for subdivisions approved by TRPA in conformance with the Bailey coefficients (listed in Attachment D of the Goals and Policies), coverage assigned to individual lots shall be the allowed base coverage,

-- for PUDs not in conformance with the Bailey coefficients, the coefficients shall apply to the entire project area minus public rights-of-way, and the allowed base coverage shall be apportioned to individual lots and common area facilities,

-- for parcels evaluated under IPES, the allowable base land coverage shall be a function of the parcel's combined score for relative erosion hazard and runoff potential, as correlated with the Bailey coefficients and applied to the evaluated area (Goals and Policies, p. II-13); the total potential land coverage for the inventory of parcels evaluated under IPES will not exceed the total potential land coverage as calculated by the application of the Bailey coefficients, based on an evaluation of a sample of 6,237 parcels assigned IPES scores during 1987 and 1988 (see Volume VII, Appendix L).

The allowed base coverage may be increased by transfer of land coverage within hydrologically-related areas up to the limits set forth in Table 15. The boundaries of the hydrologically-related areas are shown in Figure 16. Special provisions for additional coverage, such as for exceptionally long driveways and handicapped access, may also be allowed by ordinance (Goals and Policies, p. II-14).

In addition to the limitations on land coverage, above, no new land coverage or other permanent disturbance shall be allowed in land capability districts 1, 2, or 3, except as follows (Goals and Policies, pp. IV-13, -14):

TABLE 15 Table of Land Coverage Transfer Limits

Category	Maximum Allowed Land Coverage
Single Family Residential	The maximum land coverage allowed (base plus transfer) on a parcel through a transfer program shall be:

Parcel Size	Land Coverage
0 - 4,000	base land coverage only
4,001 - 9,000	1,800 sq. ft.
9,001 - 14,000	20%
14,001 - 16,000	2,900 sq. ft.
16,001 - 20,000	3,000 sq. ft.
20,001 - 25,000	3,100 sq. ft.
25,001 - 30,000	3,200 sq. ft.
30,001 - 40,000	3,300 sq. ft.
40,001 - 50,000	3,400 sq. ft.
50,001 - 70,000	3,500 sq. ft.
70,001 - 90,000	3,600 sq. ft.
90,001 - 120,000	3,700 sq. ft.
120,001 - 150,000	3,800 sq. ft.
150,001 - 200,000	3,900 sq. ft.
200,001 - 400,000	4,000 sq. ft.

Category	Maximum Allowed Land Coverage
Single Family Residential in Planned Unit Developments	The maximum coverage allowed (base plus transfer) shall be up to 100 percent of the proposed building envelope but not more than 2,500 sq. ft. Lots in subdivisions with TRPA-approved transfer programs may be permitted the coverage specified by that approval.
Commercial Facilities in an Approved Community Plan	The maximum coverage allowed (base plus transfer) on an existing undeveloped parcel shall be 70% of the land in capability districts 4, 5, 6 and 7. For existing developed parcels, the maximum is 50 percent. Coverage transfers to increase base coverage up to 50% shall be at 1:1. Coverage transfers to increase coverage above 50% shall be a gradually increasing ratios, up to a maximum of 2:1.

TABLE 15 (continued)

Category	Maximum Allowed Land Coverage
Tourist, Multi-Residential, Publ. Service, Recreation in an Approved Community Plan	The maximum coverage (base plus transfer) shall be 50% of the land in capability district 4, 5, 6 and 7. Coverage transfer ratios to increased coverage to 50% shall be at 1:1.
Other Multi-Residential	The maximum coverage (base plus transfer) shall be as set forth under Single-Family Residential, above.
Linear Public Facilities and Publ. Health and Safety Facilities	The maximum coverage (base plus transfer) shall be the minimum coverage needed to achieve their public purpose.
Public Service Facilities Not In A Community Plan Area	The maximum coverage (base plus transfer) shall be 50 percent, provided TRPA finds there is a demonstrated need and requirement to locate the facility outside a community plan area, and there is no feasibile alternative which would reduce land coverage.

Source: TRPA Goals and Policies (1986a), p. II-14, 15.

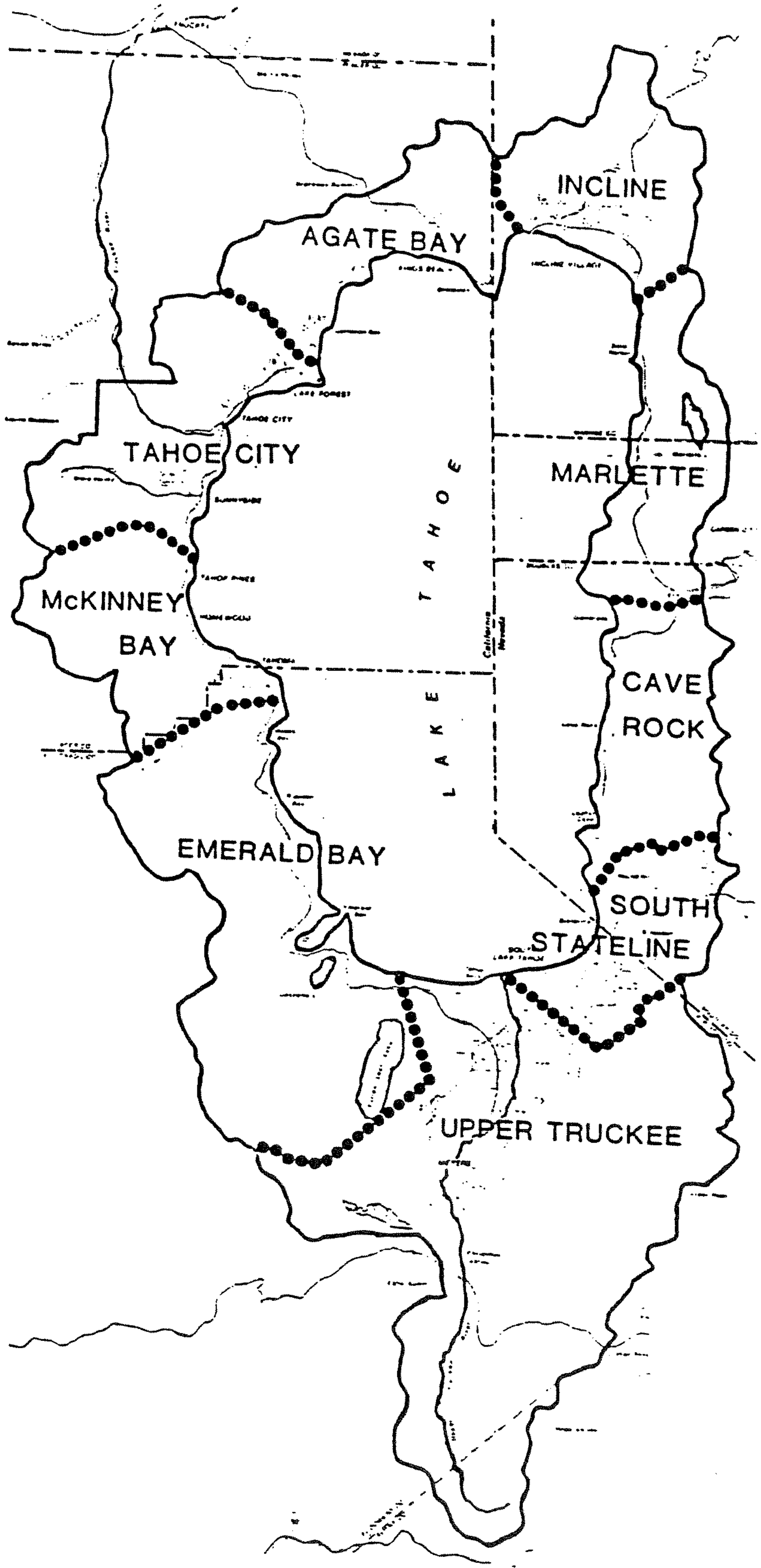


FIGURE 16 Hydrologically Related Areas

-- single-family dwellings reviewed and approved pursuant to IPES,

-- public outdoor recreation facilities if (1) necessary as part of a public agency's long range plans for public outdoor recreation, (2) consistent with the recreation element of the Regional Plan, (3) the project, by its nature, must be sited in land capability districts 1 through 3, (4) there is no feasible alternative which avoids or reduces the encroachment in districts 1 through 3, (5) the impacts are fully mitigated, and (6) capability district 1 through 3 lands are restored in an amount 1.5 times the area disturbed beyond that permitted by the Bailey coefficients, and

-- public service facilities if (1) necessary for public health, safety, or environmental protection, (2) there is no reasonable alternative which avoids or reduces the encroachment in land capability districts 1 through 3, (3) impacts are fully mitigated, and (4) district 1 through 3 lands are restored in an amount 1.5 times the area disturbed or developed beyond that permitted by the Bailey coefficients.

The 1.5:1 restoration requirement can be accomplished on-site or off-site, and is in lieu of coverage transfer or excess coverage mitigation provisions elsewhere in the Regional Plan (Goals and Policies, p. IV-14). On-site mitigation in the form of implementation of Best Management Practices is still required, however.

In making decisions regarding what types of public outdoor recreation facilities, by their nature, need or need not be sited in land capabilities districts 1, 2 and 3, TRPA shall follow the guidelines set forth in Table 16. Table 16 applies to facilities which create additional land coverage or permanent disturbance. Table 16 does not apply to facilities and activities which do not create additional land coverage or permanent disturbance by virtue of a replacement or relocation of existing coverage or disturbance.

Grading, filling, clearing of vegetation which disturbs soil, and other disturbances of soil are prohibited during inclement weather and for the resulting period of time when the site is covered with snow or in a saturated, muddy, or unstable condition. Special regulations and construction techniques will apply to construction activities occurring between October 15 and May 1. All project sites must be adequately winterized by October 15 as a condition for continued work on the site. Exceptions will be permitted in emergency situations where grading is necessary for reasons of public safety or erosion control (Goals and Policies, p. IV-15).

f. Water Quality Mitigation (regulatory)
[40 CFR 130.6(c)(4)(ii), (iii)(E) and (G)]

To ensure that both the on-site and off-site impacts of new development in the Tahoe Region are completely mitigated, TRPA shall condition approvals for new development on positive improvements in off-site erosion and runoff control in addition to provision of BMPs on-site (Goals and Policies, p. VII-16). The conditions shall require the implementation or use of remedial erosion control measures determined by TRPA to be adequate to offset or compensate for any increased erosion caused by the construction, use, or activity permitted.

Additional development shall offset its off-site water quality impacts through one of the following methods: (1) implementing and maintaining off-site erosion and runoff control projects as a condition of project approval and subject to TRPA concurrence as to effectiveness, or (2) contributing to a fund established by TRPA for implementing and maintaining off-site erosion and runoff control projects. The amount of such contribution shall be established by TRPA ordinance (Goals and Policies, p. VII-16) and will provide sufficient funding to implement those measures needed to offset the impacts of the additional development. Mitigation funds shall be used to support those activities directly related to mitigation projects. Such activities as developing community plans are not considered to be directly related to mitigation projects.

Land coverage permitted as a result of transfer of coverage; projects included in the Capital Improvements Program for Erosion and Runoff Control; and projects and activities which provide a net water quality improvement of at least 150 percent over the conditions of the project area before the project or activity are exempt from water quality mitigation requirements (Code of Ordinances, Section 82.4).

g. Transfer of Development (regulatory)
[40 CFR 130.6(c)(4)(ii), (iii) (E) and (G)]

To provide both TRPA and property owners with more flexibility to plan new development and, at the same time, mitigate existing land use and water quality problems, TRPA encourages consolidation of development through transfer of existing development, including transfer of land coverage programs (Goals and Policies, p. VII-14). There are four types of transfer programs: transfers of residential development rights; transfer of units of use; transfers of land coverage; and transfer of residential allocations.

Transfers of residential development rights are permitted from vacant parcels to parcels eligible for residential or multi-residential development. Each vacant parcel is assigned one development right which, in conjunction with a residential allocation, is required for construction of a residential unit. Multi-residential development thus requires the transfer of development rights unless bonus units are granted in relation to public benefits provided by the project, including the benefits from water quality improvements (Goals and Policies, p. VII-14). Upon transfer of a development right, sensitive parcels are not eligible for future residential development. Non-sensitive parcels are restricted from residential development unless a development right transfer back to the parcel is permitted.

Transfers of units of use may be permitted, in conjunction with TRPA approval of a project. For transfers of units of use (e.g., tourist accommodations, residential units, commercial floor area), the structures on the donor site shall be removed or modified to eliminate the transferred units. Bonus units may be granted for transferred tourist accommodation units based on public benefits provided by the project, including the benefits from water quality improvements (Goals and Policies, p. VII-14). Upon transfer of units of use, sensitive parcels are permanently restricted from receiving new development and are restored and maintained in a natural state, insofar as is possible.

Land coverage may be transferred as set forth under Limits on Impervious Coverage, above, within hydrologically-related areas (see Figure 15). The intent of the coverage transfer provisions is to allow greater flexibility in the placement of land coverage within hydrologically-related areas, utilizing land banks, lot consolidations, land coverage restoration, and transfers. The coverage transfer provisions allow for coverage in excess of base coverage to be permitted and still be consistent with the thresholds (Goals and Policies, p. II-14).

Coverage transfers for commercial and tourist accommodation projects shall be existing hard coverage (i.e., man-made structures), except where TRPA finds that there is an inadequate supply at a reasonable cost within the hydrologically- related area, in which case TRPA may increase the supply in this order of priority: (1) by allowing transfer of existing soft coverage, i.e., compacted areas without structures, (2) by allowing transfer of potential coverage, i.e., base allowed coverage, and (3) by redefining the hydrologic boundaries (Goals and Policies, p. VII-15).

Coverage transfers for residential, outdoor recreation, public service, regional public facility, and public health and safety projects may utilize either existing coverage or disturbance or potential coverage. Transfer for linear public facility projects shall have the option of transferring existing hard or soft coverage (Goals and Policies, p. VII-15).

TRPA, in conjunction with other agencies, shall establish a land coverage banking system. To the extent possible, TRPA shall utilize a land coverage banking system to facilitate the elimination of excess land coverage and to provide transfer mechanisms (Goals and Policies, p. VII-15). On February 18, 1988, TRPA and the California Tahoe Conservancy entered into a Memorandum of Understanding to establish the respective duties and authorities of the Conservancy and TRPA with respect to a land coverage bank to be operated by the Conservancy for the California side of the Tahoe Basin. TRPA will negotiate an MOU to establish a Nevada-side land bank. Private coverage transactions are also allowed in both states.

Coverage transfers are subject to the following qualifications and constraints (Goals and Policies, p. VII-15):

-- coverage transfers shall be at a ratio of 1:1 or greater,

-- coverage transferred for a single-family house shall be from a parcel equal to, or more environmentally sensitive than, the receiving parcel, and

-- in the case of parcels containing an SEZ, the amount of coverage attributable to the SEZ portion may be transferred to the non-SEZ portion or may be utilized in the SEZ pursuant to the access provisions of the SEZ policies.

In connection with a transfer of land coverage, the transferor lot shall be appropriately restricted and restored to a natural or near natural state. All transfers must be approved by the affected jurisdictions (Goals and Policies, p. VII-16).

Transfers of residential allocations are permitted from parcels located on sensitive lands to more suitable parcels. (An allocation, in addition to a residential development right, is required before any person can commence construction of an additional residential unit, except for affordable housing units as defined in the TRPA Code.) TRPA shall permit the transfer of allocations from parcels in SEZs, land capability districts 1, 2, and 3, lands determined to be sensitive under IPES, or shorezone capability districts 1 through 4, to parcels outside these areas (Goals and Policies, p. VII-16).

When an allocation is transferred, the entire donor parcel shall be permanently retired, and the transfer shall be approved by the affected jurisdictions.

5. Stream Environment Zone Encroachment

a. Restrict New Encroachment and Vegetation Alteration (regulatory)
[40 CFR 130.6(c)(4)(ii), (iii)(E) and (G); 130.6(c)(7)]

As discussed in Chapter III, Problem Assessment and Control Needs, stream environment zones (SEZs) serve many functions in the ecology of the Tahoe Region, and are very important to water quality. The Goals and Policies require that SEZs shall be protected and managed for their natural values, and that groundwater development in SEZs shall be discouraged when such development might impact associated plant communities or instream flow (Goals and Policies, pp. IV-23, 24).

In addition, no new land coverage or other permanent disturbance shall be permitted in SEZs except as follows (Goals and Policies, pp. IV-24, 25):

-- public outdoor recreation facilities if (1) necessary for a public agency's long range plans for public outdoor recreation, (2) consistent with the recreation element of the Regional Plan, (3) the project, by its nature, must be sited in an SEZ, (4) there is no feasible alternative which would reduce the extent of SEZ encroachment, (5) impacts are fully mitigated, and (6) SEZs are restored in an amount 1.5 times the area of SEZ disturbed or developed for the project,

-- public service facilities if (1) necessary for public health, safety, or environmental protection, (2) there is no reasonable alternative, including spans, which avoids or reduces the extent of encroachment, (3) the impacts are fully mitigated, (4) SEZ lands are restored in an amount 1.5 times the area of SEZ developed or disturbed by the project,

-- projects which require access across SEZs to otherwise buildable sites if (1) there is no reasonable alternative which avoids or reduces the extent of encroachment, (2) impacts are fully mitigated, (3) SEZ lands are restored in an amount 1.5 times the area of SEZ disturbed or developed by the project,

-- new development in man-modified SEZs where (1) the area no longer exhibits the characteristics of an SEZ, (2) further development will not exacerbate the problems caused by development in SEZs, (3) restoration is infeasible, and (4) mitigation is provided to at least partially offset the losses caused by modification of the SEZ, provided that only the TRPA Governing Board may designate an area man-modified where man has changed the vegetation type, made cuts, placed fill, compacted the soils, or altered the hydrology, and only upon making the required findings, and

-- SEZ restoration and erosion control projects.

In making decisions regarding what types of public outdoor recreation facilities, by their nature, need or need not be sited in SEZs, TRPA shall follow the guidelines set forth in Table 16. Table 16 applies to facilities and activities which create additional land coverage or permanent disturbance. Table 16 does not apply to facilities and activities which do not create additional land coverage or permanent disturbance by virtue of a replacement or relocation of existing coverage or disturbance.

Replacement of existing coverage in SEZs may be permitted where the project will reduce impacts on SEZs and will not impede restoration efforts. Existing structures in SEZs may be repaired or rebuilt (Goals and Policies, p. IV-25).

In response to the TRPA policy calling for updating of the procedures for SEZ identification and related hydrologic zones pursuant to the recommendations of the IPES Technical Committee (Goals and Policies, p. IV-25), TRPA has developed refined procedures for establishing SEZ boundaries. The Code of Ordinances sets forth the pertinent definitions (see Table 17) and the following procedure for identifying SEZs:

An SEZ is determined to be present if any one of the following key indicators is present or, in the absence of a key indicator, if any three of the following secondary indicators is present:

-- Key Indicators: evidence of surface water flow, including perennial, ephemeral, and intermittent streams; primary riparian vegetation; near-surface groundwater; lakes, ponds, or lagoons; beach (Be) soils; or one of the following alluvial soils: Ev and Mh.

-- Secondary Indicators: designated 100-year flood plain; groundwater between 20 and 40 inches; secondary riparian vegetation; and one of the following alluvial soils: Lo, Co, or Gr.

The boundary of an SEZ is the outermost limit of the key indicators; the outermost limit where three secondary indicators coincide; or, if Lo, Co, or Gr soils are present, the outermost limit where two secondary indicators coincide, whichever establishes the widest SEZ at any point. The outermost boundary of a stream is the bank full width of the stream. (Code, Section 37.3)

TABLE 16 Guidelines Regarding Public Outdoor Recreation Facilities and Activities Which Create Additional Land Coverage or Permanent Disturbance and Which By Their Very Nature Need Not Be Sited in Sensitive Lands (1a, 1b, 1c, 2, 3 or SEZs)

Category	Sensitive Lands: SEZs and 1b	Sensitive Lands: (Capabilities 1a, 1c, 2, 3)
Ski Areas	Any activity or facility which causes additional land coverage or permanent disturbance, except for stream crossings for ski runs provided no more than five percent of SEZ area in the ski area is affected by the stream crossings and except for facilities otherwise exempted such as utilities and erosion control facilities	Activities or facilities such as parking areas, base lodge facilities and offices, and retail shops (unless there is no feasible non-sensitive site available, the use is a necessary part of a skiing facility, and the use is pursuant to a TRPA-approved master plan), except for facilities otherwise exempted such as utilities and erosion control facilities
Campgrounds	Facilities and activities such as campsites, toilets, parking areas, maintenance facilities, offices, lodges, and entrance booths, except for facilities otherwise exempted such as pedestrian and vehicular stream crossings, utilities and erosion control facilities	Facilities and activities such as campsites, toilets, parking areas, maintenance facilities, offices, lodges, and entrance booths, except for facilities otherwise exempted such as utilities and erosion control facilities
ORV Courses	Facilities and activities such as ORV trails, staging areas, parking areas, maintenance facilities, and first aid stations, except for bridged stream crossings, and facilities otherwise exempted such as erosion control facilities	Facilities and activities such as ORV trails, staging areas, parking areas, maintenance facilities, and first aid stations (unless the ORV course is pursuant to a comprehensive TRPA-approved ORV management plan for resolving resource manage-problems associated with ORV activity), except for facilities otherwise exempted such as erosion control facilities
Golf Courses	Facilities and activities such as tees; greens; fairways and driving ranges which require mowing, vegetative disturbance or fertilizer; clubhouses; retail services; proshop; parking areas; offices; maintenance facilities; and accessory uses, except for facilities otherwise exempted such as pedestrian and vehicular stream crossings, utilities, and erosion control facilities	Facilities and activities such as tees; greens; fairways and driving ranges which require mowing, vegetative disturbance or fertilizer; clubhouses; retail services; proshop; parking areas; offices; maintenance facilities; and accessory uses, except for facilities otherwise exempted such as utilities and erosion control facilities

TRPA's official land capability maps shall be used to identify SEZs initially, but are subject to field verification in every instance. If changes are identified involving areas greater than five acres in size, the Regional Plan maps may be amended. (Code, Subsection 20.2.E) For the community planning process in designated commercial core areas, the community plan must include information of the location, amount, and condition of stream environment zones (Code, Subsection 14.6.C). TRPA shall require a team of experts to make these determinations for each community plan, as set forth in the Code, rather than relying on the TRPA land capability maps, and shall not approve any community plan or master plan, or commit significant resources to development or restoration in affected watersheds, until maps are prepared and approved which precisely identify the SEZ areas and applicable setbacks for the affected areas and contributing SEZ areas a reasonable distance upstream.

Whether an SEZ is determined to be present or not, the 100-year flood plain is still restricted from development under the TRPA Goals and Policies, which prohibit construction, grading, and filling of lands within the 100-year flood plain except as necessary to implement the Goals and Policies, and require all public utilities, transportation facilities, and other necessary public uses located in the 100-year flood plain to be constructed and maintained to prevent damage from flooding and to not cause flooding (Goals and Policies, p. II-24). Development in the 100-year flood plain shall be found to be necessary to implement the Goals and Policies only for:

(1) Public outdoor recreation facilities if: (1) the project is a necessary part of a public agency's long range plans for public outdoor recreation, (2) the project is consistent with the recreation element of the Regional Plan, (3) the project, by its very nature, must be sited in a flood plain, (4) there is no feasible alternative which would reduce the extent of encroachment in a flood plain, and (5) the impacts on the flood plain are minimized,

(2) Public service facilities if: (1) the project is necessary for public health, safety, or environmental protection, (2) there is no reasonable alternative, including spans, which avoids or reduces the extent of encroachment in a flood plain, and (3) the impacts on the flood plain are minimized,

TABLE 17 Definitions of SEZ Terminology

Alluvial Soils - All the following soil types owe their major characteristics to the presence of surface or subsurface water:

(a) Loamy alluvial land (Lo)
(b) Elmira loamy coarse sand, wet variant (Ev)
(c) Celio gravelly loamy coarse sand (Co)
(d) Marsh (Mh)
(e) Gravelly alluvial land (Gr)
(f) Fill land (Fd)

Confined - Stream types classified under major categories A and B, and stream type C2, as defined in the report entitled "A Stream Classification System", Davis L. Rosgen, April, 1985.

Designated Flood Plain - The limits of the intermediate Regional Flood where established for creeks by the U.S. Army Corps of Engineers, or the limits of the 100-year flood where established for creeks by the U.S. Army Corps of Engineers.

Ephemeral Stream - Flows sporadically only in response to precipitation, with flows lasting a short time.

Groundwater Between 20-40 Inches - Evidence of ground water between 20 and 40 inches below the ground surface (somewhat poorly drained soil).

Intermittent Stream - Flows in response to precipitation or snow melt.

Lake - A water body greater than 20 acres in size, exceeding two meters deep at low water and lacking trees, shrubs, persistent emergents, emergent mosses or lichens with greater than 20 percent aerial coverage.

Man-Made Channel - A channel constructed by man for the purpose of conveying water or a channel created by water being discharged from a man-made source, such as a culvert or pipe.

Near Surface Groundwater - Evidence of ground water within 20 inches of the ground surface (poorly drained soil).

Perennial Stream - Permanently inundated surface stream courses. Surface water flows throughout the year except in years of infrequent drought. Perennial streams shall be those shown as solid blue lines on USGS Quad Maps, or streams determined tc be perennial by TRPA.

Pond - A standing water body less than 20 acres in size and/or less than two meters deep at low water.

Primary Riparian Vegetation - The following vegetative community types as identified in the 1971 report entitled "Vegetation of the Lake Tahoe Region, A Guide for Planning:"

TABLE 17 (continued)

(a) Type 0: Open water - Open water, swamps and pools and Vernal pools.
(b) Type 2: Herbaceous - Wet marsh or meadow and Sphagnum bog.
(c) Type 7: Riparian shrub - Willow thicket and Alder thicket.
(d) Type 9: Broadleaf - Low elevations.

<u>SEZ Setbacks</u> - A strip of land adjacent to the edge of a SEZ, the designated width of which is considered the minimum width necessary to protect the integrity of the various characteristic of the SEZ. The width of the setback shall be established in accordance with the procedure set forth in Subsection 37.3.D.

<u>Secondary Riparian Vegetation</u> - The following vegetative types as identified in the 1971 report entitled "Vegetation of the Lake Tahoe Region, A Guide for Planning:"

(a) Type 2: Herbaceous - Wet mesic meadow.
(b) Type 9: Broadleaf - High elevations.
(c) Type 19: Lodgepole - Wet type.

<u>Slope Condition</u> - The condition of the slope located adjacent to the stream channel or edge of the SEZ shall be defined as follows. The extent of existing slope protection, which is defined as the percent cover of original duff layer, down logs, low growing vegetation or rock fragments greater than 1-2 inches in diameter, shall be given primary consideration when determining slope condition.

(a) Good - Slopes show little or no evidence of surface (sheet, rill, gully) erosion or mass wasting. Slopes are typically covered 90 percent or more with original duff layer, down logs, slash, low growing vegetation or rock fragments greater than 1-2 inches in diameter. Slope gradient is commonly less than 30 percent. Soil horizons are usually cohesive and consolidated.
(b) Average - Slopes show evidence of surface (sheet, rill, gully) erosion or mass wasting over 5 to 25 percent of the slope surface. Slopes are typically covered between 50 to 90 percent with original duff layer, down logs, slash, low growing vegetation or rock fragments greater than 1-2 inches in diameter. Slope gradient is commonly between 30 and 70 percent. Soil horizons are typically moderately cohesive and consolidated.
(c) Poor - Slopes show evidence of active and pronounced surface (sheet, rill, gully) erosion or mass wasting over more than 50 percent of the slope surface. Slopes are typically covered less than 50 percent with original duff layer, down logs, slash, low growing vegetation or rock fragments greater than 1-2 inches in diameter. Slope gradient is often greater than 70 percent. Soil horizons are typically non-cohesive and unconsolidated. Evidence of seeping is often present.

<u>Terrace</u> - A moderately flat land area, above the flood plain, generally less than 20 percent slope.

<u>Unconfined</u> - Stream types classified under major categories C (excluding stream type 2), D and E as defined in the report entitled "A Stream Classification System", David L. Rosgen, April 1985.

(3) Projects which require access across flood plains to otherwise buildable sites if: (1) there is no reasonable alternative which avoids or reduces the extent of encroachment in the flood plain and (2) the impacts on the flood plain are minimized, and

(4) Erosion control projects, habitat restoration projects, stream environment zone restoration projects, and similar projects provided the project is necessary for environmental protection and there is no reasonable alternative which avoids or reduces the extent of encroachment in the flood plain.

In making decisions regarding what types of public outdoor recreation facilities, by their nature, must be sited in flood plains, TRPA shall follow the guidelines set forth in Table 16. Also, the above restrictions on development within the 100-year flood plain shall not apply to the shorezone of Lake Tahoe, except where it is determined to be within the 100-year flood plain of a tributary stream. Development within the shorezone is governed by the shorezone provisions of the TRPA Code of Ordinances.

In remote locations and other locations where TRPA or the Corps of Engineers or FEMA has not yet prepared 100-year flood plain maps and TRPA has reason to believe that a flood hazard may exist, TRPA shall require project applicants to accurately delineate the 100-year flood plain in their project applications.

b. SEZ Restoration (capital improvement program, private/public)
[40 CFR 130.6(c)(4)(i), (iii)(G); 130.6(c)(7)]

The Setting, above, describes existing disturbance in SEZs within the Tahoe Region. To restore a portion of the natural treatment capacity lost from this disturbance, disturbed SEZs in undeveloped, unsubdivided lands shall be restored. In addition, 25 percent of the SEZs that have been disturbed, developed, or subdivided shall be restored (Goals and Policies, p. IV-23).

TRPA shall identify the number of acres to be restored and prepare a list of projects to achieve the threshold for SEZ restoration (Goals and Policies, p. IV-23). This restoration program is set forth in Volume III, Stream Environment Zone Protection and Restoration Program.

TRPA shall also develop an implementation program and establish an annual tracking system for SEZ restoration. The implementation program shall provide for restoration over a 20-year period (Goals and Policies, p. IV-23). Volume III of this 208 plan sets forth a more detailed schedule for refinement and implementation of the SEZ restoration program. The materials prepared by TRPA in accordance with the requirements of Chapter 32 of the Code of Ordinances provide detail on tracking of progress in SEZ restoration, and an interim target for SEZ restoration appears in Section I, Chapter VII of this volume, Plan Evaluation and Revision.

Golf courses in SEZs shall be encouraged to redesign layouts and modify fertilization to prevent the release of nutrients to adjoining ground and surface waters (Goals and Policies, p. IV-24).

c. SEZ Setbacks (regulatory)
[40 CFR 130.6(c)(4)(ii), (iii)(E) and (G); 130.6(c)(7)]

It is important to set new development back from the edge of SEZs, both to preserve the integrity of the SEZ itself, and also to preserve the important wildlife and scenic values of the edge zone created by the SEZ and the adjoining vegetation types. Buildings, other structures, and land coverage shall be set back from SEZs in accordance with Table 18, also contained in Chapter 37 of the TRPA Code as Technical Appendix I (Code, Subsection 30.5.D).

These SEZ setbacks represent a more refined system of setbacks than the buffers contained in the 1981 208 plan. The setbacks consider stream type (perennial, ephemeral, or intermittent), channel type (confined or unconfined), slope condition (good, average, poor), and situations where a channel is absent or man-made.

6. Vegetation Displacement

a. Protection of native vegetation during use and construction (regulatory)
[40 CFR 130.6(c)(4)(ii), (iii)(E) and (G)]

The Problem Assessment, above, identifies damage or displacement of vegetation and the surface duff layer as a water quality problem, and calls for controls on such activities. Permanent disturbance or unnecessary alteration of natural vegetation associated with development activities shall not exceed the approved boundaries of the building, driveway, or parking structures, or that which is necessary to reduce the risk of fire or erosion (Goals and Policies, p. IV-4).

TABLE 18 Table of SEZ Setbacks

Channel Present

- Perennial Stream
  - Confined
    - Slope Condition
      - Good: 25' from edge of SEZ or 15' from edge of terrace, whichever is less.
      - Average: 35' from edge of SEZ or 20' from edge of terrace, whichever is less.
      - Poor: 60' from edge of SEZ or 35' from edge of terrace, whichever is less.
  - Unconfined: 50' from edge of SEZ
- Ephemeral or Intermittant Stream
  - Confined
    - Slope Condition
      - Good: 15' from edge of SEZ or 10' from edge of terrace, whichever is less.
      - Average: 25' from edge of SEZ or 15' from edge of terrace, whichever is less.
      - Poor: 40' from edge of SEZ or 25' from edge of terrace, whichever is less.
  - Unconfined: 25' from edge of SEZ

Channel Absent

- 10' from Edge of SEZ

Man-Made Channels

- 10' from edge of channel or primary riparian vegetation, whichever is greater

Disturbance or removal of forest litter and the natural duff layer should also be avoided to promote the natural catchment of nutrients. A public awareness program will be implemented to inform local landowners of the value of needle litter (Goals and Policies, p. IV-5).

b. Use of native and adapted plants for revegetation (voluntary/regulatory) [40 CFR 130.6(c)(4)(i), (ii), (iii)(E) and (G)]

Revegetation of disturbed sites requires the use of species approved by TRPA. TRPA shall prepare specific policies designed to avoid the unnecessary use of landscaping which requires long-term irrigation and fertilizer use (Goals and Policies, p. IV-5). A list of approved species has been prepared, and is part of Volume II, the BMP Handbook.

c. Restoration of areas of disturbed vegetation (voluntary/regulatory/remedial) [40 CFR 130.6(c)(4)(i), (ii), (iii)(E) and (G)]

In addition to the program of SEZ restoration described above, restoration of areas which have been denuded of vegetation, or where vegetation has been badly disturbed or altered, is considered a Best Management Practice, and is subject to the implementation programs for BMPs described in this part. All persons who own land and all public agencies which manage public lands in the Region shall protect vegetation from damage, and restore the disturbed soils. This restoration of disturbed areas will have a positive impact on water quality (Goals and Policies, pp. II-41, 42).

TRPA's goal is to restore at least 80 percent of the disturbed lands within the Region to a natural or near-natural state by the application of BMPs (Goals and Policies, p. II-42). Riparian plant communities shall be restored or expanded whenever and wherever possible (Goals and Policies, p. IV-6).

Where TRPA has identified specific problems associated with the loss or alteration of vegetation, TRPA may require remedial actions to correct those problems under the provisions of Chapter 9 of the Code.

7. Fertilizer

a. Best Management Practices regarding the amounts, methods, rates, types, and locations of fertilizer application (voluntary/regulatory/remedial) [40 CFR 130.6(c)(4)(i), (ii), (iii)(C), (E) and (G); 130.6(c)(9)]

To help control water quality problems caused by the use of fertilizer, the use of fertilizer within the Tahoe Region shall be restricted to uses, areas, and practices identified in the BMP Handbook (Goals and Policies, p. II-43).

Revegetation of disturbed sites requires the use of species approved by the TRPA. A list of approved species is included in the BMP Handbook. TRPA shall prepare specific policies designed to avoid the unnecessary use of landscaping which requires long-term fertilizer use (Goals and Policies, p. IV-5).

According to the TRPA Code, projects that include landscaping or revegetation shall, as a condition of approval, be required to prepare fertilizer management programs that address: (1) the appropriate type of fertilizer to avoid the release of excess nutrients, (2) the rate of application, (3) the frequency of application, (4) appropriate watering schedules, (5) preferred plant materials, (6) landscape design that minimizes the use and impacts of fertilizer application, (7) critical areas, (8) the design and maintenance of drainage control systems, and (9) surface water and groundwater monitoring programs, where appropriate. (Code, Subsection 81.7.B).

Because of the large number of potential sites where property owners or managers may wish to apply fertilizer, and the ready availability of fertilizer from commercial outlets, public education is a very important aspect of the implementation program for fertilizer management BMPs. TRPA shall emphasize fertilizer management in its public education program, and shall make educational materials such as the Guide to Fertilizer Use in the Lake Tahoe Basin (TRPA, 1987) available to the widest possible audience.

b. Reporting requirements (regulatory)
[40 CFR 130.6(c)(4)(ii), (iii)(C) and (G); 130.6(c)(9)]

At the request of TRPA, uses that require regular fertilizer maintenance (e.g., golf courses, parks, cemeteries, ball fields, and residential yards) are required to submit fertilizer management programs for review and approval by TRPA. Failure to comply may result in remedial action under Chapter 9 of the TRPA Code. Large users of fertilizer, as identified by TRPA, shall initiate a tracking program to monitor fertilizer use on lands under their control. Such users shall present annual reports to TRPA, including information on the rate, amount, and location of use (Code, Subsection 81.7.C).

c. Effluent Limitations and Discharge Permits (regulatory)
[40 CFR 130.6(c)(2); 130.6(c)(4)(ii), (iii)(C) and (G); 130.6(c)(9)]

California and Nevada have set effluent limitations and issued discharge permits under their statewide authorities to prevent the discharge, or threatened discharge, of nutrients from fertilizer to the surface waters or groundwaters of the Tahoe Region, and shall continue to issue and administer effluent limitations in accordance with the Clean Water Act and, in California, the Porter-Cologne Act.

In September, 1987, the Lahontan Board issued notices of intent to issue Waste Discharge Requirements to California-side golf courses in the Region. These WDRs will implement policies to prevent wastes, such as nutrients contained in fertilizers, pesticides, herbicides, and products of erosion from entering surface waters of Lake Tahoe. The WDRs will also require BMPs for surface runoff from parking lots, rooftops, and other impervious areas. The requirements will allow a reasonable period of time for golf course operators to achieve compliance with specified control measures, although the Lahontan Board will require installation of temporary BMPs to control existing erosion problems (CRWQCB, 1987).

TRPA considers golf courses a high priority for retrofitting with BMPs because of their potential for significant water quality impacts from application of fertilizer. The states are encouraged to issue WDRs or NPDES permits to those facilities. If, following TRPA's comprehensive review of progress under the 208 plan in 1991, golf courses have not established retrofitting schedules, TRPA, in cooperation with the states, will require such schedules to be established.

B. AIRBORNE NUTRIENTS

1. Improved mass transit (capital improvements program) [40 CFR 130.6(c)(4)(i)]

Mass transit is an important tool for reducing regional vehicle-miles-travelled (VMT) and NOx emissions, thereby reducing direct deposition of nitrogen on Lake Tahoe from local sources of air pollution. Under both the Tahoe Regional Planning Compact and California state law, TRPA is the designated transportation planning entity for the Tahoe Region. TRPA's Regional Transportation Plan (TRPA, 1988c) includes, as a goal, the expansion of private and public transit service.

During the first five-year phase of the Regional Transportation Plan, public transit service shall be expanded consistent with the Short Range Transit Program (Tahoe Transportation District, 1986). This program calls for the establishment of intensive transit shuttle service along the heavily-travelled U.S. 50 corridor on the South Shore.

TRPA shall assist the Tahoe Transportation District and units of local government in securing funding sources for transit improvements, and TRPA shall distribute California Transportation Development Act funds to support transit service consistent with the Regional Transportation Plan and Short Range Transit Program.

TRPA shall also encourage transit improvements as follows: (1) expansion of private sector transportation services where consistent with the Short Range Transit Program, (2) shuttle services to the Lake Tahoe Airport for all scheduled commercial carriers, (3) expansion of transit service to the seasonal recreational areas within or near the Tahoe Region, and (4) implementation of transit service from Truckee, Northstar, Carson City, and the Minden-Gardnerville area to activity centers in the Tahoe Region (TRPA, 1988c).

Community and redevelopment plans shall make specific recommendations for locating mass transit and waterborne transit terminals and transfer points within their boundaries (TRPA, 1988c).

In the long-run, TRPA shall complete several evaluations of mass transit improvements which may assist in reducing dependency upon private automobiles in the Region, including a light rail or equivalent system along the U.S. 50 corridor in the South Shore and construction of multi-modal transportation terminals.

To support these anticipated mass transit improvements, TRPA shall also encourage major employers to provide incentives to increase automobile occupancies through car-pooling or van-pooling; require all new development to mitigate fully its transportation and air quality impacts; work with transit providers to increase transit ridership during peak travel demand periods; assist in the location of park-and-ride lots; and encourage the use of alternative fuels in fleet vehicles (TRPA, 1988c).

2. Redevelopment and Redirection of Land Use (voluntary) [40 CFR 130.6(c)(4)(i)]

TRPA's Regional Plan gives a high priority to correcting past deficiencies in land use (Goals and Policies, p. II-2). The redirection of development designation in the Plan Area Statements is designed to improve environmental quality and community character by changing the direction of development through relocation of facilities, rehabilitation, or restoration of existing structures and uses, while limiting new development. Another purpose of this designation is to improve the efficiency of transportation systems, thereby reducing the emissions of airborne nutrients (Goals and Policies, p. II-4).

Redevelopment shall be encouraged in areas designated for redirection to improve environmental quality, community character, and the efficiency of transportation systems. Redevelopment incentives, such as additional building height, may be obtained by providing larger reductions in travel demand than otherwise required (Goals and Policies, p. II-12).

3. Combustion heater rules, stationary source controls, and related rules (regulatory) [40 CFR 130.6(c)(4)(ii)]

To help reduce emissions of nutrients to the air which may be deposited in Lake Tahoe, TRPA will impose a number of controls on potential sources of air pollution. TRPA shall restrict the types of space heaters and hot water heaters used in the Region and establish, by ordinance, emission limitations to reduce NOx emissions. Alternatives to diesel fuels which result in lower NOx emissions should be used in the Region, where practical, and idling of diesel engines should also be regulated (Goals and Policies, p. II-31).

TRPA shall reduce atmospheric loading of nitrogen oxides by controlling stationary sources. TRPA should encourage the installation of emission control technology where feasible (Goals and Policies, p. II-32).

TRPA shall also improve the health of vegetation in the Region, restrict disturbance of vegetation, soils and the surface duff layer, require paving of unpaved roads and parking areas, and restrict use of off-road vehicles to control suspension of nutrient-laden dust in the atmosphere (Goals and Policies, p. II-33).

4. Transfer of development (voluntary) [40 CFR 130.6(c)(4)(i)]

As stated above, one of the purposes of transfer of development programs is to consolidate development in the most suitable areas, designated in the Plan Area Statements. Consolidation of development through transfer will help to reduce vehicle trip generation in the Tahoe Region and, therefore, help reduce emissions of nitrogen oxides and other airborne nutrients.

5. Program to Reduce Transport of Airborne Nutrients from Upwind Areas (non-regulatory) [40 CFR 130.6(c)(4)(i)]

Through the Legislation Committee of the TRPA Governing Board, TRPA will work with lawmakers in California to encourage additional research into the generation and transport of nitrogen compounds, to require regular reports on the subject from the CARB, and to provide incentives or disincentives to control known sources of NOx emissions upwind from the Tahoe Region. TRPA shall actively participate in the review and comment on draft air quality control plans from upwind areas to encourage additional NOx control measures. TRPA will also design and implement a monitoring program or project to further examine the nature and extent of transport of airborne nutrients into the Tahoe Region, no later than July 1, 1991.

C. WASTE MANAGEMENT

1. Sewage collection and treatment

a. Elimination of accidental releases (regulatory/CIP/voluntary) [40 CFR 130.6(c)(3)]

As discussed in the problem assessment, above, control of wastewater discharges has been a high priority in the Tahoe Region since the late 1960's. The discharge of municipal or industrial wastewaters to Lake Tahoe, its tributaries, or the groundwaters of the Tahoe Region is prohibited, except for existing development operating under approved plans for wastewater disposal (Goals and Policies, p. II-41). Sewage collection, conveyance, and treatment districts shall have approved spill contingency, prevention, and detection plans (Goals and Policies, p. II-43).

Since one of the possible causes of accidental releases of sewage is the lack of adequate capacity for sewage collection and treatment, any collection or treatment district whose facilities reach 85 percent of their design capacity shall prepare and submit a report to TRPA identifying what measures, if any, will be needed to accommodate projected population increases consistent with the Regional Plan, and otherwise prevent spills due to inadequate capacity.

b. Reduction of sewer line exfiltration (regulatory/CIP/voluntary) [40 CFR 130.6(c)(3)]

The discharge prohibitions and related policies, above, apply to sewer line exfiltration also. All agencies which collect or transport sewage should have plans for detecting and correcting exfiltration problems (Goals and Policies, p. II-44), and shall be required to vigorously implement such plans as a condition of TRPA project approvals.

c. Effluent Limitations and Discharge Permits (regulatory) [40 CFR 130.6(c)(3)]

As discussed above in relation to discharges of stormwater runoff, state agencies shall also set effluent limitations and issue discharge permits under their existing authorities to entities collecting and treating wastewaters. Effluent limitations shall be consistent, to the extent feasible, with the provisions of the 208 plan. In accordance with the Goals and Policies, sewage conveyance and treatment facilities should be allowed to expand to support existing and new development consistent with the Regional Plan (Goals and Policies, p. VI-1). Expansions of public service facilities shall be sized appropriately to meet the needs of the Region and to avoid inefficiencies caused by over-expansion or under-expansion. TRPA shall interpret "consistent with the Regional Plan" with reference to the population projections in Tables 21 and 30 and the acknowledged limitations of those projections as set forth on page 188.

All the existing sewage collection and treatment agencies in the Tahoe Region are currently covered by NPDES permits or waste discharge requirements (WDRs).

d. Wastewater disposal at sites not connected to sewers (regulatory) [40 CFR 130.6(c)(3); 130.6(c)(4)(ii)]

The discharge prohibitions stated above apply equally to dischargers in urban areas and rural or remote sites. However, under the TRPA Code, holding tanks or other no-discharge systems may be approved as a temporary measure associated with a temporary use, or as a permanent measure associated with remote public or private recreation sites where connection to a sewer system in not feasible or would create excessive adverse environmental impacts (Code, Subsection 81.2.3).

2. Solid Wastes

a. Prohibition on disposal of solid wastes in the Tahoe Region (regulatory) [40 CFR 130.6(c)(4)(ii), (iii)(B)]

To control potential water quality problems resulting from solid waste disposal, no person shall discharge solid wastes in the Tahoe Region by depositing them in or on the land, except as provided by TRPA ordinance. Existing state policies and laws will continue to govern solid waste disposal in the Tahoe Region (Goals and Policies, p. II-45). Local units of government, as well as land managers such as the U.S. Forest Service, shall police their areas of jurisdiction to control uncontrolled dumping of solid wastes to the maximum extent feasible.

b. Mandatory garbage pickup (regulatory) [40 CFR 130.6(c)(4)(ii), (iii)(B)]

Garbage pick-up service shall be mandatory throughout the Tahoe Region, and will be so structured as to encourage clean-ups and recycling. Waste disposal programs should be reviewed by local governments to provide incentives and remove disincentives for clean-up programs, composting, and recycling (Goals and Policies, p. VI-3).

3. Hazardous Spills and Hazardous Waste Management (voluntary/regulatory)
[40 CFR 130.6(c)(4)(i), (ii), (iii)(B), (E) and (G); 130.6(c)(9)]

TRPA shall cooperate with other agencies with jurisdiction in the Tahoe Region on the preparation, evaluation, and implementation of toxic and hazardous spill control plans covering Lake Tahoe and its tributaries, the groundwaters of the Tahoe Region, and the lands of the Tahoe Region. TRPA will cooperate with the Forest Service, EPA, the Coast Guard, state water quality and health agencies, and local units of government to develop programs to prevent toxic and hazardous spills and to formulate plans for responding to spills that may occur.

Underground storage tanks for sewage, fuel, or other potentially harmful substances shall meet standards set forth in TRPA ordinances and shall be installed, maintained, and monitored in accordance with the BMP Handbook (Goals and Policies, pp. II-44, 45). The BMP Handbook has been revised to address underground storage tanks.

All persons handling, transporting, using, or storing toxic or hazardous substances shall comply with the applicable requirements of state and federal law regarding waste management, spill prevention, reporting, recovery, and clean-up (Code, Section 81.5). In California, local governments are developing hazardous waste management plans. TRPA will participate on technical advisory committees, review and comment on management plans, and implement hazardous material control measures through the project review process, as appropriate, upon receiving requests to do so from local or state units of government.

During the periodic reviews of progress under the Regional Plan, and not later than September 1991, TRPA will determine the extent to which hazardous waste management plans and spill control plans are complete and, if they are lacking, take steps to cause the states, local governments, or other responsibe entities to provide them.

4. Snow and Ice Control

a. Best management practices (BMPs) (voluntary/regulatory/remedial)
[40 CFR 130.6(c)(4)(i), (ii), (iii)(G)]

As discussed in the Problem Assessment, management practices for snow and ice controls are needed to protect water quality, since snow disposal and deicing agents may add nutrients and other chemicals to runoff waters and cause damage to vegetation. Therefore, all persons engaged in public snow disposal operations in the Tahoe Region shall dispose of snow in accordance with the management standards in the BMP Handbook (Goals and Policies, p.

II-44). The BMP Handbook has been revised to address snow disposal practices.

In addition, removal of snow from individual parcels shall be limited to structures, paved areas, and unpaved areas necessary for parking or providing safe pedestrian access. Snow removal from dirt roads is subject to TRPA regulation under Chapter 9. When TRPA approves snow removal from a dirt road, pursuant to a project approval or in accordance with the provisions of Chapter 9, it shall specify required winterization practices, BMPs, the specific means of snow removal, and a schedule for either paving the dirt road or ceasing snow removal (Code, Section 81.3).

With respect to road salt, the storage of road salt shall be in accordance with the BMP Handbook (Goals and Policies, p. II-44), which has been revised to address both application and storage of road salt.

The use of deicing salt and abrasives may be restricted where damage to vegetation in specific areas may be linked to their use, or where their use would result in a violation of water quality standards. Mitigation for the use of road salt or abrasives may be required, and may include requirements to use alternative substances or change distribution patterns, frequency of application, and amount of application. Revegetation of parcels may be required where there is evidence that deicing salts or abrasives have caused vegetation mortality. TRPA may enter into MOUs with highway and street maintenance organizations to address the use of salts or abrasives in relation to safety requirements (Code, Subsection 81.4.C).

b. Reporting requirements regarding abrasives and deicers (regulatory) [40 CFR 130.6(c)(4)(ii), (iii)(G)]

All institutional users of road salt in the Tahoe Region shall keep records showing the time, rate, and location of salt application (Goals and Policies, p. II-44). State highway departments and other major users of salt and abrasives, as identified by TRPA, shall initiate a tracking program to monitor the use of deicing salt in their jurisdictions. Annual reports shall be presented to TRPA and shall include information on the rate, amount, and distribution of use (Code, Subsection 81.4.B).

D. NATURAL AREA MANAGEMENT

1. Timber Harvest

a. Best Management Practices (BMPs) regarding roads, skidding, and logging practices (regulatory/remedial) [40 CFR 130.6(c)(4)(ii), (iii)(C)]

Although timber harvesting generally does not take place in urbanized or developed areas of the Tahoe Region, it is still subject to TRPA policies which require the application of best management practices for erosion and runoff control. TRPA approval of timber harvesting shall require application of BMPs to the project area as a condition of approval (Goals and Policies, p. II-42). Application of BMPs is site-specific. The Handbook of Best Management Practices identifies the various practices which may apply.

All logging roads and skid trails shall be constructed and maintained in accordance with the TRPA Code and BMP Handbook, and BMPs shall be installed on all skid trails, landings, and roads prior to seasonal shutdown. Design, grade, tree felling in the right-of-way, slash cleanup, width, maintenance, and type of roads and trails shall meet TRPA standards, as shall cross-drain spacing (Code, Subsection 71.3.D).

In addition, the TRPA Code sets requirements for timber harvesting. In cases of substantial tree removal, the applicant is required to submit a harvest plan or tree removal plan prepared by a qualified forester. The plan shall set forth prescriptions for tree removal, water quality protection, vegetation protection, reforestation, and other considerations, and shall become part of the project's conditions of approval (Code, Subsection 71.2.B).

Management techniques for tree removal shall be consistent with the objectives of SEZ restoration, protection of sensitive lands, minimization of new road construction, revegetation of existing temporary roads, minimization of SEZ disturbance, and provisions for revegetation (Code, Subsection 71.3.A).

Sufficient trees shall be reserved and left uncut to meet minimum acceptable stocking standards, except where patch cutting is necessary for regeneration harvest or early successional stage management. Patch cuts shall be limited in size to less than five acres (Code, Subsection 71.3.B).

Tree cutting within SEZs may be permitted to allow for early successional stage vegetation management, sanitation cuts, and fish and wildlife habitat improvement, provided that:

-- all vehicles shall be restricted to areas outside the SEZ or to existing roads within SEZs, except for over-snow tree removal,

-- work within SEZs shall be limited to times of year when soils are dry and stable or when snow depth is adequate for over-snow removal,

-- felled trees and harvest debris shall be kept out of all perennial or intermittent streams,

-- crossing of perennial streams or other wet areas shall be limited to improved crossings in accordance with the BMP Handbook or to temporary bridge spans that can be removed upon project completion or the end of the work season, whichever is sooner, and damage to the SEZ associated with a temporary crossing shall be restored within one year of removal, and

-- special conditions shall be placed on tree harvest within SEZs or edge zones adjoining SEZs, as necessary to protect instream values and habitat (Code, Subsection 71.3.C).

Tree removal methods within the various land capability districts shall be limited to the methods shown in Table 19 (Code, Subsection 71.3.E). Skidding over snow is preferred to ground skidding, and shall be limited to appropriate snow conditions and equipment (Code, Subsection 71.3.F).

b. Land use planning and controls on timber harvesting (regulatory)
[40 CFR 130.6(c)(4)(ii), (iii)(C)]

Reforestation, regeneration harvest, sanitation salvage cut, selection cut, special cut, thinning, timber stand improvement, tree farms, early successional stage vegetation management, structural wildlife habitat management, fire detection and suppression, fuels treatment and management, insect and disease suppression, and prescribed fire management are primary resource management uses and are permissible as set forth in the TRPA Plan Area Statements (Code, Chapter 18).

2. Outdoor Recreation

a. Land use planning and controls (regulatory)
[40 CFR 130.6(c)(4)(ii), (iii)(G)]

Beach recreation, boat launching facilities, cross-country skiing courses, developed campgrounds, golf courses, group facilities, off-road vehicle courses, outdoor recreation concessions, marinas, RV parks, riding and hiking trails, rural sports, skiing facilities, snow mobile courses, undeveloped campgrounds, and

TABLE 19 Tree Removal Methods

Removal Methods: Only the following tree removal methods shall be used on lands located with the land capability districts shown:

Land Capability District	Removal Method
1a, 1c, or 2	Aerial removal, hand carry, and use of existing roads, in conformance with the Code of Ordinances. Over-snow removal may be approved.
1b (stream environment zones)	As permitted in Land Capability District 1a. End lining may be approved when site conditions are dry enough and suitable so as to avoid adverse impacts to the soil and vegetation.
3	As permitted in Land Capability District 1b. Ground Skidding pursuant to the Code of Ordinances may be approved.
4, 5, 6 and 7	As permitted in Land Capability District 1b. Ground skidding, as well as pickup and removal by conventional construction equipment, may be approved.

visitor information centers are primary recreational uses and are permissible uses as set forth in the Plan Area Statements (Code, Chapter 18).

Expansion of existing ski facilities may be permitted based on a master plan for the entire ski area. The master plan must demonstrate: (1) consistency with the Regional Plan and the Compact, (2) consistency with the availability of accommodations and infrastructure, and (3) that expansion of existing parking facilities for day use does not occur (Goals and Policies, p. V-7).

New campground facilities shall be located in areas of suitable land capability and in proximity to the necessary infrastructure. Existing recreation facilities in sensitive areas shall be encouraged, through incentives, to relocate to higher capability lands, except for those facilities that are slope-dependent, such as downhill skiing. Development of day-use facilities shall be encouraged in or near established urban areas, wherever practical (Goals and Policies, p. V-6).

Off-road vehicle use is prohibited in the Tahoe Region except on specified roads, trails, or designated areas where the impacts can be mitigated. This policy prohibits the use of motorized vehicles in areas other than those designated. Areas for this form of recreation shall be determined by TRPA in cooperation with ORV clubs, the USFS, and state and local governments. Continued use of designated areas will depend on compliance with this policy and the ability to mitigate impacts (Goals and Policies, p. V-3).

b. Temporary and permanent BMPs (regulatory, voluntary, remedial) [40 CFR 130.6(c)(4)(i), (ii), (iii)(E) and (G)]

Outdoor recreational uses are subject to the BMP requirements of the Regional Plan. The necessary BMPs are set forth in the BMP Handbook. New projects on undeveloped parcels shall require application of BMPs as a condition of project approval. Projects which expand structures or land coverage shall require application of BMPs to those areas affected by the project, and the balance of the project area shall be treated as a rehabilitation. Rehabilitation projects shall require the preparation of a plan and a schedule for retrofit of BMPs to the entire project area. The amount of retrofit work required at the time of project approval shall be based on the cost and nature of the project (Goals and Policies, p. II-42).

Where owners or operators of outdoor recreational facilities have no cause to apply for a TRPA permit, implementation of BMPs shall rely on voluntary compliance efforts (Goals and Policies, p. II-42). However, where TRPA identifies water quality problems associated with a specific outdoor recreation facility, TRPA may request or require an action plan to resolve the problems (Code, Chapter 9).

Owners or operators of lands with existing ORV roads and trails which are not in compliance with the BMP Handbook shall be required to apply BMPs as a condition of approval for any project. As with other uses which require application of BMPs, rehabilitation projects shall require the preparation of a plan and schedule for retrofit of BMPs to the entire project area. The amount of retrofit work required at the time of project approval shall be based on the cost and nature of the project (Goals and Policies, p. II-42).

c. Control of encroachment and land coverage in sensitive areas (regulatory/remedial) [40 CFR 130.6(c)(4)(ii), (iii)(E) and (G)]

As discussed, above, under limitations on land coverage and SEZ protection practices, public outdoor recreation facilities may encroach into land capability districts 1, 2, and 3 and into SEZs, provided TRPA makes certain required findings, designed to protect water quality and ensure provision of mitigation and attainment of water quality standards and thresholds. For information on what types of outdoor recreation facilities may qualify for the required finding that, by their nature, they must be sited in sensitive lands, see Table 16.

Land coverage for recreation projects outside community plan areas is limited to the Bailey coefficients, without the availability of excess coverage by transfer. Within community plan areas, such projects may be allowed 50 percent land coverage by transfer.

d. Effluent Limitations (regulatory) [40 CFR 130.6(c)(2); 130.6(c)(4)(ii)]

TRPA considers golf courses and ski areas high priorities for retrofitting with BMPs because of their potential for significant water quality impacts from runoff. The states are encouraged to issue WDRs or NPDES permits to those facilities. If, following TRPA's comprehensive review of progress under the 208 plan in 1991, facilities in those categories have not established retrofitting schedules, TRPA, in cooperation with the states, will require such schedules to be established.

3. Livestock Confinement and Grazing

a. Best management practices (voluntary/regulatory/remedial) [40 CFR 130.6(c)(4)(i), (ii), (iii)(C)]

The application of BMPs is required for owners and operators of livestock confinement (generally corrals) and grazing uses (i.e., utilization of natural forage as subsistence for livestock), as it is required for all lands in the Tahoe Region. The implementation program is as described above for Outdoor Recreation. TRPA shall review the grazing BMPs of TRPA and the U.S. Forest Service and, if appropriate, revise or refine the grazing BMPs, in cooperation with affected segments of the public, within one year of the date of EPA adoption of these 208 plan amendments.

In addition, grazing pursuant to TRPA approval shall comply with the following standards (Code, Section 73.2):

- -- grazing is limited to June 15 through September 15, or as indicated in the approval,
- -- livestock shall be allowed onsite only when soil is firm enough to prevent damage to soil and vegetation,
- -- the grazing level shall not exceed the carrying capacity of the range,
- -- livestock use shall not conflict with the attainment of water quality standards,
- -- new livestock confinement facilities shall be developed in conformance with the BMP Handbook, and
- -- livestock shall be excluded from banks of streams where soil erosion or water quality problems exist.

Existing livestock confinement facilities not in conformance with the BMP Handbook shall be brought into conformance by July 1, 1992 (Code, Section 73.3). Also, note that the SEZ restoration program in Volume III of this plan includes several projects which involve the reduction or elimination of grazing impacts upon SEZs.

b. Land use planning and controls (regulatory) [40 CFR 130.6(c)(4)(ii), (iii)(C)]

Farm and ranch structures, grazing, range pasture management, and range improvement are primary resource management uses and are permissible as set forth in the Plan Area Statements (Code, Chapter 18). TRPA approval shall be required for any new livestock grazing or confinement project involving ten or more head of stock, expansion of existing activity outside the current range, or an increase in historical levels of ten or more head at one time (Code, Section 73.1).

An applicant for a grazing permit shall submit a grazing management plan prepared by a qualified range consultant. The grazing plan shall include pertinent information and a certification by the range consultant that the plan complies with the TRPA Code (Code, Section 73.4).

4. Pesticides

a. Best management practices (voluntary/regulatory/remedial) [40 CFR 130.6(c)(4)(i), (ii), (iii)(C) and (G)]

The use of insecticides, fungicides, and herbicides shall be consistent with the BMP Handbook. TRPA shall discourage pesticide use for pest management. Prior to applying any pesticide, potential users shall consider integrated pest management (IPM) practices, including alternatives to chemical applications, management of forest resources in a manner less conducive to pests, and reduced reliance on potentially hazardous chemicals (Code, Section 81.6).

The program of BMP implementation is as described in this Chapter, and consists of voluntary, regulatory, and remedial aspects.

b. Substance and operator certification (regulatory) [40 CFR 130.6(c)(4)(ii), (iii)(C) and (G)]

Only chemicals registered with EPA and the state agency of appropriate jurisdiction shall be used for pest control, and then only for their registered application. No detectable concentration of any pesticide shall be allowed to enter any SEZ unless TRPA finds that the application is necessary to attain or maintain the thresholds (Code, Subsection 81.6.A). Pesticide storage and use must be consistent with California and Nevada water quality standards, as set forth in Attachment 2, and TRPA thresholds.

E. WATER QUALITY PROBLEMS IN LAKE TAHOE AND THE SHOREZONE

1. Shoreline Erosion

a. Restrictions on shorezone encroachment and vegetation alteration (regulatory) [40 CFR 130.6(c)(4)(ii), (iii)(E); 130.6(c)(7)]

Because the shorezone represents the potential for immediate discharges of runoff water and eroded materials to Lake Tahoe and the other lakes of the Region, various policies shall be enforced to protect the values of the shorezone. All vegetation at the interface between the backshore and foreshore zones shall remain undisturbed unless disturbance is permitted for uses otherwise consistent with the shorezone policies. The interface includes backshore cliffs and other unstable lands influenced by littoral or wave processes (Goals and Policies, p. IV-16).

The use of lawns or ornamental vegetation in the shorezone shall be discouraged. Plant species approved by TRPA shall be selected when revegetating disturbed sites (Goals and Policies, p. IV-16).

There are eight shorezone tolerance districts identified along the shoreline of Lake Tahoe, Fallen Leaf Lake, and Cascade Lake. These districts are depicted on TRPA Shorezone Tolerance District and Land Capability Overlay maps (Code, Section 53.2).

Shorezone Tolerance District 1, beaches that form a low sandy barrier separating the Lake from marshes and wetlands, are ecological fragile. Access to the shoreline shall be restricted to planned footpaths which minimize the impact to the backshore; vegetation shall not be manipulated or otherwise disturbed except for permitted public outdoor recreation, public service, erosion control, or access to structures or uses in the nearshore or foreshore; no drainage of backshore wetlands is permitted; and new development shall be regulated as for SEZs (Code, Section 53.6).

Shorezone Tolerance Districts 2 and 3, shorezones with slopes over 30 percent, have potentially unstable shorezone cliffs. Permitted development or use may be conditioned upon installation of vegetation to stabilize backshore areas; projects shall not be permitted if they are likely to accelerate or initiate backshore erosion; and access to the shorezone is restricted to stabilized access ways (Code, Section 53.7).

Shorezone Tolerance Districts 4 and 5 have a low to moderate potential for erosion. Permitted development or use may be conditioned upon installation of vegetation to stabilize backshore areas; projects shall not be permitted in the backshore if the project requires mechanical stabilization of the backshore; access to the shoreline is restricted to stabilized access ways; and access to buoys, piers, floating platforms, and boat ramps shall cause the least possible harm to the backshore (Code, Section 53.8).

Shorezone Tolerance Districts 6, 7, and 8 generally have a low potential for erosion. Vehicular access to the shoreline is not permitted where it will cause environmental harm, and boat launching facilities shall be located where the nearshore shelf is sufficiently wide to allow construction without significant erosion (Code, Section 53.9)

TRPA shall regulate the placement of new piers, buoys, and other structures in the foreshore and nearshore to avoid degradation of fish habitat, interference with littoral drift, and other concerns. TRPA shall regulate the maintenance, repair, and modification of piers and other structures in the nearshore and foreshore (Goals and Policies, p. IV-18).

Finally, construction activity should be set back to ensure no disturbance of the interface between high capability backshore and cliff areas. Retention of a natural buffer to minimize impacts of backshore development is preferred over engineering solutions to backshore instability (Goals and Policies, p. IV-16). Construction of man-made lagoons connected to any lake in the Region, not including existing marinas and modifications thereto, and construction of artificial islands, are prohibited (Code of Ordinances, Subsection 54.15).

b. Best management practices (voluntary/regulatory/remedial) [40 CFR 130.6(c)(4)(i), (ii), (iii)(E); 130.6(c)(7)]

The requirements for application of BMPs to public and private lands in the Tahoe Region apply to shorezone areas as they apply to all other areas. The program of BMP implementation is the same in the shorezone as it is in other areas, and involves voluntary, regulatory, and remedial aspects.

The BMP Handbook has been amended to include special construction techniques and development criteria applicable to projects in the shorezone. Proper construction techniques and other measures will be required to mitigate activities in the shorezone and protect the natural values of the shorezone (Goals and Policies, p. II-45).

c. Protection of stream deltas (regulatory/remedial) [40 CFR 130.6(c)(4)(ii), (iii)(E); 130.6(c)(7)]

The protection of stream deltas is important to the stability of the shoreline of lakes in the Region, as described in Chapter II. Stream deltas shall be protected from encroachment and disturbance as described under the SEZ Protection provisions, above.

2. Vessels and Related Facilities

a. Marina master plans (voluntary/regulatory) [40 CFR 130.6(c)(4)(i), (ii), (iii)(E) and (G)]

Because marinas are intensive shorezone uses which have the potential to cause immediate water quality problems during construction and operations, planning for marinas is appropriate to protect water quality. Expansion of a marina shall be limited to no more than ten new boat slips and ten new buoys from the effective date of the Regional Plan until TRPA adopts a master plan for the marina (Code, Section 16.1).

Each master plan shall include, at a minimum, a physical plan, operational plan, mitigation program, and monitoring program. The mitigation program shall describe all mitigation measures incorporated into the plan, including erosion and runoff controls, revegetation and restoration, mitigation of shorezone impacts, construction schedules, maintenance programs, and implementation schedules (Code, Section 16.8). TRPA shall prepare and adopt marina master plan guidelines no later than six months from the date of EPA approval of the 208 plan amendments.

b. Additional pump-out facilities (voluntary/regulatory/remedial) [40 CFR 130.6(c)(2); 130.6(c)(4)(i), (ii)]

Liquid or solid wastes from boats shall be discharged at approved pump-out facilities. Pump-out facilities shall be provided by marinas, launching facilities, and other relevant facilities in accordance with the BMP Handbook (Goals and Policies, p. II-45). There is a present shortage of pump-out facilities, as described in Chapter III.

In Volume II of this plan, pump-out facilities are listed as a BMP for marinas and related facilities. TRPA's implementation program for obtaining installation of additional pump-out facilities at marinas includes voluntary, regulatory, and remedial aspects, as it does for all BMPs. When a marina owner or operator applies to TRPA for approval of a project, TRPA will require application of BMPs to the project as a condition of approval. If the project involves modification of an existing marina, TRPA shall also require preparation of a plan and a schedule for retrofit of BMPs to the entire marina. Normally, the schedule could cover a period of up to 10 years, but TRPA may require an accelerated schedule to avoid water quality problems.

If the marina operator has no cause to come to TRPA for a project approval, TRPA will rely initially on voluntary compliance with the BMP Handbook. However, in response to a significant environmental problem, TRPA may also require a remedial action plan to correct the problem, pursuant to Chapters 9 and 25 of the Code of Ordinances.

Under Chapter 54 of the Code of Ordinances, pump-out facilities for boat sewage shall be provided at all new and expanded commercial marinas and harbors, and may be required by TRPA at other existing marinas as conditions of project approval.

TRPA will immediately initiate a program, coordinated with the Lahontan Board, NDEP, local government, and the sewage collection and treatment districts, to obtain prompt compliance with the BMP calling for pump-out facilities at marinas, with a goal of obtaining either immediate compliance or agreement to a compliance schedule at every commercial marina by June 30, 1990.

c. Controls on anti-fouling coatings (regulatory) [40 CFR 130.6(c)(4)(ii)]

Anti-fouling coatings, such as tributyl tin (TBT), are pesticides applied to the hulls of boats and to structures to prevent or reduce biological fouling. These pesticides shall be regulated, in accordance with California and federal laws, by the Lahontan Board and TRPA. The Handbook of Best Management Practices, Volume II of this plan, incorporates the California and federal restrictions on use of paints containing TBT, and applies those restrictions to all portions of the Tahoe Region.

California legislation enacted in 1988 prohibits the use of TBT paints, except on aluminum vessel hulls and vessels 25 meters or more in length. Vessels painted with TBT before January 1, 1988 may still be used, but not repainted with TBT. Federal regulations ban the use of TBT on non-aluminum hulls of vessels less than 82 feet in length, and limit the release from other hulls to 0.4 $ug/cm^2/day$.

3. Dredging and Construction in Lake Tahoe

a. Best management practices to prevent resuspension of sediments (voluntary/ regulatory/remedial) [40 CFR 130.6(c)(4)(i), (ii), (iii)(E); 130.6(c)(7)]

The BMP Handbook has been amended to include special construction techniques, discharge standards, and development criteria applicable to projects in the shorezone, pursuant to the Goals and Policies, p. II-45. The program of BMP implementation is as described elsewhere in this part, and includes voluntary, regulatory, and remedial aspects.

b. Restrictions and conditions on filling and dredging (regulatory) [40 CFR 130.6(c)(4)(ii), (iii)(E); 130.6(c)(7)]

Filling and dredging in the lakes of the Region are permissible activities, but are subject to ordinance provisions to protect water quality and the natural function and dynamics of the shorelines and lakebeds. TRPA shall apply state and TRPA water quality thresholds, standards, and guidelines to activities which involve construction within Lake Tahoe. Where turbidity curtains are used to prevent the mixing of turbid waters near the construction site with clear Lake waters, TRPA shall apply and enforce the Uniform Regional Runoff Guidelines for discharges of surface runoff to surface waters at the point or points of discharge from the turbidity curtain. Ambient water quality thresholds and standards applicable in the littoral zone shall be applied and enforced at a reasonable distance from the construction activity.

Filling is limited to dredging, shoreline protective measures, beach replenishment, or other activities that can be found to be beneficial to existing shorezone conditions or water quality or clarity (Code, Chapter 54).

Dredging techniques and discharge standards are as set forth in the BMP Handbook. Filling and dredging proposals require the approval of other involved agencies, including NDEP or the Lahontan Board, as appropriate, pursuant to section 401 of the Clean Water Act; the Army Corps of Engineers; state fish and wildlife agencies; and state lands agencies. TRPA, in coordination with these agencies, shall recognize potential water quality impacts from spoils disposal, as well as from dredging itself, in its permitting process.

Because of prevailing low water conditions in 1988, TRPA issued a number of dredging permits to marina operators to keep navigation channels open. TRPA will prepare a report covering the strengths and weaknesses of the dredging operations and the permitting process no later than March 30, 1989. On the basis of the findings of that report, TRPA shall make changes in the control program for dredging operations.

V. PLAN IMPLEMENTATION

A. MANAGEMENT AGENCIES

1. Responsibilities and Authorities

The list below assigns responsibility for each water quality control program listed in IV, above, to a management agency, pursuant to section 208 and the Code of Federal Regulations (40 CFR 130.6(c)(5)). The authority under which each management agency will carry out its responsibility appears in parentheses.

a. Urban Runoff and Erosion

Best Management Practices--all applications: TRPA (Code of Ordinances, Chapter 25); LTBMU/USFS (federal regulations, LTBMU Land and Resource Management Plan)

Capital Improvements Program for erosion and runoff control:
state highways: CALTRANS, NDOT
local streets and roads: local government, improvement districts, private operators
forest roads: USFS, state parks departments
technical assistance: SCS, NTCD, TRCD, CDF, NDF (federal, state, and local law)

Coverage mitigation program:
program administration: TRPA (Code, Chapter 20)
land bank: California Tahoe Conservancy (Memorandum of Understanding, February 18, 1988) [Note: land banking agreements are still being negotiated for the Nevada portions of the Region.]

Effluent limitations and discharge permits for urban drainage problems: Lahontan Board, TRPA, NDEP (Federal Clean Water Act, Porter-Cologne Act (CA), Nevada Revised Statutes, Tahoe Regional Planning Compact)

Limitations on new subdivisions: TRPA (Regional Plan Goals and Policies, Land Use Element)

Land use planning and control: TRPA (Code, Chapter 18), LTBMU/USFS (federal statutes)

Development priorities (IPES): TRPA (Code, Chapter 37)

Limits on impervious coverage: TRPA (Code, Chapter 20)

Water quality mitigation program: TRPA (Code, Chapter 82)

Transfer of Development Rights:
- program administration: TRPA (Code, Chapter 20 and 34)
- land bank: California Tahoe Conservancy (Memorandum of Understanding, February 18, 1988) [Note: land banking agreements are still being negotiated for the Nevada portions of the Region.]

Restrictions on new encroachment and vegetation alteration in SEZs: TRPA (Code, Chapter 20)

SEZ Restoration Program:
- implementation: local, state, and federal units of government including USFS, state parks departments, California Tahoe Conservancy, and Nevada Tahoe Basin Act Land Acquisition Program; utility and improvement districts
- technical assistance: SCS, TRCD, NTCD, CDF, NDF (federal, state, and local law)

SEZ setbacks: TRPA (Code, Chapter 30)

Protection of native vegetation during use and construction: TRPA (Code, Chapters 20 and 25)

Use of native and adapted plants for revegetation: TRPA (Code, Chapter 77)

Restoration of areas of disturbed vegetation: TRPA (Code, Chapter 25)

Fertilizer reporting requirements: TRPA (Code, Chapter 81)

Effluent limitations and discharge permits for fertilizer control: Lahontan Board, NDEP, TRPA (Federal Clean Water Act, Porter-Cologne Act (CA), Nevada Revised Statutes, Tahoe Regional Planning Compact)

b. Airborne Nutrients

Improved mass transit: local government (state and local laws)

Redevelopment and redirection of land use: local government (state and local laws)

Combustion heater rules, stationary source rules, and related rules: TRPA (Code, Chapter 91)

Transfer of development rights:
program administration: TRPA (Code, Chaps. 20, 34)
land bank: California Tahoe Conservancy (Memorandum of Understanding, February 18, 1988) [Note: land banking agreements are still being negotiated for the Nevada portions of the Region.]

c. Waste Management

Elimination of accidental releases: sewage collection, conveyance, and treatment districts (state and local laws)

Reduction of sewer line exfiltration: sewage collection, conveyance, and treatment districts (state and local laws)

Effluent limitations and discharge permits for wastewater disposal: Lahontan Board, NDEP (Federal Clean Water Act, Porter-Cologne Act (CA), Nevada Revised Statutes)

Oversight of wastewater disposal from remote sites: Lahontan Board, NDEP (Federal Clean Water Act, Porter-Cologne Act (CA), Nevada Revised Statutes)

Prohibition on disposal of solid wastes in the Tahoe Region: states of Nevada and California (state law, including SWRCB, 1980 pursuant to Porter-Cologne Act)

Mandatory garbage pickup: local government (state and local laws)

Hazardous materials and wastes--spill prevention and abatement programs: local government, states of Nevada and California, USEPA (state law, RCRA)

Best management practices for snow and ice control: TRPA (Code, Chapter 25)

Reporting requirements regarding road abrasives and deicers: TRPA (Code, Chapter 81)

d. Natural Area Management

Best management practices--all applications: TRPA (Code, Chapter 25), LTBMU/USFS (federal regulations, LTBMU Land and Resource Management Plan)

Land use planning and controls on timber harvesting, outdoor recreation, ORV use, livestock confinement and grazing: TRPA (Code, Chapter 18), LTBMU/USFS (federal statutes)

Control of encroachment in sensitive areas: TRPA (Code, Chapter 20)

Pesticides--substance and operator certification: state government, U.S.E.P.A (federal and state law)

e. Water Quality Problems in Lake Tahoe and the Shorezone

Best management practices--all applications: TRPA (Code, Chapter 25), LTBMU/USFS (federal regulations, LTBMU Land and Resource Management Plan)

Restrictions on shorezone encroachment and vegetation alteration: TRPA (Code, Chapter 53)

Protection of stream-mouth deltas: TRPA (Code, Chapter 20)

Marina master plans: TRPA (Code, Chapter 16)

Additional pump-out facilities for vessel wastes: Lahontan Board, NDEP, public utility districts (federal, state, and local laws)

Controls on discharges of anti-fouling coatings: Lahontan Board, NDEP (federal and state law)

Restrictions and conditions on filling and dredging: TRPA (Code, Chapter 54), Lahontan Board (Porter-Cologne Act, Section 401 of federal Clean Water Act), California Department of State Lands (state statutes), Nevada Division of State Lands (Nevada Revised Statutes), Army Corps of Engineers (Section 404 of federal Clean Water Act), Nevada Division of Environmental Protection (Nevada Revised Statutes)

2. Administrative and Financial Capability

The Clean Water Act and the Code of Federal Regulations require that all designated management agencies have adequate administrative and financial capability to carry out their assigned responsibilities under the 208 plan (40 CFR 35.1521-3(c)). The following paragraphs describe the responsibilities and the administrative and financial capabilities of the management agencies listed above, and identify reporting procedures and methods for coordination with the planning agency as required in 40 CFR 35.1521-3(c)(1) and (2).

California Department of Transportation (CALTRANS). Caltrans District 3, located in Marysville, CA, is responsible for implementing the capital improvements program on California state highways within the Tahoe Region. Since 1976, Caltrans has expended approximately $8 million on erosion and runoff control projects within the Region, and has participated in 15 major erosion control projects (over $100,000) at Rufus Allen Drive, the U.S. 50 corridor, Luther Pass, Emerald Bay, Bliss State Park, Tahoe City, Griff Creek, Brockway, Eagle Creek, and Rubicon. Revenues for the capital improvements come from state appropriations and are programmed through the State Transportation Improvements Program (STIP), primarily as "minor" STIP projects. The total estimated cost of remaining capital improvement project needs for Caltrans is $18.4 million, according to Volume IV of this plan.

Although there are no formal reporting requirements placed on Caltrans with respect to progress on the CIP, Caltrans does provide detailed annual reports to TRPA on STIP progress. Caltrans and TRPA coordinate their activities closely, since TRPA is a designated Regional Transportation Planning Agency under California law, and must prepare an annual work program that is approved and partially funded by Caltrans.

California Department of State Parks. The California Department of State Parks, a California agency located in Sacramento, is responsible for capital improvements for erosion and runoff control and for SEZ restoration on state park properties. They administer the Tahoe State Recreation Area in Tahoe City, Sugar Pine Point State Park between Tahoma and Meeks Bay, D.L. Bliss State Park north of Emerald Bay, Emerald Bay State Park, and the Washoe Meadow State Park.

There are no formal reporting requirements or coordination mechanisms between TRPA and the Department.

California Regional Water Quality Control Board--Lahontan Region (Lahontan Board). The Lahontan Board, a California agency, is located in the City of South Lake Tahoe. The Lahontan Board receives revenues annually from state appropriations, and other sources, including the possibility of section 205(j) grants under the federal Clean Water Act. The Board implements NPDES permits and waste discharge requirements (WDRs) for those who discharge to the surface or groundwaters of the Tahoe Region, including owners and operators of storm drainage systems, roads and highways, and commercial establishments. The Board maintains the regional water quality plans under Section 303(e) of the federal Clean Water Act, participates in water quality planning programs in the Region, reviews and comments on section 205(j) grant applications in the Region, funds special monitoring studies, and participates on the TRPA monitoring technical committee.

There are no formal reporting requirements established between TRPA and the Lahontan Board. However, the Lahontan Board is represented on TRPA's Advisory Planning Commission (Tahoe Regional Planning Compact, Article III(h)), and the staffs of the two agencies coordinate their activities on a regular basis.

California State Water Resources Control Board (State Board). The State Board, located in Sacramento, California, is a California state agency. The State Board receives revenues from state appropriations, federal grants, and filing fees. The State Board is the lead water quality agency in the State, and is responsible for implementation of the NPDES permit program, the construction grants program, adoption of water quality management plans, and many other functions. The State Board annually contributes to the funding of the Lake Tahoe Interagency Monitoring Program (LTIMP), funds special studies, reviews and approves section 205(j) grant applications, and administers State Assistance Grants for erosion and runoff control.

California Tahoe Conservancy. The Tahoe Conservancy, an agency of the state of California, is responsible for administering the land bank in the portions of the Tahoe Region in California. The Conservancy also implements environmental restoration projects with bond funding in the Region.

City of South Lake Tahoe, California (City). The City of South Lake Tahoe, located on the Lake Tahoe's south shore within El Dorado County, is responsible for implementing the capital improvements program on city streets, roads, and rights-of-way; SEZ restoration projects within its jurisdiction; improved mass transit within its jurisdiction; redevelopment and redirection of land use within the City; and mandatory garbage pickup.

Since 1985, the City has expended or committed approximately $5.3 million on erosion and runoff control projects, including the $3.1 million Wildwood-Bijou Phase I project. Revenues for these improvements come from federal and state grants, water quality mitigation funds, and other sources. According to Volume IV of this plan, the City has remaining capital improvement project needs for erosion and runoff control of $58.9 million.

There are no formal reporting mechanisms established between the City and TRPA regarding progress on programs for which the City is responsible. However, the City sits on the TRPA Governing Board (Compact, Article III(a)) and Advisory Planning Commission (Compact, Article III(h)), and cooperates with TRPA on the development, approval, and implementation of redevelopment plans and community plans (Code, Chapters 14 and 15). The City also participates in the Tahoe Basin Association of Governments, which provides advice to TRPA on matters of mutual interest.

Douglas County, Nevada. Douglas County, Nevada, includes the southeast shore of Lake Tahoe. The county seat is Minden, Nevada. The County is responsible for implementing the capital improvements program on county streets, roads, and rights-of-way; SEZ restoration projects; improved mass transit; redevelopment and redirection of land use; and mandatory garbage pickup within the County.

Since 1981, the County has expended approximately $2.5 million on erosion and runoff control projects, including over $1.6 million on Kingsbury Grade erosion control projects. Revenues for these improvements come from federal and state grants, water quality mitigation funds, and other sources. According to Volume IV of this plan, Douglas County has remaining needs for capital improvement projects for erosion and runoff control of $14.6 million.

There are no formal reporting mechanisms established between the County and TRPA regarding progress on programs for which the County is responsible. However, the County sits on the TRPA Governing Board (Compact, Article III(a)) and Advisory Planning Commission (Compact, Article III(h)), and cooperates with TRPA on the development, approval, and implementation of redevelopment plans and community plans (Code, Chapters 14 and 15). The County also participates in the Tahoe Basin Association of Governments, which advises TRPA on matters of mutual interest.

Douglas County Sewer Improvement District (DCSID). DCSID is responsible for treating and exporting sewage collected from its service area in Douglas County, and for erosion and runoff control, SEZ restoration, elimination of spills, and reduction of sewer line exfiltration on property owned or controlled by the District, and for provision of vessel waste pump-out facilities, as appropriate, within its service area.

The DCSID treatment plant is located just south of Round Hill, Nevada. Sewage is pumped from the plant over Daggett Pass for disposal outside the Tahoe Region.

El Dorado County, California. El Dorado County, California, includes a large area of the south shore of Lake Tahoe. The county seat is Placerville, California, but the county has additional public works and administrative offices in the Tahoe Basin. The County is responsible for implementing the capital improvements program and SEZ restoration program on streets, roads, rights-of-way, and other property owned or controlled by the County, and for improved mass transit, redirection of land use, and mandatory garbage pickup within the unincorporated area of the county.

Since 1982, the County has expended or committed approximately $7.0 million on erosion and runoff control projects, including the $1.6 million Rubicon project and the $4.5 million Tahoma project. Revenues for these improvements come from federal and state grants, water quality mitigation funds, and other sources. For the Tahoma erosion control project, construction in 1987-88, the County established a benefit assessment district, becoming the first jurisdiction to establish such a district for an erosion control project in the Tahoe Region. According to Volume IV of this plan, El Dorado County has remaining needs for capital improvement projects for erosion and runoff control of $58.1 million.

There are no formal reporting mechanisms established between the County and TRPA regarding progress on programs for which the County is responsible. However, the County sits on the TRPA Governing Board (Compact, Article III(a)) and Advisory Planning Commission (Compact, Article III(h)), and cooperates with TRPA on the development, approval, and implementation of redevelopment plans and community plans (Code, Chapters 14 and 15). The County also participates in the Tahoe Basin Association of Governments, which advises TRPA on matters of mutual interest.

Incline Village General Improvement District. IVGID is responsible for treating and exporting sewage collected from its service area in Washoe County, and for erosion and runoff control, SEZ restoration, elimination of spills, and reduction of sewer line exfiltration on property owned or controlled by the District, and for provision of vessel waste pump-out facilities, as appropriate, within its service area.

The IVGID treatment plant is located in Incline Village, Nevada. Sewage is pumped from the plant over Spooner Summit for disposal outside the Tahoe Region.

Kingsbury Grade Improvement District (KGID). KGID is responsible for collecting sewage from its service area in Douglas County, and transmitting that sewage to DCSID for treatment. KGID is also responsible for erosion and runoff control, SEZ restoration, elimination of spills, and reduction of sewer line exfiltration on property owner or controlled by the District.

Nevada Department of Transportation (NDOT). NDOT, with headquarters in Carson City, Nevada, is responsible for implementing the capital improvements program on Nevada state highways within the Tahoe Region. Since 1979, NDOT has expended or committed approximately $4.3 million on erosion and runoff control projects within the Region, including the $3.7 million Mount Rose Highway project. Revenues for the capital improvements come from state appropriations and are programmed through the state transportation improvements program. According to Volume IV of this plan, NDOT has remaining needs for capital improvement projects for erosion and runoff control of $25.2 million.

There are no formal reporting requirements placed on NDOT with respect to progress on the CIP. Coordination between NDOT and TRPA is informal.

Nevada Division of State Parks and Recreation. The Nevada Division of State Parks and Recreation is responsible for capital improvements for erosion and runoff control and for SEZ restoration on state park properties. They administer the Lake Tahoe State Parks near Spooner Summit and Sand Harbor on the east shore of Lake Tahoe.

There are no formal reporting requirements or coordination mechanisms between TRPA and the Department.

Nevada Division of Environmental Protection (NDEP). NDEP, a division of the Nevada Department of Conservation and Natural Resources, is located in Carson City, Nevada. NDEP is responsible for issuing discharge permits in accordance with the 208 plan, and for related activities. NDEP receives revenues from state appropriations, federal grants, and other sources. The Division is responsible for implementing NPDES permits and regulating pesticides and vessel wastes. Since 1972, NDEP has issued three NPDES discharge permits within the Tahoe Region.

There are no formal reporting requirements on NDEP with respect to its issuance of discharge permits. However, NDEP is represented on TRPA's Advisory Planning Commission (Compact, Article III(h)) and on TRPA's monitoring committee.

Nevada Tahoe Conservation District (NTCD). The NTCD, located on the Nevada side of the Tahoe Region, provides technical assistance on resource conservation matters to public agencies and private individuals. The District works closely with the Soil Conservation Service office in South Lake Tahoe.

North Tahoe Public Utility District (NTPUD). NTPUD is responsible for collecting sewage from its service area in Placer County, and for erosion and runoff control, SEZ restoration, elimination of spills, and reduction of sewer line exfiltration on property owned or controlled by the District, and for provision of vessel waste pump-out facilities, as appropriate, within its service area. NTPUD also provides and operates recreation facilities.

The NTPUD offices are located in Kings Beach, California. Sewage flows from the collection system by pipeline to the Tahoe-Truckee Sanitation Agency Plant near Truckee for treatment and disposal outside the Tahoe Region.

Placer County, California. Placer County, California, includes the northeast shore of Lake Tahoe. The county seat is in Auburn, California. The County is responsible for implementing the capital improvements program and SEZ restoration program on streets, roads, highways, and other property owned or controlled by the County, and for improved mass transit, redirection of land use, and mandatory garbage pickup within the unincorporated area of the County.

Since 1982, the County has expended approximately $3.2 million on erosion and runoff control projects, including 12 separate projects. Revenues for these improvements come from federal and state grants, water quality mitigation funds, and other sources. According to Volume IV of this plan, Placer County has remaining needs for capital improvement projects for erosion and runoff control of $74.9 million.

There are no formal reporting mechanisms established between the County and TRPA regarding progress on programs for which the County is responsible. However, the County sits on the TRPA Governing Board (Compact, Article III(a)) and Advisory Planning Commission (Compact, Article III(h)), and cooperates with TRPA on the development, approval, and implementation of redevelopment plans and community plans (Code, Chapters 14 and 15). The County also participates in the Tahoe Basin Association of Governments, which advises TRPA on matters of mutual interest.

South Tahoe Public Utility District (STPUD). STPUD, located in the City of South Lake Tahoe near the Bijou/Al Tahoe area, is responsible for collecting and treating sewage from its service area in the City and El Dorado County, for erosion and runoff control, SEZ restoration, elimination of spills, and reduction of sewer line exfiltration on property owned or controlled by the District, and for provision of vessel waste pump-out facilities, as appropriate, within its service area.

Sewage is treated at the STPUD plant and pumped over Luther Pass for disposal outside the Tahoe Region.

Tahoe City Public Utility District (TCPUD). TCPUD, with offices in Tahoe City, California, is responsible for collecting sewage from its service area in Placer and El Dorado Counties, for erosion and runoff control, SEZ restoration, elimination of spills, and reduction of sewer line exfiltration on property owned or controlled by the District, and for provision of vessel waste pump-out facilities, as appropriate, within its service area. TCPUD also provides and operates recreation facilities.

Sewage flows by pipeline to the Tahoe-Truckee Sanitation Agency near Truckee, California for treatment and disposal outside the Tahoe Region.

Tahoe Regional Planning Agency (TRPA). TRPA, a bi-state compact agency located at Zephyr Cove, Nevada, has an existing staff of about 34 full-time employees and an annual budget of approximately $3,000,000. TRPA receives revenues annually from California and Nevada appropriations, filing fees, local government appropriations pursuant to the Compact, state grants and subventions, and other sources.

TRPA is responsible for administration of BMP requirements, the coverage mitigation program, discharge standards, limits on new subdivisions, land use planning and control, development priorities, limits on impervious coverage, the water quality mitigation program, transfer of development rights, restrictions on SEZ encroachments and disturbance, SEZ setbacks, protection of native vegetation, revegetation requirements, fertilizer reporting requirements, combustion heater and stationary source rules, road salt and abrasive reporting requirements, restrictions on development and use in the shorezone, marina master plans, and restrictions on filling and dredging.

Most of these functions are carried out by the Project Review and Compliance Divisions, which implement TRPA's regulatory programs. These activities are coordinated with the activities of the Long Range Planning Division, which prepares environmental control and land use plans and provides basic data (e.g., land capability data) to support the project review and compliance programs.

TRPA is subject to reporting requirements set forth in the Code of Ordinances related to the tracking of information for individual parcels in the Region. Under Chapter 38 of the Code, TRPA records and tracks information for each parcel on BMPs, coverage mitigation, IPES, impervious coverage, water quality mitigation, and transfer of development rights. Chapter 81 of the Code requires reporting to TRPA by affecting agencies using fertilizer and road salt and abrasives.

TRPA conducts monitoring programs and prepares reports annually and more comprehensively at five-year intervals.

Tahoe Resource Conservation District (TRCD). The TRCD, located on the California side of the Tahoe Region, provides technical assistance on resource conservation matters to public agencies and private individuals. The District works closely with the Soil Conservation Service office in South Lake Tahoe.

United States Environmental Protection Agency, Region IX (EPA). EPA Region IX, located in San Francisco, California, is the lead federal water quality management agency for the states of California and Nevada, as well as Arizona and Hawaii. EPA administers all aspects of the federal Clean Water Act, although certain programs, such as NPDES permits, are delegated to the states. EPA reviews and approves water quality management plans, oversees the section 205(j) grant program, and implements many other water quality-related programs.

United States Forest Service, Lake Tahoe Basin Management Unit (LTBMU). The LTBMU is located in the City of South Lake Tahoe. The LTBMU receives revenues from annual federal appropriations and other sources. The Forest Service is responsible for land and resource planning on National Forest Land, subject to applicable requirements of TRPA and state requirements on air and water quality. The LTBMU is guided by an Interim Land Management Plan (LTBMU, 1981) and has prepared a new Land and Resource Management Plan (LRMP) scheduled for adoption in the summer of 1988. The plans contain policies and direction for activities on National Forest Land. The LRMP contains inventories and sets programs for Forest Service activities.

The LTBMU is responsible for capital improvements and restoration projects on forest lands. The LTBMU also issues permits which implement the LTBMU's responsibilities in the areas of recreation development and operation, sewage treatment and disposal, timber harvest, and livestock and grazing.

The LTBMU provides grant funds for water quality improvements to local government pursuant to the Santini-Burton Act program. The LTBMU is represented on the Advisory Planning Commission (Compact, Article III(h)) and issues regular reports on accomplishments.

Washoe County, Nevada. Washoe County, Nevada, includes the northeast shore of Lake Tahoe. The county seat is located in Reno, Nevada. The county is responsible for implementing the capital improvements program and SEZ restoration program on streets, roads, rights-of-way, and other property owned or controlled by the County, and for improved mass transit, redirection of land use, and mandatory garbage pickup within the county.

Since 1979, the County has expended or committed approximately $1.6 million on erosion and runoff control projects, including the $600,000 Fairview-Incline erosion control project and the $625,000 Crystal Bay-Incline project. Revenues for these improvements come from local general funds, federal and state grants, water quality mitigation funds, and other sources. According to Volume IV of this plan, Washoe County has remaining needs for capital improvement projects for erosion and runoff control of $19.3 million.

There are no formal reporting mechanisms established between the County and TRPA regarding progress on programs for which the County is responsible. However, the County sits on the TRPA Governing Board (Compact, Article III(a)) and Advisory Planning Commission (Compact, Article III(h)), and cooperates with TRPA on the development, approval, and implementation of community plans (Code, Chapters 14 and 15). The County also participates in the Tahoe Basin Association of Governments, which advises TRPA on matters of mutual interest.

B. IMPLEMENTATION SCHEDULES [See 40 CFR 130.6(c)(6)]

1. Regulatory Programs

All of the regulatory programs described in part V, above, as being implemented by TRPA under the authority of the Code of Ordinances are in place, except for IPES, land coverage transfers, and revised criteria for identification of SEZs which would be implemented upon certification and approval of these amendments to the 208 plan. Detailed subdivision ordinances are being drafted, however, until their adoption, TRPA is implementing the subdivision policies set forth in the Goals and Policies (TRPA, 1986a).

Those agencies responsible for the issuance of discharge permits, the Lahontan Board and NDEP, have the authority in place to issue necessary permits under state and federal law, and have issued permits to units of local government, sewage collection and treatment entities, and private individuals as described in Part IV, Program Descriptions.

2. Capital Improvement Programs

There are two main capital improvement programs in the 208 plan, the erosion and runoff control CIP, and the SEZ restoration program. These programs are described in detail in Volumes III and IV of this plan. In general, both programs are scheduled to be completed in approximately 20 years.

The CIP in the 1981 208 plan was scheduled to be completed within 20 years. Since 1981, considerable progress has been made, but additional projects and programs have been identified, including SEZ restoration. The result is that the estimated cost of water quality improvement programs has grown to far exceed the estimated cost of the 1981 program adjusted to 1988 dollars. Thus, the schedule for completion of the CIP is 20 years from 1988. This schedule is consistent with the other programs related to attainment and maintenance of water quality standards.

The implementation schedule for improvements to mass transit is set forth in TRPA's Regional Transportation Plan (TRPA, 1988c).

The Lake Tahoe Basin Management Unit, USFS, annually implements portions of its watershed restoration plan. According to Volume III of this plan, SEZ Restoration and Protection Program, the LTBMU may attain the SEZ restoration threshold for SEZs on National Forest lands within two years.

3. Other Programs

Redevelopment. Pursuant to California redevelopment law (California Health and Safety Code Section 33000 et seq.) the South Tahoe Redevelopment Agency proposes to adopt and implement a redevelopment plan for the area within the City of South Lake Tahoe that extends along U.S. 50 from Ski Run Boulevard to the stateline. The TRPA Plan Area Statements designate this area as suitable for redevelopment, with a "redirection of development" management theme. The tentative implementation schedule calls for approval of a final redevelopment plan in June, 1988; voter approval of a sales tax increase in June, 1988; voter approval of a Transient Occupancy Tax (TOT) increase in September, 1988; and implementation of the first three phases of the redevelopment plan by 1992 (Brady and Associates, 1988, p. 63). (As of the date of this plan, November 1988, the redevelopment plan had been approved by the South Tahoe Redevelopment Agency and the voters had approved the TOT.)

Community Planning. A partnership of local business interests, local government, TRPA, and the general public will develop community plans for designated commercial areas in the Tahoe Region. Community planning is underway in Tahoe City and Douglas County. Starting in July, 1988, additional community planning efforts will begin in Washoe County, El Dorado County, and the City of South Lake Tahoe. TRPA's goal is to have all community plans completed by December 1, 1989. However, current projections of activity in the program extend until June, 1991. Each adopted community plan will guide development in the applicable area for at least ten years, and will be kept current by periodic review (Goals and Policies, p. II-6).

Other. The Program Descriptions, above, include several other implementation schedules, including schedules for preparation of marina master plan guidelines, preparation of a report on the effectiveness of dredging permits, implementation of a compliance program to establish sewage pump-out facilities at all commercial marinas, and implementation of a monitoring program to study transport of airborne nutrients into the Tahoe Region.

C. TRPA COMPLIANCE PROGRAM

TRPA's program for enforcement of project approvals, including conditions of approval, and the provisions of the Compact, the Goals and Policies, and the Code, is described in Chapter 8 of the TRPA Code of Ordinances.

Projects approved by TRPA are subject to inspections by TRPA at any reasonable time. The permittee is responsible for making the project area accessible for inspections. The following inspections are required by the Code:

- for projects which require grading, a pregrading inspection to determine if the permittee has satisfied pregrading conditions of approval, including installation of temporary BMPs,

- for all projects, inspections as necessary to assure the permittee has complied with the project approval and provisions of the law, and

- prior to issuance of a local certificate of occupancy, the scheduled date of project completion, or project completion, whichever is earliest, a final project inspection to ensure that all conditions of project approval shall be satisfied.

TRPA shall maintain a record of all inspections made. In the event that a person fails to comply with provisions of the law or of project approval, TRPA may take one or both of the following actions: (1) issue a correction notice describing the action needed to comply, or (2) issue a cease and desist order describing the actions which shall be taken before the cease and desist order will be withdrawn.

If a person fails to comply with the terms of a correction notice or cease and desist order, TRPA may suspend or revoke the permit. TRPA may adopt monetary penalties for the resolution of compliance matters. As a condition of project approval, permittees may be required to post a security with TRPA to ensure compliance. The approval identifies the conditions which are subject to the security.

TRPA shall monitor compliance with secured conditions of approval. A security shall be forfeited if TRPA finds that a secured condition has not been complied with on time and that the security, or a portion thereof, is necessary to achieve compliance. After giving notice and an opportunity for a hearing, TRPA may use the security to accomplish the condition of approval which was not complied with.

TRPA maintains a full-time compliance staff, and adds seasonal compliance personnel during the summer building seasons.

VI. COORDINATION

The Code of Federal Regulations requires water quality management planning activities to be coordinated with related programs (See 40 CFR 130.6(f), 130.12, and part 35.) Planning activities involve potentially affected agencies including units of local government, designated management agencies, and state and federal agencies involved in recreation, air quality, solid waste management, drinking water, and fish and game programs.

All units of local government are represented on TRPA's Advisory Planning Commission and Governing Board. Both the APC and Board meet on a monthly basis, and will review and act on these proposed amendments to the 208 plan. The Lahontan Board, California Air Resources Board, NDEP, the LTBMU (USFS), the Soil Conservation Service, and the Resource Conservation Districts are also represented on the APC, and serve on the APC's natural resources committee.

Coordination with the utility districts and water suppliers is more informal. TRPA staff meets regularly with the utility districts and water purveyors to exchange information and discuss issues, and the utility districts named a representative to serve on the Consensus Building Workshop from 1985 to 1987. Coordination with state parks departments, the California Tahoe Conservancy, the Tahoe Basin Act Land Acquisition Program (Nevada), and state and federal fish and game departments is also informal, but TRPA staff meet with representatives of these agencies regularly to discuss issues of mutual interest. A Memorandum of Understanding between TRPA and the California Tahoe Conservancy establishing the Conservancy as the California-side land bank was signed in January, 1988.

The federal regulations also require federal properties, facilities, and activities to comply with state, interstate, and local programs to control and abate water pollution (40 CFR 130.12(c)). The LTBMU, which manages over three-quarters of the land area in the Tahoe Region, is the primary federal agency affected by this regulation. TRPA and the LTBMU implement the 208 plan on National Forest lands under the TRPA Code of Ordinances and a detailed Memorandum of Understanding. The Forest Service also has its own 208 plan for water quality management on National Forest lands in California, portions of which are incorporated in TRPA's 208 plan.

VII. PLAN EVALUATION AND REVISION [40 CFR 130.6(e)]

A. WATER QUALITY MONITORING PROGRAM

The TRPA Goals and Policies include a goal to implement a monitoring program to evaluate the environmental thresholds, the effectiveness of the Regional Plan, and the implementing ordinances and programs. TRPA shall maintain an operational monitoring program, consisting of planning and administration, data collection, data storage and retrieval, and data analysis, and use the products of the program to identify problems and evaluate progress under the Regional Plan (Goals and Policies, p. VII-25).

The monitoring program shall include continuous scientific monitoring of environmental conditions related to the thresholds for pelagic Lake Tahoe, littoral Lake Tahoe, tributary streams, surface runoff, groundwater, land coverage, and SEZs (Goals and Policies, p. VII-25). Specifically related to IPES, TRPA will monitor representative tributaries to provide a basis for evaluating the relative health of watersheds where development is contemplated. This monitoring program shall be in place in a local jurisdiction, and shall establish baseline water quality conditions, before the numerical level defining the top rank of parcels for the jurisdiction is lowered (Goals and Policies, p. VII-25).

TRPA will also establish a science advisory panel to review the technical assumptions, techniques, and procedures associated with monitoring and analysis efforts (Goals and Policies, p. VII-26).

The Lake Tahoe Interagency Monitoring Program (LTIMP) was established in 1980 to acquire and disseminate the water quality information for Lake Tahoe necessary to support regulatory, management, and planning activities in the Region. The main participants in the LTIMP have been the California State Water Resources Control Board (SWRCB), California Department of Water Resources (DWR), United States Geological Survey (USGS), the University of California-Davis (UCD), the Lake Tahoe Basin Management Unit (USFS), the Lahontan Board, and TRPA.

Until FY 87-88, funding for the basic LTIMP program was provided primarily by the USGS and the SWRCB. UCD conducted certain work elements, including all in-Lake monitoring, under contract to the USGS. UCD and USGS conduct most of the field work, data computation, and compilation. UCD conducts most of the laboratory work and produces the annual reports. Starting in FY 87-88, TRPA was also able to match USGS funding, and expand the tributary monitoring network.

In 1985, as an outgrowth of the Consensus Building Workshop, TRPA convened a monitoring committee and began holding regular meetings. The purpose of the committee is to involve all entities who conduct environmental monitoring in the Tahoe Region (including air quality, noise, and biology in addition to water quality) in the oversight of TRPA's annual monitoring work program, which is a requirement of the 1987 Regional Plan amendments. The membership of TRPA's monitoring committee includes all the LTIMP agencies.

For FY 88-89, TRPA has obtained additional monitoring funds from California and Nevada which, combined with federal matching funds, will add over $400,000 to the water quality monitoring and research program.

For more details on the water quality monitoring program, see the monitoring work program in the Technical Appendix.

B. RESEARCH NEEDS

The Setting (Volume I, Section I, Chapter II) and the Response to Comments (Volume VI) have identified a number of research needs for water quality management in the Tahoe Region. In general, research is needed into the details of Lake Tahoe's nutrient budget, the nutrient inputs and outputs of the watershed and the airshed, and the effectiveness of Best Management Practices and other control measures. Specifically, research needs have been identified in the following areas: (1) development of a data base on the treatment of runoff in natural and artificial wetlands and SEZs, (2) the quantity and quality of urban runoff and the contributions of urban runoff to Lake Tahoe's nutrient budget, (3) effectiveness of erosion and runoff control projects, (4) transport of airborne nutrients, particularly nitrogen, from upwind areas into the Tahoe Region, (5) effects of fertilizer use on water quality and effectiveness of fertilizer management programs, and (6) effectiveness of stream environment zone restoration projects and techniques.

The Tahoe Research Group is currently researching the nutrient budget of Lake Tahoe, particularly nutrient cycling and sedimentation, with assistance from TRPA.

C. EVALUATION INTERVALS AND TARGETS

At least every five years, TRPA shall evaluate the results of its monitoring programs. The first comprehensive five-year review shall be conducted by September 30, 1991.

A special component of the monitoring program shall be designed to evaluate the success of IPES at the end of five years, and will be the basis for extending, modifying, or discontinuing IPES. Monitoring shall cover both scientific information (e.g., tributary stream water quality) and nonscientific items (e.g., rate of installation of remedial erosion control projects, extent of retrofitting existing development with BMPs) (Goals and Policies, p. VII-26).

TRPA will publish annual or semi-annual reports on the implementation of the monitoring program covering progress on threshold attainment and maintenance, research, and overall monitoring results (Goals and Policies, p. VII-26).

Both the scientific data and the nonscientific information gathered through the monitoring program shall have predetermined benchmarks to measure against to evaluate the effectiveness and adequacy of control measures and the success of the Regional Plan. These benchmarks shall be established based on recommendations from the TRPA's monitoring committee (Goals and Policies, p. VII-26).

Detailed procedures for establishing these benchmarks and evaluating the effectiveness and adequacy of control measures are set forth in Chapter 32 of the TRPA Code of Ordinances. Chapter 32 requires TRPA to identify interim targets for each threshold and applicable state standard not in attainment. It also requires TRPA to identify, for each water quality control measure, the size and rate of its contribution to attainment of the threshold or standard, and to ensure that the control measures are adequate to attain and maintain the thresholds and standards.

Parallel to its adoption of this 208 plan, TRPA shall adopt materials prepared pursuant to Chapter 32 covering the areas of water quality, soil conservation, and air quality. For each of the thresholds and applicable state and federal standards covered by the Chapter 32 documents, TRPA shall set interim performance targets for the year 1991. Wherever possible, these targets shall be numerical targets, but in some instances, narrative targets are required.

The following interim targets from the materials prepared pursuant to Chapter 32 are also made a part of this 208 plan:

1. Category: water quality
   Parameter: turbidity, shallow waters of Lake Tahoe
   Standard: (TRPA) Decrease sediment load as required to attain turbidity values not to exceed 3 JTU in littoral Lake Tahoe. In addition, turbidity shall not exceed 1 JTU in shallow waters of Lake Tahoe not directly influenced by stream discharges.
   Indicator: Turbidity offshore at the 25-meter depth contour at the following locations in littoral Lake Tahoe (JTU): (1) mouth of Upper Truckee River and Trout Creek, (2) El Dorado Beach, (3) mouth of Edgewood Creek, (4) Nevada Beach, (5) mouth of Incline Creek, (6) Burnt Cedar Beach, (6) mouth of Ward Creek, (8) Tahoe State Recreation area.
   Interim Target: Due to the lack of recent monitoring data on littoral zone turbidity, no numerical target is set. By July 1989, TRPA shall establish criteria for measuring and evaluating turbidity of the littoral zone of Lake Tahoe. By September 1991, TRPA shall determine the status of this indicator with respect to attaining and maintaining the TRPA threshold, based on historical data and data gathered from 1988 through 1991, and shall identify compliance measures necessary and sufficient to attain and maintain the threshold.

2. Category: water quality
   Parameter: winter clarity, pelagic Lake Tahoe
   Standard: (TRPA) average Secchi depth, December-March, shall not be less than 33.4 meters. (California) Secchi disk transparency shall not be decreased below levels recorded in 1967-71 based on a comparison of seasonal and annual mean values.
   Indicator: Secchi depth, annual average, TRG index station (meters).
   Interim Target (1991): Not less than 21.9 meters.

3. Category: water quality
   Parameter: phytoplankton primary productivity (PPR), pelagic Lake Tahoe.
   Standard: (TRPA) Annual mean PPR shall not exceed 52 $gmC/m^2/yr$. (California) Algal productivity shall not be increased beyond levels recorded in 1967-71, based on a statistical comparison of seasonal and annual mean values.
   Indicator: PPR, annual average, TRG index station ($gmC/m^2/year$).
   Interim Target (1991): Not greater than 133 $gmC/m^2/yr$.

4. Category: water quality
Parameter: tributary water quality
Standard: (California and Nevada) See Volume I, Attachment 2. (TRPA) Attain a 90th percentile value for suspended sediment of 60 mg/l.
Indicator: Annual average concentrations of appropriate constituents in any tributary stream for which states have established standards (mg/l). 90th percentile suspended sediment concentrations for any tributary stream (mg/l).
Interim Targets (1991): Due to the lack of recent monitoring data on the following constituents, no numerical target is set: California total nitrogen standards, California total iron standards, and TRPA suspended sediment threshold. By September 1991, TRPA shall determine the status with respect to attaining and maintaining these standards on streams covered by TRPA's monitoring program; establish interim targets as appropriate for nitrogen, phosphorus, and suspended sediments for those streams; and identify compliance measures necessary and sufficient to attain and maintain the standards on those streams. For the California total phosphorus standard: General Creek: not greater than 17 mg/l; Trout Creek: not greater than 42 mg/l; Upper Truckee River: not greater than 33 mg/l; Ward Creek: not greater than 24 mg/l. Pending confirmation by monitoring data, Nevada tributaries in the monitoring program meet Nevada standards.

5. Category: water quality
Parameter: runoff water quality--discharges to surface waters
Standards: Total nitrogen as N: 0.5 mg/l
Total phosphate as P: 0.1 mg/l
Total iron as Fe: 0.5 mg/l
Turbidity: 20 JTU
Suspended sediment: 250 mg/l
Grease and oil: 2.0 mg/l
Indicator: Concentration of applicable constituent in samples of surface runoff (localized surface flow from rainfall and snowmelt draining small sub-watersheds) at point of discharge to surface waters (mg/l or JTU). Also, as related factors, progress on implementation of the capital improvements program for erosion and runoff control (p. 183) and implementation of BMPs (p. 184).
Interim Targets (1991): Given the large number of points of discharge of runoff waters to the surface waters of the Region, it is not practical at this time to set numerical performance targets. By September 1991, TRPA shall map the significant points of discharge of surface runoff to the surface waters of the Tahoe Region, shall evaluate the status of compliance with the above standards for a

representative sample of the points of discharge, and shall establish interim targets and identify compliance measures necessary and sufficient to attain and maintain the threshold.

6. Category: water quality
   Parameter: runoff water quality--discharges to groundwater
   Standards: Total nitrogen as N: 5 mg/l
   Total phosphate as P: 1 mg/l
   Total iron: 4 mg/l
   Turbidity: 200 JTU
   Grease/oil: 40 mg/l
   Indicator: Concentration of applicable constituent in samples of surface runoff at points of discharge to groundwater (mg/l or JTU). Also, as related factors, progress on implementation of the capital improvements program for erosion and runoff control (p. 183) and implementation of BMPs (p. 184).
   Interim Targets (1991): Given the large number of points of discharge of runoff waters to the groundwaters of the Region, it is not practical at this time to set numerical performance targets. By September 1991, TRPA shall map the significant points of discharge of surface runoff to the groundwaters of the Tahoe Region, shall evaluate the status of compliance with the above standards for a representative sample of the points of discharge, and shall establish interim targets and identify compliance measures necessary and sufficient to attain and maintain the threshold.

7. Category: water quality
   Parameter: other lakes
   Standards: See Volume I, Attachment 2.
   Indicator: Annual average or 90th percentile concentrations of applicable constituents, as appropriate, from samples of other lakes in the Tahoe Region, particularly Cascade Lake, Upper and Lower Echo Lakes, Marlette Lake, and Fallen Leaf Lake. Also, as related factors, progress on implementation of the capital improvements program for erosion and runoff control (p. 183) and implementation of BMPs (p. 184).
   Interim Target (1991): Due to the lack of recent monitoring data on other lakes, no numerical targets are set. By September 1991, TRPA shall determine the status of this indicator with respect to attaining and maintaining the state standards, particularly for the lakes mentioned, shall identify compliance measures necessary and sufficient to attain and maintain the standards, and shall establish interim targets and identify compliance measures necessary and sufficient to attain and maintain the threshold.

8. Category: soil conservation
Parameter: naturally-functioning SEZ
Standard: (TRPA) Preserve naturally-functioning SEZs in their natural condition; restore all disturbed SEZ lands in undeveloped, unsubdivided lands; restore 25 percent of SEZ lands identified as disturbed, developed, or subdivided, to obtain a 5 percent increase in the area of naturally-functioning SEZ lands.
Indicator: Area of naturally-functioning SEZs (acres).
Interim Target (1991): Increase area of naturally-functioning SEZ from approximately 12,100 acres to approximately 12,500 acres, an increase of 400 acres.

9. Category: air quality
Parameter: vehicle miles travelled (VMT)
Standard: (TRPA) Reduce VMT 10 percent from 1981 value, estimated at 1.70 million, peak summer day.
Indicator: VMT calculated by TRPA for peak summer day using Quick Response System (QRS) transportation model or equivalent model.
Interim Target (1991): Not greater than 1.625 million.

10. Category: air quality
Parameter: atmospheric nutrient loading
Standard: (TRPA) Reduction in direct DIN load on Lake Tahoe from atmospheric sources by approximately 20 percent of the 1973-1981 annual average.
Indicator: Annual average concentration of particulate NO_3 at the Lake Tahoe Boulevard air quality monitoring station (ug/m^3).
Interim Target (1991): Not greater than 1.27 ug/m^3.

In addition to the indicators and targets adopted pursuant to Chapter 32 of the TRPA Code of Ordinances, TRPA also adopts the following indicators and performance targets to assist with the evaluation of performance in the areas of implementation of the Capital Improvement Program for Erosion and Runoff Control and implementation of Best Management Practices:

1. Category: water quality
Parameter: implementation of Capital Improvement Program for Erosion and Runoff Control
Indicators: For each local unit of government, Caltrans, and NDOT: (1) total expenditures on CIP projects, not including operations and maintenance, (2) miles of road shoulder treated with erosion and runoff control practices, (3) area of public right-of-way treated with erosion and runoff control practices (acres).

Targets (20-years): Pursuant to Volume IV of this plan:

City of South Lake Tahoe: $58.9 million
El Dorado County: $49.8 million
Placer County: $78.0 million
Washoe County: $19.3 million
Douglas County: $14.6 million
Caltrans: $18.4 million
NDOT: $25.2 million
USFS/LTBMU: $25.3 million

Interim Targets (1991): Pursuant to Volume IV of this plan, by December 30, 1991:

City of South Lake Tahoe: $10.0 million
El Dorado County: $7.8 million
Placer County: $7.6 million
Washoe County: $3.9 million
Douglas County: $2.9 million
Caltrans: $3.7 million
NDOT: $5.0 million
USFS/LTBMU: $5.1 million

In addition, TRPA will set performance targets for indicators (2) and (3), above, by January 1, 1991.

2. Category: water quality
Parameter: implementation of Best Management Practices
Indicators: Based on a stratified random survey of residential, commercial, public service, and recreation properties, percentage of properties with: (1) BMPs in place in accordance with the Handbook of Best Management Practices and (2) revegetation of areas disturbed (e.g., denuded or compacted without structures) as of July 1, 1989.
Targets (20-years): For indicator (1), 100 percent of properties in the survey; for indicator (2), 80 percent of properties in the survey.
Interim Targets (1991): For indicator (1), 15 percent of properties in the survey; for indicator (2) 12 percent of properties in the survey.

As reported in Volume IV of this plan, 65 erosion and runoff control projects have been completed in the Tahoe Region, with funding from a variety of federal, state, and local sources: federal Clean Lakes Grants, federal forest highways funds, erosion control grants under the Burton-Santini program administered by the LTBMU (USFS), California state assistance grants administered by the Lahontan Board, site improvement and land acquisition grants from the California Tahoe Conservancy, state transportation improvement funds, local general funds, benefit assessment districts, and CTRPA and TRPA mitigation funds. Except for California state assistance grants (which have been entirely committed) and CTRPA mitigation funds (which no longer are collected), TRPA expects these funding sources to continue to support erosion and runoff control projects in the future, with the addition of Nevada Bond Act grants for erosion and runoff control starting in 1989.

TRPA will work the all the other entities involved in implementing the capital improvements program to develop dedicated long-term funding sources which will allow the responsible agencies to meet their 20-year CIP targets. The assurance of long-term funding is necessary to allow units of local government and other implementing agencies to increase their annual outlays on erosion and runoff control projects to a level commensurate with the 20-year targets. For more discussion of long-term funding strategies, see Volume VI (p. 42) of this plan, Responsiveness Summary and Response to Comments.

No less often than once a year, TRPA will also meet with representatives of local public works departments, local elected officials, Caltrans, NDOT, the LTBMU, and other affected entities to review progress on the CIP; problems encountered within the past year; new information on project design and construction techniques; possible cost-reduction methodologies; project expenditures and cost estimates; additional sources of funding; and related topics. Subsequent to these meetings, TRPA shall prepare annual status reports on the progress of the capital improvements program.

D. ASSESSMENT OF EFFECTIVENESS AND ADEQUACY

If the 208 plan produces the expected benefits to the environment sooner than anticipated, or more slowly than anticipated, as determined by evaluation of the indicators in C, above, TRPA shall make adjustments to the Regional Plan. Based on results of scientific studies, TRPA may also adjust the targets to make them consistent with the latest scientific information (Goals and Policies, p. VII-23).

No later than September 1991, and every five years thereafter, TRPA shall issue a progress report covering: (1) the amount and rate of progress toward the targets in C, above, (2) the cumulative impacts on each indicator of projects approved by TRPA from the date of approval of the 208 plan, (3) the extent to which the Region and applicable sub-regions are making progress toward the thresholds and standards listed in C, above, and (4) recommendations for implementation of supplemental or contingency measures necessary to attain and maintain the targets and standards, or modification or elimination of compliance measures in place to attain and maintain the targets and standards. For a list of supplemental compliance measures and contingency measures which TRPA has identified as of November 1988, see Appendix O in Volume VII of this plan, Technical Appendices. TRPA may amend these supplemental compliance measures from time to time, pursuant to Chapter 32 of the TRPA Code of Ordinances.

Based on information presented in the progress report, TRPA shall find, with respect to each of the indicators in C, above, that either: (1) the interim target has been met, or (2) the interim target has not been met and adjustments have been made to the Regional Plan sufficient to ensure progress toward the attainment and maintenance of the threshold or standard.

Prior to the date of each evaluation, TRPA may make a finding, based on the best available scientific evidence, that a better indicator exists to measure attainment of a threshold or standard. In such a case, the findings referred to in the preceding paragraph may be made concerning the new indicator, instead of the original indicator, as long as sufficient measurements of the new indicator exist for a determination of whether the applicable interim target for that new indicator has or has not been met.

E. CONFLICT RESOLUTION PROCESS

During the process of coordinating these proposed 208 amendments with the affected federal, state, and local agencies, several agencies requested TRPA to identify a conflict resolution process as part of the 208 plan. The purpose of the conflict resolution process is to anticipate issues and events in implementation of the 208 plan which may be controversial, and to establish procedures in advance to resolve conflicts.

To assist with the drafting of these proposed amendments, TPRA, the Lahontan Board, NDEP and USEPA convened a working group to identify and discuss 208-related issues and to recommend acceptable strategies and approaches to those issues. The working group has met eleven times between August, 1987 and the present. The primary purpose of the working group has been to exchange information and discuss issues. To the extent that such informal exchange is beneficial to resolve future conflicts, TRPA and the other agencies will reconvene the working group.

Should contentious issues arise that involve serious conflicts among the members of the working group, or conflicts between the 208 planning and management agencies and the public, TRPA may attempt to identify consensus solutions to the issues by convening a workshop similar to the Consensus Building Workshop described in Chapter I of this Section. Such a workshop would involve specialized techniques for conducting meetings and reaching consensus; identify and involve all the stakeholders in the issue; and obtain appropriate scientific and technical input to aid the process. The purpose of the workshop would be to make recommendations to the decision-makers (e.g., the TRPA Governing Board) on the resolution of key issues.

Although consensus-building approaches have been successful in resolving conflicts in the Tahoe Region and elsewhere, it must be recognized that these approaches are time consuming and resource intensive. The Consensus Building Workshop, which recommended solutions to TRPA's Regional Plan-related litigation, met regularly for 15 months, consumed over 16,000 hours of staff and participant time, and cost TRPA over $50,000 in consultant and other costs. Therefore, TRPA will not utilize a formal consensus-building approach unless the gravity of the issues involved demand it.

Other means of conflict resolution will be considered, such as simple negotiation or mediation. If appropriate, the TRPA Governing Board or Advisory Planning Commission will hold public workshops or hearings to invite public comment on controversial implementation issues. In some circumstances, such as when necessary for immediate action to avoid environmental harm, or when legal considerations warrant it, the courts may be the arena for conflict resolution.

VOLUME I. WATER QUALITY MANAGEMENT PLAN

SECTION II. ENVIRONMENTAL, SOCIAL, AND ECONOMIC IMPACTS

The discussion of impacts in this Section is tiered off a series of environmental documents prepared by TRPA since the amendments to the Tahoe Regional Planning Compact in 1980. The Compact requires TRPA to adopt environmental threshold carrying capacities to protect the values of the Tahoe Region, to amend the Regional Plan to attain and maintain the thresholds, and to implement the Regional Plan. The following TRPA documents discuss the environmental, social, and economic impacts of the thresholds, the Goals and Policies, the Code of Ordinances, the Plan Area Statements, and related parts of the Regional Plan package, and are incorporated herein by reference:

TRPA, 1982. Environmental Impact Statement for the Establishment of Environmental Threshold Carrying Capacities.

TRPA, 1982. Study Report for the Establishment of Environmental Threshold Carrying Capacities.

TRPA, 1983. Environmental Impact Statement for Adoption of a Regional Plan for the Lake Tahoe Region.

TRPA, 1984. Response to Comments, EIS for Adoption of a Regional Plan for the Lake Tahoe Region.

TRPA, 1986. Supplement to the Environmental Impact Statement for Adoption of a Regional Plan for the Lake Tahoe Region.

TRPA, 1987. Final Environmental Impact Statement: Plan Area Statements and Implementing Ordinances of the Regional Plan.

TRPA, 1988. Final Environmental Impact Report/Environmental Impact Statement, Regional Transportation Plan: Lake Tahoe Basin.

These related environmental documents are available for public inspection at the TRPA offices, 195 U.S. Highway 50, Round Hill, Nevada.

The documents listed above are related to this analysis of environmental, social, and economic impacts in several ways. First, they discuss the process of setting the environmental threshold standards for the Tahoe Region, which standards are applicable to the analysis of water quality, soils, stream environment zones, air quality, transportation, community design, fish, noise, recreation, scenic resources and wildlife. Second, they analyze the environmental impacts of a wide variety of alternative Regional Plan components which the TRPA considered in adopting the Goals and Policies, the Plan Area Statements, and the Code of Ordinances which, in turn, set the stage for the proposed amendments to the 208 plan. Finally, they include a wealth of detailed information relevant to this analysis which the reader may refer to for additional detail. Where TRPA has relied on information from these related documents, citations and summaries are provided.

The disclosure which follows is intended to allow decision-makers and the public to make reasoned decisions regarding the relative environmental, social, and economic impacts of the four alternatives, prior to taking any action to amend, adopt, or approve policies for water quality management.

The disclosure is divided into two main parts: the description of alternatives to the proposed action, and anticipated environmental, social, and economic impacts. The discussion of impacts is also in two parts: major considerations and other considerations. The major considerations--land use, soils, stream environment zones, transportation, air quality, water quality, sewage treatment, water supply, and the economy--are presented first for the convenience of the reader. The other considerations, which follow, cover areas in which the differences between the alternatives are more subtle or non-existent.

The reader should note that, throughout the analysis of the four alternative plans, TRPA has made certain projections of additional commercial floor area, hotel/motel units, multi-family units, single-family homes, and public service development over the next 20 years. These projections are made only for purposes of analyzing the potential impacts of additional development, and are not to be construed as levels of additional development permitted by TRPA, nor as limits on additional development. The Regional Plan establishes allocation limits for single-family homes through 1991, and limits on tourist accomodation units and commercial floor area through July 1, 1997. TRPA will decide later on additional development beyond these periods, but only after appropriate environmental documentation, including a demonstration that environmental thresholds will be attained and maintained.

In addition, prior to approving any amendment to the Regional Plan package, adopting any community plan, approving any expansion of sewage treatment capacity, or taking any similar action, which would have impacts on water quality greater than those analyzed or assumed in this 208 plan, TRPA shall amend this 208 plan as appropriate.

I. ALTERNATIVES TO THE PROPOSED ACTION

To assess the environmental, social, and economic impacts of these 208 amendments, Section II analyzes the impacts of four alternatives: (1) the No-Growth Alternative, (2) the No-Action Alternative, implementation of the 1981 208 plan, (3) the Hybrid Alternative, a combination of parts of the 1981 plan and the proposed amendments, and (4) the proposed action, as described in Section I. See Table 20 for a comparison of the four alternatives.

Alternative 1, the No-Growth Alternative, provides a baseline for comparison and represents the existing "on the ground" situation, as described in Section I, with application of the corrective and remedial programs for water quality management.

Alternative 2, the 1981 208 plan, has been implemented by TRPA and the designated management agencies from 1981 to the present. In adopting the 1981 208 plan, TRPA recognized that the 208 planning process and the thresholds-related planning process under the Compact were separate, but that adoption of the 208 plan was necessary to protect water quality until adoption of a revised Regional Plan under the Compact (TRPA, 1981b). In the 1981 208 plan, TRPA states that the plan will "be in effect only until the adoption by TRPA of a new Regional Plan, based on environmental threshold carrying capacities." (TRPA, 1981d, p. 1) Thus, TRPA intended the 1981 208 plan to be an interim plan, and consideration of amendments to the 1981 plan at this time is consistent with the previous findings of TRPA.

Alternative 3, the Hybrid Alternative, adds several water quality programs which are absent from the 1981 plan but which TRPA is already implementing. These programs are: the land use planning elements of the proposed action, the excess coverage mitigation program, the shorezone protection program, transfer of development (other than transfer of coverage), explicit offsets for projects by public entities which create coverage in excess of the Bailey coefficients, the SEZ restoration program, programs to control airborne nutrients, mandatory garbage pick-up, and the marina master plan requirements.

Alternative 3 represents the status quo, but TRPA does not intend the hybrid plan to be a long-term plan. Alternative 3 implements those standards of both the 1981 plan and the proposed 208 amendments which are consistent, but it is inconsistent with the TRPA Goals and Policies, the Code of Ordinances, and the recommendations of the Consensus Building

Workshop to resolve the litigation involving the TRPA, the League to Save Lake Tahoe, and the California Attorney General. (See Section I, p. 3, for additional discussion of this point.)

Alternative 4, the proposed 208 amendments, is similar to Alternative 3. The main changes from the hybrid plan are in the following areas: the Individual Parcel Evaluation System (IPES), transfers of land coverage, the identification of stream environment zones (SEZs), requirements for SEZ setbacks, and exceptions to the Bailey system of land capability classification.

Some differences between Alternatives 2, 3, and 4 reflect a shift in philosophy, strategy, or approach since the adoption of the 1981 plan, but result in no real differences in required control measures. For example, the 1981 plan includes an emphasis on the use of National Pollutant Discharge Elimination System (NPDES) permits to control the water quality impacts of stormwater discharges. However, since 1981 the U.S. Environmental Protection Agency (USEPA) has not promulgated a program to use NPDES permits for this purpose and, as a result, the proposed amendments place less emphasis on this tool.

A. THE NO-GROWTH ALTERNATIVE (Alternative 1)

The No-Growth Alternative incorporates the regulatory and remedial programs of the proposed amendments, but does not allow any new development in the Tahoe Region. Specifically, this alternative allows no new impervious coverage, no transfers of existing coverage, and no new encroachment on SEZs. However, it does include the following programs from the proposed amendments, as described in Section I, Chapter IV: the program of BMP implementation; the SEZ Protection and Restoration Program (Volume III), the Capital Improvements Program (Volume IV); the excess coverage mitigation program; water quality discharge standards and permits; land use planning and controls; transfer of development, provided no new coverage is created; native and adapted plant requirements; fertilizer reporting requirements; improved mass transit; combustion heater rules and related rules; waste management provisions; restrictions on shoreline encroachment and vegetation alteration; and restrictions on dredging and filling.

TABLE 20
Comparison Table of the Alternatives

Water Quality Management Control Measures	Alternative 1- No-Growth	2- No-Action	3- Hybrid Plan	4- Proposed Action
A. Urban Runoff and Erosion				
1. installation and maintenance of BMPs required on all property	yes	no	yes	yes
2. specific program of BMP implementation	yes	no	yes	yes
3. TRPA remedial actions to implement BMP requirements	yes	yes	yes	yes
4. implementation of Capital Imrovements Program (CIP)	yes	yes	yes	yes
5. excess coverage mitigation program	yes	no	yes	yes
6. effluent limits and permits	yes	yes	yes	yes
7. limits on new subdivisions	n/a	yes	yes	yes
8. land use planning and control	yes	no	yes	yes
9. residential development priorities	n/a	[1]	[1]	[2]
10. limits on additional land coverage	n/a	yes[3]	yes	yes
11. water quality mitigation program	n/a	yes	yes	yes
12. transfer of development				
a. residential development rights	yes	no	yes	yes
b. existing development	yes	no	yes	yes
c. land coverage	n/a	no	no	yes
d. residential allocations	n/a	yes	yes	yes
13. restrictions on SEZ encroachment	n/a	yes	yes	yes
14. SEZ restoration program	yes	no	yes	yes
15. SEZ setbacks	n/a	[4]	[4]	[5]
16. protection of native vegetation	yes	yes	yes	yes

Table 20, cont.

Water Quality Management Control Measures	Alternative			
	1- No-Growth	2- No-Action	3- Hybrid Plan	4- Proposed Action
A. Urban Runoff and Erosion, cont.				
17. native and adapted plant requirements for revegetation	yes	yes-	yes	yes
18. restoration of disturbed areas	yes	yes-	yes	yes
19. fertilizer reporting requirements	yes	no	yes	yes
B. Airborne Nutrients				
1. improved mass transit	yes	no	yes	yes
2. redevelopment and redirection of land use	no	no	no	yes
3. combustion heater, stationary source, and related rules	yes	no	yes	yes
C. Waste Management				
1. sewage collection and treatment policies	yes	yes	yes	yes
2. solid waste management policies	yes	yes	yes	yes
3. controls on hazardous materials and wastes	yes	yes-	yes	yes
4. snow and ice control BMPs and reporting requirements	yes	yes-	yes	yes
D. Natural Area Management				
1. requirements to apply BMPs on all property	yes	yes-	yes	yes
2. land use planning and controls	yes	no	yes	yes
3. control of encroachment in sensitive areas	yes	yes	yes	yes

Table 20, cont.

Water Quality Management Control Measures	1- No-Growth	2- No-Action	3- Hybrid Plan	4- Proposed Action
	Alternative			
E. Lake Tahoe and the Shorezone				
1. restrictions on shorezone encroachment and veg'n alteration	yes	no	yes	yes
2. shorezone BMPs	yes	no	yes	yes
3. vessel waste controls	yes	yes	yes	yes
4. dredging BMPs	yes	no	yes	yes
5. restrictions and conditions on dredging, filling, and construction in Lake Tahoe	yes	yes-	yes	yes

Key to Table 20

Alternative 1 -- No-Growth Alternative; no additional land coverage, no transfers of land coverage
Alternative 2 -- No-Action Alternative, implementation of the 1981 208 plan
Alternative 3 -- Hybrid Plan, adds additional water quality control measures to Alternative 2
Alternative 4 -- proposed 208 plan amendments

"yes" -- this program is a part of the alternative
"yes-" -- this program is a part of the alternative, but is significantly inferior or less-detailed than the other alternatives
"no" -- this program is not a part of the alternative

Footnotes

1. this alternative directs additional residential development to capability districts 4, 5, 6 and 7
2. this alternative directs additional residential development to capability districts 4, 5, 6, and 7 and, for single-family homes approved under IPES, to capability districts 1, 2, and 3.
3. this alternative allows overrides of the Bailey coefficients, with mitigation, for certain public projects
4. this alternative has no SEZ setbacks, but includes a buffer zone within the SEZ itself
5. this alternative includes SEZ setbacks from all SEZs

B. THE NO-ACTION ALTERNATIVE--1981 208 PLAN (Alternative 2)

As discussed in Section I, TRPA adopted the 208 plan in May, 1981 ("1981 208 plan" or "1981 plan"). It includes parts of three documents, listed in Section I, p. 3, and is implemented under TRPA Ordinances 81-4 and 81-5. The following pages describe the 1981 plan and parallels the outline of the description of the proposed amendments, Section I, Chapter IV.

In some areas of the 1981 plan, different policies apply to the California and Nevada portions of the Tahoe Region. This is the result of TRPA's adoption of portions of the Lake Tahoe Basin Water Quality Plan (SWRCB, 1980) for the portions of the Region within California. (See TRPA Ordinances 81-4 and 81-5.) The description of the No-Action alternative identifies, where applicable, those policies that apply in California only.

1. Urban Runoff and Erosion

a. Existing streets, roads, and highways

Best Management Practices. Alternative 2 relies on the regulatory powers of TRPA to remedy existing on-site runoff problems wherever they are identified (TRPA, 1981d, p. 95). TRPA Ordinance 82-4 (TRPA, 1982e), adopted in accordance with Condition C of EPA's approval, gives TRPA the authority to carry out the remedial program.

For the portions of the Region in California, this alternative provides that the Lahontan Board can issue waste discharge requirements (WDRs) or other orders requiring correction of existing erosion and runoff problems. WDRs are required for any discharge which may affect water quality, including discharges from existing streets, roads, and highways, unless the Lahontan Board waives the requirements (SWRCB, 1980, p. 142).

Through the WDRs, the Lahontan Board will require responsible persons to submit a schedule of compliance, detailing specific actions to be taken. If a person fails to comply with the WDRs or the schedule, the Lahontan Board may issue a cease and desist order, seek an injunction, or undertake the work itself and charge the property owner for the costs of the project (SWRCB, 1980, p. 142).

Capital Improvements Program. Alternative 2 contains a complete program for correcting existing erosion and drainage problems, presented in Figures VIII-1 through VIII-18 of the Water Quality Problems and Management Program (TRPA, 1977b). The proposed systems are conceptual; more detailed feasibility studies and designs are called for. This alternative includes a 20-year phased implementation schedule for construction of the improvements. TRPA will review projects for their cost-effectiveness, pursuant to the priority system developed by the SWRCB in the Lake Tahoe Basin Water Quality Plan (SWRCB, 1980) (TRPA, 1981d, p. 92; SWRCB, 1980, p. 106). A regulatory program will be utilized to ensure each phase is completed according to the implementation schedule, and NPDES permits or similar programs will be required to ensure timely implementation of all phases (TRPA, 1981d, p. 96).

Project priority groups are identified based on cost-effectiveness, estimated based on controllable soil loss, including sheet, rill, and gully erosion (SWRCB, 1980, pp. 108, 109). The top four project priorities address erosion on steep slopes and revegetation on all lands. The next three priorities deal with dirt roads, eroding shoulders, and drainage control in high erosion hazard lands. The remaining five priorities deal with dirt roads, eroding shoulders, and drainage control on moderate and low erosion hazard lands (SWRCB, 1980, p. 109).

These priorities are further divided into four control levels, which are meant to be achieved in five-year increments (SWRCB, 1980, p. 111):

Control Level	Priorities	Cumulative Sediment Reduction	Cumulative Cost
I	1-4	52%	26%
II	5-8	77%	52%
III	9-10	94%	80%
IV	11-12	100%	100%

Project priority lists for California and Nevada are included in the 1981 plan, Alternative 2. A priority ranking is not meant to preclude construction of a lower-priority project where it can be incorporated into a higher-priority project (SWRCB, 1980, p. 111).

None of the project lists include projects on lands managed by the United States Forest Service. However, under the 1981 plan, the USFS is responsible for planning, design, construction, and operation of erosion and runoff control projects on lands under its control.

b. Other Existing Urban Development

Best Management Practices. As described above under Existing Streets, Roads, and Highways, the 1981 plan includes a program to correct existing on-site erosion and runoff problems wherever they are identified (TRPA, 1981d, pp. 89-90). TRPA's authority to implement the program is set forth in Ordinance 82-4.

For discharges in California, the Lahontan Board can issue WDRs or other orders requiring correction of erosion and runoff problems, either on private property or where other agencies fail to act. WDRs are required for any discharge which may affect water quality unless the Regional Board waives the requirement (SWRCB, 1980, p. 141). Local government and TRPA are encouraged to adopt programs to require property owners to control on-site runoff from driveways and dirt roads, including sites not otherwise before the TRPA (SWRCB, 1980, pp. 157-158).

Excess Coverage Mitigation. This program, described in Section I, Chapter IV, is not a part of the 1981 208 plan, Alternative 2.

c. Existing Urban Drainage Problems

Best Management Practices. The program of BMP implementation for existing urban drainage problems in Alternative 2 is the same as described above for existing streets, roads, and highways, but with a stronger emphasis on effluent limitations and discharge permits, as follows:

Effluent Limitations and Discharge Permits. The 1981 plan includes a program to correct existing water quality problems from drainage systems wherever they are identified. NPDES permits may be issued, where a responsible state agency finds it necessary. These NPDES permits shall be consistent with TRPA regulations (TRPA, 1981d, p. 90).

The California-side policies say that general NPDES permits should be issued for each city or county in the Region, covering discharges from storm sewers. Other individual permits may also be issued. The permits must include compliance schedules consistent with the plan (SWRCB, 1980, p. 143). [Note: Although no NPDES permits have been issued under the existing plan, the Lahontan Board has issued WDRs to the three units of local government on the California side, as described in Section I, Chapter IV.]

The California-side policies require all persons subject to the stormwater discharge permits to comply with the other control measures of the plan, including the prohibitions on new subdivisions; coverage on individual parcels in excess of the Bailey (1974) coverage coefficients; construction in SEZs; and construction not offset by erosion and runoff control projects (SWRCB, 1980, p. 159).

d. Additional Development

Best Management Practices. The regulatory controls of the 1981 208 plan include application of BMPs to all new development, in accordance with the BMP Handbook (TRPA, 1978, p. VII-17; SWRCB, 1980, p. 161).

The California-side policies provide additional detail on the application of BMPs to additional development. Temporary stabilization measures must be installed as soon as possible after soil disturbance to protect the surface during construction. Permanent stabilization measures must be integrated into construction plans. Revegetation must be provided as soon as possible, and vegetation must be protected during construction, in accordance with the BMP Handbook (SWRCB, 1980, pp. 118, 128). The land owner is responsible for the costs of erosion control on private lands, however, technical advice is available from the Soil Conservation Service and the Resource Conservation Districts (SWRCB, 1980, p. 144).

Limits on New Subdivisions. The 1981 plan prohibits construction of subdivisions not previously approved by TRPA, except as provided in the Tahoe Regional Planning Compact, Article VI(c)(1) (TRPA, 1981d, p. 90). Article VI(c)(1) of the Compact creates a special exemption to the subdivision moratorium for subdivision of land owned by a general improvement district, which existed and owned the land before December 19, 1980, "if subdivision of the land is necessary to avoid insolvency of the district."

The California-side rules prohibit the discharge or threatened discharge of solid or liquid waste attributable to the development of any new subdivision. A new subdivision is defined as any new development involving the division of a parcel into two or more lots or condominiums which results in greater land coverage or disturbance or divides the parcel into five or more lots or condominiums (SWRCB, 1980, Table IV-5, p. 165).

Land Use Planning and Control. The land use plan for the Tahoe Region described in Section I, Chapter IV, is not a part of the 1981 208 plan, Alternative 2.

Limits on Land Coverage. The 1981 208 plan, Alternative 2, requires future development to comply with the Bailey coefficients on a lot-by-lot basis (TRPA, 1981d, p. 87). Lot consolidation or expansion of the project area to satisfy the Bailey coefficients is acceptable. Overrides of the Bailey coefficients are not allowed, except for approved erosion control work or creation of coverage by a public entity where necessary for the implementation of the air quality nonattainment plan or the transportation element of the regional plan, public recreation, or protection of the public health, safety, and general welfare, provided all other feasible alternatives have been exhausted (TRPA, 1981b, Ordinance 81-5, Section 14.20). Where overrides are allowed, mitigation is required, which may or may not involve transfers of land coverage.

For portions of the Region within California, the discharge or threatened discharge of solid or liquid wastes attributable to new development which is not in accordance with land capability is prohibited (SWRCB, 1980, p. 165), with the exceptions as noted above.

Water Quality Mitigation. The 1981 208 plan provides that new development will be based on an offset of anticipated erosion problems, and sets forth a mitigation fee schedule (TRPA, 1981e, p. 28).

The California-side rules prohibit the discharge or threatened discharge of solid or liquid wastes from development not offset by implementation of remedial erosion control measures (SWRCB, 1980, p. 165). New development must be phased in as remedial projects are implemented, and offset policies should tie the level of development to progress on construction of remedial projects (SWRCB, 1980, pp. 128, 168).

Transfer of Development. The 1981 plan includes general policies which encourage transfers of development. TRPA will encourage existing development to transfer to areas outside SEZs which meet the requirements of the water quality plan, and will initiate an ordinance amendment (TRPA, 1981d, p. 83). TRPA Ordinance 81-5 (TRPA, 1981b), as amended, includes a limited transfer program for commercial uses within individual watersheds in Nevada.

e. SEZ Encroachment

Restrictions on SEZ Encroachment and Vegetation Alteration. The 1981 plan prohibits construction, grading, and vegetation removal within stream environment zones (SEZs). Development is permitted within SEZs only for approved erosion control work or projects necessary for implementation of the air quality nonattainment plan or the transportation element of the Regional Plan, or necessary for public recreation or the protection of the public health, safety, or general welfare, provided all feasible alternatives have been exhausted (TRPA, 1981b, Ordinance 81-5, Section 13.30). Where development is allowed within SEZs, mitigation is required. TRPA will conduct site reviews to determine the limits of SEZs, in accordance with the procedures defined in the BMP Handbook (TRPA, 1978).

The prohibitions on development in SEZs do not apply to SEZs modified prior to the effective date of TRPA ordinances so as to alter land capability, soils, hydrology, geomorphology, and vegetation, provided that only the TRPA Board may designate a SEZ man-modified, after making the required findings. Future development of such areas requires mitigation of existing SEZ impacts (TRPA, 1981d, p. 83).

For the portions of the Region within California, the discharge or threatened discharge of solid or liquid wastes attributable to new development in SEZs in prohibited (SWRCB, 1980, p. 165), with the exceptions as noted above. The California-side policies do not adopt SEZ maps, but reply on site-specific identification of SEZ boundaries according to the procedures in the 1977 BMP Handbook (SWRCB, 1980, p. 174).

The 1981 plan identifies the boundary of an SEZ as the outermost boundary of the following four attributes: (1) a buffer strip 100 feet on each side from the edge of the stream channel for third order or greater streams, 50 feet on each side from the stream centerline for second order streams, and 25 feet on each side from the stream centerline for first order streams, (2) alluvial soil types Lo, Ev, Co, Mh, Gr, and Fd (Rogers, 1974), (3) existing riparian vegetation, and (4) the 100-year flood plain (TRPA, 1978, p. III-6).

SEZ Restoration Program. The SEZ Restoration program, described in Section I (p. 136) and presented in Volume III, is not a part of the 1981 208 plan, Alternative 2.

SEZ Setbacks. Except for livestock confinement facilities (see p. 205), the 1981 plan does not employ SEZ setbacks. Instead, the 1981 plan utilizes buffer strips based on stream order to set development back from stream channels. The buffer strip is part of the SEZ, and is allowed one percent impervious coverage under the Bailey coefficients. The 1981 plan includes no SEZ buffers or setbacks in the absence of a stream channel.

f. Vegetation Displacement

The 1981 plan, Alternative 2, requires the protection of native vegetation during and after construction (TRPA, 1978, p. I-15; SWRCB, 1980, p. 118). Native plants shall be used to the maximum extent possible in revegetation projects (TRPA, 1978, p. XI-2).

g. Fertilizer Management

Best Management Practices. The 1981 plan (Alternative 2) includes BMPs for fertilizer use. The BMP Handbook (TRPA, 1978, p. XI-49) states that fertilizer shall be used only when soil nutrient deficiencies exist and establishment of desired vegetation is impaired. The BMPs cover types and rates of fertilizer use for general, seeding, and planting applications.

The bi-state policies of the 1981 plan incorporate BMP XII-C (TRPA, 1978, p. XII-3) as a guideline for golf courses. Slow release fertilizers which release nutrients due to bacterial action are preferred for use on golf courses. Application rates shall not exceed the rates stated in the BMP Handbook. [Note: Although the 1981 plan says that BMP XII-C includes "a prohibition of use of fertilizer of the fast release variety," (TRPA, 1981d, p. 96), it contains no such prohibition. Therefore, Alternative 2 contains a preference for slow-release fertilizers, but does not prohibit fast-release fertilizers, and identifies some situations where fast-release fertilizers are appropriate.]

The policies for the portions of the Region in California add additional detail on BMPs for fertilizer control on golf courses. Golf courses should have a control plan covering nutrient loads, nutrient pathways, and control strategies. Fertilizer use must be strictly limited in SEZs (SWRCB, 1980, p. 118). The control strategies shall include (1) annual, monthly, and daily fertilizer limits, (2) controlled drainage, (3) maintenance of drainage systems, and (4) surface and groundwater monitoring (SWRCB, 1980, p. 119).

Also, the California-side policies limit fertilizer use at existing golf courses to the minimum necessary to maintain the facilities, and prohibit further encroachment of golf courses into SEZs and fertilizer use on new or expanded golf courses except where they are relocated away from SEZs (SWRCB, 1980, p. 119).

Effluent Limitations and Discharge Permits. The 1981 plan provides that state water quality agencies may issue NPDES permits or use similar mechanisms to control the discharge of nutrients from fertilizer to the surface or groundwaters of the Tahoe Region. The Lahontan Board has initiated the process of issuing WDRs to golf courses in the California portions of the Tahoe Region, as described in Section I (p. 140).

Reporting Requirements. Reporting requirements for users of fertilizers are not a part of the 1981 208 plan, Alternative 2.

2. Airborne Nutrients

The 1981 208 plan does not include specific control measures to control airborne nutrients, other than BMPs to control dust. The California-side policies call for studies of the atmospheric contributions to water quality problems (SWRCB, 1980, p. 180). Programs such as improved mass transit, redevelopment and redirection of land use, and emission limitations for combustion heaters and other sources are not a part of the 1981 208 plan, Alternative 2.

3. Waste Management

a. Sewage Collection and Treatment

Alternative 2, the 1981 plan, includes the California and Nevada prohibitions on the discharge of sewage in the Tahoe Basin (TRPA, 1977b, p. IV-3). Each sewage disposal agency should make available to all land use and water quality management agencies annual reports which provide the following information: (1) the capacity of all elements of its collect, treatment, and export systems, (2) present needs and capacity demands of the service area, (3) projected needs and capacity demands for the next 10-year period together with population projections upon which those needs are based, and (4) proposed actions, including time schedules and financial requirements and sources for providing the necessary capacity, including programs to control infiltration, programs to implement water conservation, and plans to increase capacity (TRPA, 1977b, pp. IV-8, IV-13).

The California-side policies provide additional detail on elimination of accidental releases, reduction of sewer line exfiltration, effluent limitations, and development not connected to sewers, as follows:

<u>Elimination of Accidental Release</u>. All sewage collection and disposal agencies should have preventive maintenance and spill response programs, and shall develop such programs as conditions of grants, WDRs, and NPDES permits (SWRCB, 1980, pp. 134, 181). Sealed manhole covers should be added to sewer lines parallel to the shoreline of lakes or in SEZs, or the sewer lines should be relocated to higher ground (SWRCB, 1980, p. 134).

<u>Reduction of Sewer Line Exfiltration</u>. All grants, WDRs, or NPDES permits should require study of the exfiltration problem. State water quality agencies may enforce violations of the discharge standards (SWRCB, 1980, pp. 134, 181).

Effluent Limitations. The California-side rules also require annual reports from sewage disposal agencies operating under NPDES permits or WDRs. The reports must state (1) the effective capacity of each process module, (2) current high flows, (3) the allocation of capacity to existing and future development, (4) the number of additional connections projected, and (5) proposed actions to increase capacity. The reports shall be reviewed by the Lahontan Board and NDEP and made available to the public (SWRCB, 1980, pp. 200, 201).

Development Not Connected to Sewers. A survey is needed to find development not connected to the sewer. Utility records should be checked, and dye or smoke tests used as required. Exceptions under state law to the prohibition on wastewater discharge should be checked periodically for compliance with their discharge requirements (SWRCB, 1980, p. 135).

b. Solid Wastes

Prohibition on Solid Waste Disposal. This alternative would continue the policy of exporting solid waste from the Tahoe Region (TRPA, 1977b, p. IV-13; SWRCB, 1980, p. 238). For portions of the Region within California, the designated solid waste management agencies should prepare comprehensive plans; pursue the goals of waste reduction, recycling, and resource recovery; address short-term and long-term contingency plans regarding the availability of landfills; and increase the amount of waste collected (SWRCB, 1980, pp. 135, 182). Where monitoring programs identify water quality problems from past disposal sites, remedial actions should be taken, as for erosion control (SWRCB, 1980, p. 183).

Mandatory Garbage Pickup. Mandatory garbage pick-up is not a part of the 1981 208 plan, Alternative 2.

c. Hazardous Materials and Spills

The bi-state policies of the 1981 plan do not address prevention or abatement of toxic or hazardous spills. For portions of the Region within California, the plan calls for an interagency spill plan for toxic and hazardous spills, which should include: (1) incident reporting, (2) lines of communication, (3) areas of responsibility, (4) chain of command, and (5) response, clean-up, and disposal procedures (SWRCB, 1980, p. 136).

d. Snow and Ice Control

The bi-state policies of the 1981 plan do not address control of water quality problems resulting from snow and ice control. For portions of the Region within California, snow disposal areas should be located on high-capability land with rapid permeability, and should be separated from SEZs and contained with berms (SWRCB, 1980, p. 118).

4. Natural Area Management

a. Timber Harvest

Best Management Practices. Alternative 2, the 1981 plan, requires the implementation of BMPs for existing problems on forest lands (TRPA, 1981d, p. 96). The BMP Handbook requires a construction plan as a part of all logging, timber harvest, or forest products removal permit applications, and requires annual progress reports. No riparian vegetation may be disturbed or removed during timber harvesting operations. Self-monitoring of surface runoff water quality, revegetation, slope stabilization, drainage, and infiltration facilities shall be conducted by all timber harvesters for ten years following the harvest (TRPA, 1978, p. XII-4).

For portions of the Region within California, the Plan requires these additional measures to protect water quality: (1) no permanent soil disturbance in SEZs, high erosion hazard lands, soils with low productivity, or soils with low revegetation potential, (2) tree removal on high erosion hazard lands must be by helicopter, balloon, over-snow, or an equivalent method, (3) no vegetation must be disturbed in or removed from SEZs except to maintain the health, diversity, and character of the SEZ, and (4) all tree cutting is limited to tree selection operations except to remove diseased or infested trees or to maintain the health of vegetation.

No clear-cut logging is permitted (TRPA, 1981d, p. 92; SWRCB, 1980, p. 130).

Land Use Planning and Control. The 1981 plan, Alternative 2, does not include land use controls that limit timber harvest to certain areas of the Tahoe Region.

b. Outdoor Recreation

Best Management Practices. The 1981 plan, Alternative 2, requires all ski areas to file an annual report identifying water quality and related revegetation and slope stabilization problems, efforts of the past year to solve these problems, and a proposed schedule for correction of remaining problems. Ski areas shall immediately stabilize and revegetate all slopes upon completion of any grading, construction, or vegetation removal (TRPA, 1978, p. XII-2).

For the portions of the Region within California, dirt roads in developed campgrounds should be surfaced, or closed and revegetated. Other control measures may be required, such as infiltration or relocation of facilities (SWRCB, 1980, p. 131). Ski run and trail maintenance vehicles must not be operated in a manner that disturbs the soil. Snow cover must be sufficient to protect the soil (SWRCB, 1980, p. 132).

Control of Encroachment in Sensitive Areas. With respect to ski areas, the 1981 plan, Alternative 2, prohibits channelization, diversion, or other manipulation of streams. No physical structures or other improvements are allowed within SEZs. No riparian vegetation may be removed. Crossing of any SEZ with a ski run shall be accomplished with as little disturbance to the natural stream alignment, gradient, vegetation, and channel as possible (TRPA, 1978, p. XII-2).

For new ski resorts within California, the 1981 Plan includes additional restrictions: (1) new roads are prohibited on high erosion hazard lands and in SEZs, (2) there shall be no soil disturbance greater than one percent on high erosion hazard lands, soils with low productivity, or soils with low vegetation potential, (3) stream crossings shall not affect greater than five percent of the total SEZ within the ski area, with no cuts or fills in any SEZ, no SEZ relocation, and original grades maintained at all crossings, (4) no soil disturbance is permitted within SEZs except for stream crossings, and (5) where vegetation is removed, revegetation shall take place with native plants and rhizomatous grasses (SWRCB, 1980, p. 133).

For portions of the Region in California, construction of new campgrounds is subject to the coverage restrictions and BMP requirements of the water quality plan, and campground development shall not be permitted in high erosion hazard lands or SEZs (SWRCB, 1980, p. 131).

Land Use Planning and Control. The 1981 plan, Alternative 2, does not include land use controls that limit outdoor recreational uses to certain areas of the Tahoe Region.

c. Off-Road Vehicle Use

Under Alternative 2, the 1981 208 plan, off-road motorized vehicle (ORV) use is prohibited except within areas specifically designated for that use. Areas for ORV use shall be designated open, closed, or restricted. Open areas may be used in an essentially unrestricted manner. ORVs are prohibited in closed areas. In restricted areas, ORVs may operate subject to specified conditions such as time of year, access routes, through travel only, and camping restrictions (TRPA, 1978, p. XII-5).

Establishment of open areas shall be prohibited unless it is determined that the designation will not result in vegetation damage or disturbance, increase fire hazards, or interfere with the objectives of the water quality plan. Restricted areas may be designated only for travel on designated routes where existing rights-of-way are not creating erosion or vegetation problems. All areas designated for open or restricted use shall provide protection for SEZs and high erosion hazard lands. They shall also provide camping facilities, garbage collection, and sewage facilities in areas of concentrated ORV use (TRPA, 1978, pp. XII-5, 6).

d. Livestock Confinement and Grazing

Under the 1981 208 plan, Alternative 2, livestock confinement facilities shall not be located within 100 feet of an SEZ, nor shall surface water be allowed to flow from these facilities into an SEZ. Stockpiling of animal wastes within 100 feet of an SEZ is prohibited, and surface runoff from animal waste stockpiles shall not flow into an SEZ. Livestock confinement facilities shall not be located on sites which exceed five percent slope, and must be in land capability districts 5, 6, or 7.

Animal confinement facilities shall not be located on land with high groundwater (within 48 inches of the surface at any time of the year), and shall be equipped with infiltration systems to infiltrate a 5-year, 6-hour storm.

No manure storage or disposal piles shall be located at animal confinement facilities unless they are protected from precipitation and surface runoff. Manure shall be exported from the Region or composted and used for revegetation by October 15 of each year (TRPA, 1978, p. XII-2).

e. Pesticides

The 1981 208 Plan contains no provisions specifically addressing the use of pesticides in the Tahoe Region. Pesticide use must be consistent with state water quality standards.

5. Water Quality Problems in Lake Tahoe and the Shorezone

a. Shoreline Erosion

The 1981 plan does not contain provisions which specifically address water quality problems related to shoreline erosion in Lake Tahoe and other lakes in the Region. To the extent that the portions of the shorezone are identified as SEZs, they are afforded the protection of SEZs.

b. Vessel Wastes

The 1981 plan cites the prohibitions in state law against discharges of wastewater in the Tahoe Region. Prohibitions of discharge of waste from boats should be strictly and vigorously enforced to protect the public health. The 1981 plan also requires restrooms, pumpout facilities, and trash receptacles to be provided at commercial marinas and harbors, and requires boat washing facilities to be connected to a sewer system unless an acceptable alternative is provided (TRPA, 1977b, p. IV-15; SWRCB, 1980, p. 136).

The 1981 plan does not require master plans for marina expansion or controls on anti-fouling coatings.

c. Dredging and Construction in Lake Tahoe

The bi-state policies of the 1981 208 plan do not address water quality problems from dredging and construction in Lake Tahoe. The California-side policies call for the development of BMPs, and require construction in Lake Tahoe to be surrounded by vertical sediment barriers (SWRCB, 1980, p. 135).

The California-side policies also prohibit the discharge, or threatened discharge, of solid or liquid wastes attributable to new pier construction in significant fish spawning habitat or areas immediately offshore of stream inlets to a depth of 30 feet (SWRCB, 1980, p. 183). Pier construction is discouraged in other prime fish habitat, and piers and jetties should not block currents (SWRCB, 1980, p. 135).

Section 404 of the federal Clean Water Act requires a Army Corps of Engineers permit for any project involving placement of fill or earthen material in wetlands. Such permits cannot be issued without state certification regarding attainment of water quality standards. The California-side policies state that the Corps should not use general permits to regulate such activities in the Tahoe Region (SWRCB, 1980, p. 166).

C. THE HYBRID ALTERNATIVE (ALTERNATIVE 3)

The third alternative addressed in this impact assessment adds several water quality programs which TRPA is already implementing to the 1981 plan (Alternative 2). It represents the status quo, but is not considered a viable long-range alternative. (See discussion at page 189.)

The following paragraphs describe only those programs which would be added to the 1981 plan, Alternative 2, under this alternative. The balance of the water quality management programs are exactly as described for the 1981 plan.

1. Urban Runoff and Erosion

Program of BMP Implementation. The hybrid plan (Alternative 3) includes the program of BMP implementation described in Section I (p. 108). When a property owner applies to TRPA for a development permit, TRPA shall require application of BMPs to the project site as a condition of approval. When the project involves modification of an existing facility, TRPA shall also require preparation of a plan and a schedule for retroactive application of BMPs to the entire parcel or project area. The proportion of retrofit work required at the time of project implementation is a function of the cost and the nature of the project in question.

For persons who have no cause to come before TRPA for a project approval, TRPA will rely initially on voluntary compliance and public education to implement the BMPs. If TRPA identifies a significant environmental problem resulting from a lack of BMPs, TRPA may also request or require a remedial action plan to correct the problem.

Limits on Land Coverage and SEZ Encroachment. Like the 1981 plan, the hybrid plan (Alternative 3) allows the creation of land coverage in land capability districts 1, 2 and 3 and SEZs for projects by public entities where necessary for the implementation of the air quality nonattainment plan or the transportation element of the regional plan, public recreation, or protection of the public health safety, and general welfare, provided all other feasible alternatives have been exhausted. However, the hybrid plan adds the explicit requirement that land in capability districts 1, 2 and 3 must be restored in an amount 1.5 times the area disturbed beyond what the Bailey coefficients would allow or, if the project is in an SEZ, 1.5 times the area of SEZ disturbed by the project.

Excess Coverage Mitigation Program. The hybrid plan (Alternative 3) incorporates the excess coverage mitigation program described in Section I (p. 111) into the 1981 208 plan. When projects are approved for modification or rehabilitation of facilities on parcels with existing coverage in excess of the Bailey coefficients ("excess coverage"), the land coverage mitigation program provides for the reduction of coverage in an amount proportional to the cost of the project and the extent of excess coverage. To accomplish these reductions, property owners may (1) reduce coverage on-site, (2) reduce coverage off-site within the hydrologically-related area, (3) in lieu of coverage reduction, pay an excess coverage mitigation fee to a land bank established to accomplish coverage reductions, (4) consolidate lots or adjust lot lines, or (5) any combination of the above.

Land Use Planning and Control. The hybrid plan (Alternative 3) adds land use planning and control to the 1981 208 plan, as described in Section I (p. 114). The land use plan, as set forth in the Goals and Policies and the Plan Area Statements and Maps, assists TRPA in meeting its water quality objectives by directing additions and changes in land use to the most appropriate areas.

Transfer of Development. The hybrid plan incorporates transfer programs, except for transfers of land coverage that result in coverage on a parcel exceeding the Bailey coefficients, into the 1981 208 plan. There are three types of transfer programs which are included in the hybrid plan: transfers of residential development rights, transfers of existing development, and transfers of residential allocations. For a description of these programs, see Section I (p. 126).

SEZ Restoration Program. Alternative 3, the hybrid plan, includes the SEZ restoration program, set forth in Volume III.

Fertilizer Reporting Requirements. The hybrid plan, Alternative 3, adds fertilizer reporting requirements to the 1981 208 plan, Alternative 2. As described in Section I (p. 140), TRPA may require uses that require regular fertilizer maintenance (e.g., golf courses) to submit fertilizer management programs for TRPA review and approval. Large users of fertilizer identified by TRPA shall initiate tracking programs to monitor fertilizer use on lands under their control.

2. Airborne Nutrients

The hybrid plan, Alternative 3, adds programs to control the deposition of airborne nutrients on Lake Tahoe to the 1981 208 plan. The programs include improved mass transit, redevelopment and redirection of land use, and emission limitations for combustion heaters, to the extent that these programs are consistent with the 1981 plan's limitations on land coverage and disturbance of SEZs. For more information on these programs, see Section I, p. 141.

3. Waste Management

Mandatory Garbage Pickup. The hybrid plan adds the requirement of mandatory garbage pickup to the 1981 208 plan. (See Section I, p. 145.)

Snow and Ice Control. The hybrid plan adds requirements to provide BMPs for snow and ice control, and reporting requirements for persons using highway abrasives and deicers, to the 1981 208 plan. (See Section I, p. 146.)

4. Natural Area Management

Land Use Planning and Control. The hybrid plan (Alternative 3) adds land use planning and control for natural areas to the 1981 208 plan, as described in Section I (pp. 149, 153). The land use plan, as set forth in the Goals and Policies and the Plan Area Statements and Maps, assists TRPA in meeting is water quality objectives by directing additions and changes in land use to the most appropriate areas. Planning and controls for natural areas cover timber harvest, outdoor recreation, ORV use, and livestock confinement and grazing.

Pesticide Controls. The hybrid plan (Alternative 3) adds pesticide control provisions, as described in Section I (p. 154) to the provisions of the 1981 208 plan.

5. Water Quality Problems in Lake Tahoe and the Shorezone

Shoreline Erosion. The hybrid plan (Alternative 3) adds restrictions on shorezone encroachment and vegetation alteration, and requirements for BMPs in shorezone areas, to the 1981 plan, Alternative 2. These programs, described in Section I (p. 154) restrict shorezone development in accordance with the shorezone tolerance districts depicted on TRPA overlay maps, and require the application of BMPs to public and private lands in shorezone areas, as in all other areas of the Region.

D. THE PROPOSED ALTERNATIVE--AMENDMENTS TO THE 208 PLAN AS DESCRIBED IN SECTION I (Alternative 4)

The fourth alternative addressed in this assessment of environment, social, and economic impacts is the proposed amendments to the 208 plan described in Section I. Rather than TRPA repeating the description of the proposed action here, the reader should refer to Section I, Chapter IV. That description follows the same outline as the description of the 1981 plan, Alternative 2.

Alternative 4 is most similar to the hybrid plan, Alternative 3, but it contains several key concepts which cannot be implemented under the 1981 208 plan, and which are not included in Alternatives 2 and 3. The following paragraphs summarize the water quality management programs unique to Alternative 4:

Individual Parcel Evaluation System (IPES). IPES is a development priority system for single-family parcels which directs development first to those parcels most suitable for development in accordance with the thresholds and other considerations. IPES evaluates a parcel with respect to seven criteria and ranks them from most suitable to least suitable, by jurisdiction. Only parcels in the top rank as defined by TRPA may pursue a building permit. The numerical level defining the top rank for any jurisdiction may be lowered annually by the number of allocations utilized in that jurisdiction the previous year, provided a number of conditions are met. (For a detailed description of IPES, see Section I, p. 116.)

Under the 1981 208 plan (Alternative 2), TRPA determines the eligibility for development of single-family homes by limiting development to land capability districts 4, 5, 6 and 7, as set forth in the Bailey Report.

However, based on the recommendations of the Consensus Building Workshop to develop and implement a new system which is credible and understandable by the public and as accurate, objective, and scientific as possible, the TRPA proposes to amend the 1981 plan by incorporating IPES.

Coverage Transfers. Based on recommendations from the Consensus Building Workshop and the IPES technical committee, TRPA has adopted policies allowing for limited transfers of coverage between parcels, and proposes to amend the 1981 208 plan to accommodate these policies. The allowed base coverage on a parcel (i.e., the Bailey coverage) may be increased by transfer within hydrologically-related areas up to the limits set forth in Table 15. Only certain uses in certain circumstances may increase their allowed coverage by transfer. (For a detailed description of coverage transfers, see Section I, p. 121.)

The 1981 plan (Alternative 2) sets the allowable impervious coverage for a given parcel or project area by applying the coverage coefficients in the Bailey report with certain exceptions. The TRPA threshold for soil conservation also states that impervious coverage shall comply with the Bailey Report.

SEZ Criteria and Setbacks. The 1981 208 plan (Alternative 2) identifies SEZs using four criteria: minimum buffer strip, riparian vegetation, alluvial soils, and 100-year flood plain. However, the TRPA Goals and Policies (TRPA, 1986a) say that this process shall be reviewed and revised pursuant to the recommendations of the IPES technical committee (Goals and Policies, p. IV-25). The IPES technical committee recommended refined criteria for SEZ identification, based on the use of primary and secondary SEZ indicators. (For a detailed description of these criteria, see Section I, p. 133).

One of the recommendations of the IPES technical committee was to separate buffers, or setbacks, from the SEZ itself. Thus, under the proposed amendments to the 208 plan (Alternative 4), only areas displaying the hydrological and biological features of an SEZ are identified as SEZ; setbacks are provided from the edge of all SEZs. Under the 1981 Plan (Alternative 2), buffer zones are included within the SEZ, and may or may not provide setbacks from the hydrological and biological attributes of the SEZ.

Exceptions to the Restrictions on Land Coverage and SEZ Disturbance. The 1981 plan (Alternative 2) allows exceptions to the prohibitions on development in SEZs and in excess of the Bailey coefficients for approved erosion control work and for projects necessary to implement the approved air quality nonattainment plan or the transportation element of the Regional Plan, or for public recreation or the protection of the public health, safety, or welfare, provided all feasible alternatives have been exhausted and mitigation is provided (TRPA Ordinance 81-5).

The proposed amendments (Alternative 4) allow exceptions to the prohibitions on SEZ disturbance and disturbance in excess of the Bailey coefficients only by transfer or with 1.5:1 offsets. The proposed amendments allow land coverage in SEZs for public health and safety, environmental protection, public outdoor recreation, and access to otherwise buildable sites, provided that TRPA makes required findings and all encroachment is offset by restoration of disturbed SEZs at the rate of 1.5:1. (For a detailed description, see Section I, pp. 121, 125, 129.)

The proposed 208 amendments allow coverage in excess of the Bailey coefficients by transfer only, only for certain uses and circumstances, as described in Section I (p. 121) and under Coverage Transfers, above.

Finally, for portions of the Region within California, the 1981 Plan (Alternative 2) prohibits certain uses in land capability districts 1, 2, and 3: campgrounds, ski area roads, and livestock confinement facilities. All other uses are allowed, provided they conform to the coverage coefficients of the Bailey system. (See Ordinance 81-5, TRPA, 1981b.) The proposed 208 amendments (Alternative 4) permit only certain new uses in capability districts 1, 2, and 3, and prohibit all others. Public outdoor recreation and public service uses may be permitted in capability districts 1, 2, and 3, provided TRPA makes the required findings, and any coverage in excess of the Bailey coefficients is offset at a rate of 1.5:1. (Coverage in excess of the Bailey coefficients is not allowed unless provided for under the policies governing coverage transfers.)

Other differences. In addition to these four main categories, there are other differences between Alternative 4 and Alternatives 2 and 3 which may affect the analysis of environmental, social, and economic impacts. The 1981 plan, includes more-detailed rules regarding the use of fertilizers on golf courses in California; requires annual reports from wastewater collection and treatment facilities and ski areas; calls for development of a comprehensive solid waste management plan; sets up a three-level system of land designations for ORV use; establishes different performance standards for grazing and livestock confinement; calls for additional waste management practices at marinas; and sets different limits on construction within the shorezone of Lake Tahoe. The impacts of these different policies will be discussed in Chapter II, Probable Environmental, Social, and Economic Impacts of the Proposed Action and Alternatives. See Table 20 for a summary of all the provisions of the four alternatives.

II. PROBABLE ENVIRONMENTAL, SOCIAL, AND ECONOMIC IMPACTS OF THE PROPOSED ACTION AND ALTERNATIVES

The following discussions of the major considerations cover the applicable standards, the existing situation, and anticipated impacts and required mitigation for each alternative. Detailed technical discussions referred to in the text of this chapter appear in the Technical Appendix, Volume VII.

A. LAND USE

1. Applicable Standards

The land use plans of local government, federal and state land management agencies, and TRPA constitute the applicable land use standards in the Tahoe Region. Where there are differences between other land use plans and TRPA's Plan Area Statements, the most stringent requirements are applied. Units of local government have attempted to make their zoning consistent with the TRPA standards to minimize conflicts.

The Plan Area Statements (TRPA, 1987d) are described in Section I (p. 114). They implement specific land use policies, such as permissible uses and densities, for areas of similar use and character. TRPA may also adopt more-detailed plans, such as community plans and master plans, which constitute additional land use standards.

2. Existing Situation

Existing land use in the Tahoe Region is described in the Setting (Section I, Chapter II). The TRPA Goals and Policies and Plan Area Statements and Maps constitute a land use plan which is being implemented under the authority of the Compact. Activities in the Region must comply with the land use plan which restricts new subdivisions, identifies permissible uses, adopts land use districts and themes, limits land coverage and disturbance on sensitive lands, restricts development in flood plains, and targets SEZs for restoration.

The Regional Plan establishes the theme of development with mitigation as the dominant land use theme, but also provides for maximum regulation of certain areas, such as the portion of the Desolation Wilderness within the Tahoe Region (consistent with federal statutes and the LTBMU Land and Resource Management Plan), and for redirection of land use in blighted areas, such as the City of South Lake Tahoe redevelopment area.

As of October, 1988, the Redevelopment Agency of the City of South Lake Tahoe is preparing a redevelopment plan for the redevelopment area between Ski Run Boulevard and the south stateline. Community planning, as described in Section I (p. 115) is underway in Tahoe City and Douglas County. The TRPA has adopted a preliminary plan for Tahoe City.

3. Anticipated Land Use Impacts

a. No-Growth Alternative (Alternative 1)

The No-Growth Alternative (Alternative 1) allows no new impervious coverage in the Tahoe Region and no transfer of existing coverage between parcels. It limits new development to rehabilitation only, and allows transfers of development provided they involve no new coverage or transfer of coverage.

Under the No-Growth Alternative, redevelopment and community planning programs would have to observe the policies of no new coverage and no transfers of existing coverage. These policies would tend to discourage redevelopment and remove incentives for community planning under the Goals and Policies. Thus, the negative aspects of the existing urban land use pattern would be perpetuated. The existing land use matrix includes many facilities that have become obsolete, and the inadequacies of the built environment are detrimental to the economic vigor of the Region (Urban Land Institute, 1985). Many of the tourist-serving facilities are 30 to 40 years old and do not meet the needs of current visitors and the potential visitor market (Economic Technical Committee, 1986).

This alternative would freeze existing land use types, locations, and intensities as they are today, except as they would be affected by rehabilitation and transfer of development. The rehabilitation of existing structures would generate coverage mitigation projects, primarily on property of low economic efficiency, since the land bank or a person doing a private mitigation project will normally attempt to minimize the cost of mitigating coverage. The Tahoe Conservancy, in a staff report on land coverage banking, said that properties obtained by the Conservancy for coverage mitigation would tend to be environmentally sensitive or restorable parcels with substandard structures on them (California Tahoe Conservancy, 1988).

TRPA has estimated, based on projected levels of permit activity, that the coverage mitigation program would restore about three acres of coverage per year (TRPA, 1988a). Over 20 years, the program could restore approximately 60 acres of coverage.

However, the reduction in incentives for redevelopment and community planning might lower the propensity to rehabilitate properties, leading to a lower rate of coverage reduction than projected. The results would be spread evenly around the Region, since excess coverage must be mitigated within hydrologically related areas.

The SEZ restoration program, a part of the No-Growth Alternative, will create new areas of open space and opportunities for passive recreation. TRPA thresholds require restoration of 25 percent (or about 1100 acres) of the disturbed, subdivided, and developed SEZs. The restoration program is found in Volume III.

It is difficult to predict the impact of the No-Growth Alternative on population. During the period of building moratoria and slow growth in the Tahoe Region since about 1980, the population of the Region did not change significantly. Even though one segment of the resident economy, the skilled building trades, was significantly diminished, it appears to have been replaced by minimum-wage service industry workers (Economic Technical Committee, 1986). Assuming these trends are representative of long-term conditions under a no-growth alternative, TRPA projects a relatively stable population, with a lower average income, over time. See Table 21 for a comparison of population impacts of the four alternatives.

b. No-Action Alternative (1981 208 Plan)

The 1981 208 plan (the No-Action Alternative or Alternative 2) places restrictions on new subdivisions and requires all new development to comply with the Bailey land coverage coefficients on a parcel-by-parcel basis. It does not allow coverage transfers, except by lot consolidation or expansion of the project area, with a limited exception for commercial transfers within single watersheds in Nevada (TRPA, 1981b, Ordinance 81-5). It does allow transfer of development provided the resulting coverage on a parcel does not exceed the Bailey coefficients or the existing coverage, whichever is greater.

This alternative will maintain the existing boundaries of the urban area within the Region, and will generally result in the in-fill of property in land capability districts 4 through 7 with urban land uses, consistent with the TRPA Plan Area Statements. It also will result in expanded use of non-urban areas for recreation and resource management, within the constraints of the land coverage policies.

Based on data obtained by the IPES crews during the summer of 1987, TRPA estimates that approximately 9000 single-family parcels remain in land capability districts 4 through 7. (For details on this estimate, see the Technical Appendix.) Under this alternative, these parcels would eventually be developed with single-family homes. See Table 19 for a comparison of the additional single-family parcels which could be developed under the four alternatives.

The level of additional commercial, tourist, multi-family and public service development that could ultimately be anticipated under this alternative is constrained by limits on impervious coverage, limited available land, and economic demand. Over 20 years, TRPA projects 850,000 square feet of additional commercial floor area, 400 additional hotel/motel units, 1,600 additional multi-family units, and a congruent level of growth in the public service sector (TRPA, 1987a, Technical Appendix). Note that these projections and the projections made for the other alternatives are only for purposes of analyzing the potential impacts of additional development. They are not to be construed as levels of additional development permitted by TRPA, nor are they to be construed as limits on additional development. The Regional Plan establishes allocation limits for single family homes through 1991, and limits on tourist accomodation units and commercial floor area through the first ten years (until July 1, 1997). TRPA will decide later on additional development beyond these periods, but only after appropriate environmental documentation, including a demonstration that environmental thresholds will be attained and maintained.

Like the No-Growth Alternative, this alternative tends to reduce the incentives for redevelopment and community planning. Thus, the resulting pattern of land use would tend to reflect existing conditions rather than redirect or concentrate land use in commercial core areas.

The impact of this alternative on regional population depends upon the number of available housing units and average occupancy rates. Given the assumptions regarding new residential, commercial, tourist, recreation, and public service growth stated above, TRPA estimates that the ultimate population of both residents and overnight visitors will increase about 35 percent over 1985 levels. See Table 21 for a comparison of projected ultimate population levels under the four alternatives.

This alternative, the 1981 plan, would have some specific land use impacts for the portions of the Region within California. The California-side policies of the 1981 plan effectively prohibit the construction of new golf courses (SWRCB, 1980, p. 232), and do not allow the development of new campgrounds in high erosion hazard lands or SEZs (SWRCB, 1980, p. 131). The latter policy would tend to direct overnight recreational facilities to higher capability lands.

c. The Hybrid Plan (Alternative 3)

The hybrid plan, Alternative 3, would have impacts on land use similar to the 1981 plan, Alternative 2. However, as a hybrid of the 1981 plan and TRPA's recently-amended Regional Plan, development of new single-family homes would be constrained to approximately 6000 homes over a 20-year period in order to meet transportation and other thresholds. (See the discussion in TRPA, 1987a, p. IV-28.) These homes would be built in land capability districts 4, 5, 6 and 7.

Another difference will result from implementation of the coverage mitigation program, which would have an effect on land use by creating up to 60 additional acres, over 20 years, of open space, largely from properties currently committed to sub-standard development. This alternative would also create new open space and passive recreation opportunities through the SEZ Restoration Program. See the descriptions of these impacts under the No-Growth Alternative.

Given the assumptions regarding new residential, commercial, tourist, recreation, and public service development presented under Land Use, TRPA estimates that the ultimate population of residents and overnight visitors will increase about 27 percent over 1985 levels. See Table 21.

d. The Proposed Amendments (Alternative 4)

The proposed 208 amendments, Alternative 4, include strict limits on new subdivisions, use IPES to direct the development of single-family homes, and use the Bailey coverage coefficients or the IPES equivalent (with the possibility of transfers) to guide all types of development in conjunction with the TRPA Plan Area Statements and local land use plans.

This alternative will maintain the existing boundaries of the urban area within the Region, and will generally result in the in-fill of property in land capability districts 4 through 7 with urban land uses, consistent with the TRPA Plan Area Statements. It also will result in expanded use of non-urban areas for recreation and resource management, within the constraints of the land coverage policies.

The number of additional single-family homes which could be eligible to be built under IPES is about the same as the number of homes which would be built under Alternative 2, the 1981 plan. But like Alternative 3, the actual number of single-family homes which can be developed is constrained to approximately 6000 over 20 years, in order to achieve the transportation thresholds. See Table 22 for a comparison of single-family parcels, by county, which could be developed under the four alternatives.

The pattern of land use in the single-family home sector will be similar to the in-fill pattern in Alternatives 2 and 3, but will involve larger areas of existing subdivisions, since IPES is not limited to parcels verified to be in land capability districts 4, 5, 6 and 7. All parcels developed for single-family uses must be served by paved road, water, sewer, and electric utility, although waivers of the paved road requirement are possible in some instances.

Projected levels of commercial, multi-residential, tourist, recreation, and public service growth are the same for Alternative 4 as for Alternatives 2 and 3. However, the pattern of land use will be different, since Alternative 4 will guide most commercial, tourist, and multi-residential development to community plan areas to take advantage of the transfer of coverage provisions. The community plan areas are: Tahoe City, Kings Beach, Tahoma, Homewood, Sunnyside, Lake Forest, Carnelian Bay, and Tahoe Vista in Placer County; Meyers, the South Wye, Bijou/Al Tahoe, and the Ski Run-to-Stateline redevelopment area in El Dorado County; North Stateline and the Incline commercial, tourist, and industrial areas in Washoe County; and Stateline, Kingsbury Grade, and Round Hill in Douglas County.

The transfer of coverage provisions, which will be facilitated by land banks, will have a positive impact on land use by creating incentives to rehabilitate or replace obsolete uses, reducing unconsolidated or strip development, and contributing to upgrading of the the built environment and economic recovery.

As in Alternatives 1 and 3, the excess coverage mitigation program will result in the restoration of parcels currently committed to land coverage and substandard development. Since the redevelopment plans and community plans are expected to create a higher propensity to rehabilitate property in commercial core areas, the rate of coverage mitigation should be higher, and the ultimate of amount of coverage restored should be larger than the other alternatives. However, since data on the propensity to rehabilitate property under the various alternatives do not exist, TRPA estimates that the ultimate amount of coverage restored through coverage mitigation will also be about 60 acres for this alternative.

Like the other alternatives, the impact of Alternative 4 on regional population depends upon the number of available housing units and average occupancy rates. Given the assumptions regarding new residential, commercial, tourist, recreation, and public service growth stated above, TRPA estimates that the ultimate population of residents and overnight visitors will increase about 27 percent over 1985 levels. See Table 21 for a comparison of projected ultimate population levels under the four alternatives.

TABLE 21

2005 Population Estimates, by Alternative

County	Alternative 1	Alternative 2	Alternative 3	Alternative 4
El Dorado				
Total	48,818	68,618	63,235	63,378
Resident	26,064	39,323	35,307	35,415
Visitor	22,753	29,294	27,928	27,964
Placer				
Total	20,418	27,938	26,067	25,293
Resident	8,631	11,715	10,744	10,342
Visitor	11,786	16,223	15,323	14,951
Douglas				
Total	11,156	13,386	13,386	13,812
Resident	5,084	5,375	5,375	5,691
Visitor	6,073	8,011	8,011	8,122
Washoe				
Total	11,698	14,122	14,122	14,261
Resident	5,861	7,321	7,321	7,414
Visitor	5,837	6,801	6,801	6,846
TOTAL				
Total	92,090	124,063 (+35%)	116,810 (+27%)	116,746 (+27%)
Resident	45,641	63,734	58,747	58,862
Visitor	46,450	60,330	58,063	57,884

TABLE 22

Additional Single Family Dwellings, by Alternative

	Alt 2 No-Action	Alt 3 Hybrid	Alt 4 Proposed
El Dorado Co.	6,270	4,020	4,080
Placer Co.	2,090	1,340	1,034
Douglas Co.	80	80	272
Washoe Co.	560	560	614
Total	9,000	6,000	6,000

B. SOILS

1. Applicable Standards

The TRPA thresholds establish standards applicable to soil conservation in the Tahoe Region. The thresholds state, "Impervious cover shall comply with the Land Capability Classification of the Lake Tahoe Basin, California-Nevada, A Guide for Planning (Bailey, 1974)." Two other soil conservation thresholds which apply to SEZs are discussed on page II-17 under SEZs.

The Bailey coefficients for impervious coverage in the various land capability districts are as follows:

Capability District	Percent Cover
1a,b,c	1
2	1
3	5
4	20
5	25
6	30
7	30

The Bailey Report does not include a detailed implementation program. However, TRPA, CTRPA, and the Lahontan Board have applied the coverage coefficients prospectively to new development on unimproved parcels and in some cases have required reductions in excess coverage on improved parcels as a condition of project approval for future improvements or modifications.

2. Existing Situation

The Setting (Section I, Chapter II) describes the soils and geology of the Tahoe Region. In general, the Region includes a band of good capability land of varying width near Lake Tahoe, and lands of moderate and low capability in the foothills and the mountainous areas away from the Lake. The good capability lands near the Lake are interspersed with marshes, wetlands, and other stream environment zones which are sensitive to disturbance and require a high level of protection.

For the Region as a whole, development in stream environment zones has resulted in approximately 10 times the coverage that the Bailey coefficients would allow. Coverage in other low capability lands is roughly equal to what the Bailey coefficients would allow. Disturbance (i.e., compacted or denuded areas that are not paved) covers more area than so-called hard coverage (TRPA, 1983, p. 171). In Incline Village, the Cave Rock area, and the Kingsbury area, total hard coverage exceeds the total coverage allowed under the Bailey coefficients (TRPA, 1983, pp. 176-179).

The majority of improved properties in the Tahoe Region were improved before the regulatory agencies applied the Bailey coefficients on a parcel-by-parcel basis. Typical coverage for single-family homes is 50 percent or more, and many commercial properties are covered 90 percent or more.

The existing situation in the Tahoe Region includes many examples of soil conservation problems. Unstable cut and fill slopes on existing streets, roads, and highways are chronic erosion sites and difficult to revegetate. Denuded and compacted areas associated with existing urban development hinder infiltration of rain and snowmelt and contribute sediments to runoff waters. Channelization of runoff in urban areas erodes unstable drainage channels. And uses of natural areas for outdoor recreation, ORV trails, and grazing may contribute to soil erosion if not properly designed and maintained to control erosion.

Since 1981, the 1981 208 plan has set the land coverage standards in the Region. Although the Bailey coefficients are generally applied on a parcel-by-parcel basis, TRPA Ordinance 81-5 (TRPA, 1981b), which implemented the 1981 208 Plan, allowed transfer of coverage for commercial uses within individual watersheds in Nevada. The TRPA Code of Ordinances includes the additional transfer of coverage provisions of the proposed 208 amendments, which will take effect upon certification and approval of the amendments.

To compare the impacts of the three alternatives on soils, TRPA has estimated the amount of additional coverage projected to be built under each alternative by applying the applicable coverage restrictions to the additional development described under Land Use, above. The comparison also considers the application of BMPs and the CIP for erosion and runoff control. For more information on the process of making the coverage estimates, see the Technical Appendix, Volume VII.

3. Anticipated Impacts on Soils

a. No-Growth Alternative (Alternative 1)

This alternative, the No-Growth Alternative, would allow no additional impervious coverage, and no transfers of existing coverage. It would, however, include the the coverage mitigation program, application of Best Management Practices to existing development, and implementation of the Capital Improvements Program for erosion and runoff control.

As discussed under Land Use, TRPA estimates that the coverage mitigation program could result in the restoration of up to 3 acres of impervious coverage per year, or 60 acres over a 20-year period (TRPA, 1988a). This program would have a beneficial impact on soil conservation, since coverage mitigation projects will target sensitive, restorable parcels with substandard structures for restoration. These benefits will be evenly distributed throughout the Region, since coverage mitigation must take place within hydrologically-related areas.

The Region-wide application of Best Management Practices under the No-Growth Alternative would have a large positive impact on soil conservation. TRPA's goal is to restore 80 percent, or approximately 5800 acres, of the Region's disturbed (i.e., compacted, denuded) areas with BMPs. This restoration, in conjunction with BMPs to infiltrate runoff, stabilize slopes, and stabilize drainage channels, will contribute greatly to the stability, productivity, and filtration capacity of the Region's soils.

The Capital Improvements Program (Volume IV) will also control erosion and runoff problems from existing streets, roads, and highways over approximately 20 years. This program will rectify the largest and most visible sources of soil erosion in the Region through the application of vegetative and mechanical stabilization methods.

The No-Growth Alternative will attain and maintain the TRPA threshold for impervious coverage since it allows no new coverage and requires reductions in excess coverage on improved parcels as a condition of project approval for future improvements or modifications.

b. The 1981 208 Plan (Alternative 2)

The 1981 208 plan (Alternative 2) allows the creation of additional land coverage in accordance with the Bailey coefficients, applied on a parcel-by-parcel basis. No coverage transfers are permitted (except for the limited commercial Nevada-side transfer provision in Ordinance 81-5), although allowed coverage may be increased on a parcel through lot consolidation or expansion of the project area.

This alternative allows certain types of uses to exceed the Bailey coefficients, as described in Chapter I (p. 199). Water quality and erosion control projects, projects necessary to implement the approved air quality non-attainment plan and regional transportation plan, and projects for public recreation, health, safety, and welfare are exempt from the coverage restrictions.

This alternative will result in the creation of new impervious coverage in the following development categories: residential, commercial, tourist, public service, and recreation. The estimates of additional land coverage which would result under this alternative are based on the land use assumptions and analysis under Land Use. See Table 23 for a comparison of the additional impervious coverage which would be created under the four alternatives.

The ultimate amount of additional land coverage projected under this alternative is approximately 662 acres, with only certain public service and recreation coverage in land capability districts 1-3. (For details on the the process of estimating coverage, see the Technical Appendix, Volume VII.)

The Region-wide application of Best Management Practices under the 1981 208 plan (Alternative 2) would also have a large positive impact on soil conservation. Restoration of disturbed (i.e., compacted, denuded) areas, in conjunction with BMPs to infiltrate runoff, stabilize slopes, and stabilize drainage channels, will contribute greatly to the stability, productivity, and filtration capacity of the Region's soils. Since the BMP implementation program of the 1981 plan lacks explicit requirements to bring about retroactive application of BMPs, the rate at which these contributions materialize will be slower than it would be under Alternatives 1, 3, and 4.

The Capital Improvements Program of the 1981 plan will control erosion and runoff problems from existing streets, roads, and highways over approximately 20 years. This program will rectify the largest and most visible sources of soil erosion in the Region through the application of vegetative and mechanical stabilization methods.

The 1981 208 plan does not comply with the applicable standard, the TRPA threshold for impervious coverage since it allows certain types of projects to exceed the impervious coverage standard.

c. The Hybrid Plan (Alternative 3)

The hybrid plan (Alternative 3) allows the creation of additional land coverage in accordance with the Bailey coefficients, applied on a parcel-by-parcel basis, as does Alternative 2. However, the hybrid plan does not allow new uses to exceed the Bailey coefficients without transfer. Projects allowed overrides of the Bailey coefficients under Alternative 2 would be allowed to increase their base coverage only by transfer within hydrologically-related areas up to the limits set forth in Table 15.

This alternative will result in the creation of new impervious coverage in the residential, commercial, tourist, public service, and recreation categories. See Table 23 for a summary of the additional land coverage created under the four alternatives. The ultimate amount of additional land coverage projected under the hybrid plan, Alternative 3, is approximately 379 acres, with a net reduction of coverage in land capability districts 1, 2, and 3 of approximately 87 acres.

As discussed under Land Use, TRPA estimates that the coverage mitigation program could result in the restoration of up to 60 acres over a 20-year period (TRPA, 1988a). This program would have a beneficial impact on soil conservation, since coverage mitigation projects will target sensitive, restorable parcels with substandard structures for restoration. These benefits will be evenly distributed throughout the Region, since coverage mitigation must take place within hydrologically-related areas.

The Region-wide application of BMPs under the hybrid plan would also have a large positive impact on soil conservation. BMPs to restore disturbed areas, infiltrate runoff, stabilize slopes, and stabilize drainage channels will contribute greatly to the stability, productivity, and filtration capacity of the Region's soils. The implementation program of the hybrid plan includes explicit provisions calling for retroactive application of BMPs to existing development, which will contribute to the achievement of TRPA's soil conservation goals.

The Capital Improvements Program will control erosion and runoff problems from existing streets, roads, and highways over approximately 20 years, and will rectify the largest and most visible sources of soil erosion in the Region.

The hybrid plan (Alternative 3) complies with the applicable standard, the TRPA threshold for impervious coverage, since it allows coverage in excess of the Bailey coefficients only by transfer, and only for water quality and erosion control projects, projects necessary to implement the air quality non-attainment plan and regional transportation plan, and projects for public recreation, health, safety, and welfare, provided all other feasible alternatives have been exhausted.

d. The Proposed 208 Amendments (Alternative 4)

This alternative includes Region-wide application of BMPs, implementation of the Capital Improvements Program for erosion and runoff control, and the coverage mitigation program. It allows additional impervious coverage in the Region, provided development is consistent with the TRPA Code and Plan Area Statements, in land capability districts 4, 5, 6 and 7, and in other land capability districts in the following circumstances: for single-family homes approved under IPES and for public outdoor recreation and public service uses provided TRPA makes the required findings and offsets are provided.

This alternative also includes the concept of coverage transfers, as described in Section I (p. 121). Table 15 summarizes the base allowed coverage, and the maximum coverage allowed with transfer, for the various types of development and land capability districts.

Estimates of additional residential, commercial, tourist, recreation, and public service coverage for the four alternatives are presented in Table 23 and are based on the land use assumptions and analysis under Land Use. The ultimate amount of additional land coverage projected under this alternative is approximately 331 acres, with a net reduction of land coverage in land capability districts 1, 2, and 3 of about 99 acres. Only certain public service and recreation coverage and approximately 625 single-family homes will be developed in land capability districts 1, 2 and 3, and that coverage in excess of the Bailey coefficients will be obtained only through transfer programs. For information on the process of making these land coverage estimates, see the Technical Appendix, Volume VII.

The transfer of coverage provisions in Alternative 4 do not create additional coverage in the Region, but they affect the distribution of coverage. Compared to Alternative 3, coverage will be more concentrated in community planning areas.

Since land coverage transfers for commercial uses must involve existing land coverage, and since TRPA estimates that up to 48 acres of commercial land coverage may be placed in community plan areas by transfer over the next 20 years, those transfers will result in the restoration of 48 or more acres of existing coverage. The transfer ratio for commercial coverage ranges from 1:1 to 2:1, as described in Table 15.

As discussed under Land Use, concentration of coverage under Alternative 4 will occur in the following community plan areas: Tahoe City, Kings Beach, and Homewood in Placer County; Meyers, the South Wye, Bijou/Al Tahoe, and the redevelopment area in El Dorado County; North Stateline and the Incline commercial area in Washoe County; and Stateline, Kingsbury Grade, and Round Hill in Douglas County.

As in Alternatives 1 and 3, TRPA estimates that the coverage mitigation program could result in the restoration of up to 3 acres of impervious coverage per year, or 60 acres over a 20-year period (TRPA, 1988a). This program would have a beneficial impact on soil conservation, since coverage mitigation projects will target sensitive, restorable parcels with substandard structures for restoration. These benefits will be evenly distributed throughout the Region, since coverage mitigation must take place within hydrologically-related areas. As discussed under Land Use, the propensity to rehabilitate property under Alternative 4 is likely to be higher than under Alternatives 1 and 3, which would contribute to a higher rate and amount of coverage mitigation. However, precise data on propensity to rehabilitate property under the three alternatives do not exist.

The Region-wide application of Best Management Practices under the proposed amendments (Alternative 4) would also have a large positive impact on soil conservation. TRPA's goal is to restore 80 percent, or approximately 5700 acres, of the Region's disturbed (i.e., compacted, denuded) areas with BMPs. This restoration, in conjunction with BMPs to infiltrate runoff, stabilize slopes, and stabilize drainage channels, will contribute greatly to the stability, productivity, and filtration capacity of the Region's soils. This alternative includes explicit provisions to bring about retroactive application of BMPs to existing development, and should accomplish TRPA's goals more rapidly than Alternative 2.

The Capital Improvements Program (Volume IV) will also control erosion and runoff problems from existing streets, roads, and highways over approximately 20 years. This program will rectify the largest and most visible sources of soil erosion in the Region through the application of vegetative and mechanical stabilization methods.

The proposed 208 amendments comply with the applicable standard, the TRPA threshold for impervious coverage. All additional development must comply with the Bailey coverage coefficients, either by virtue of base allowed coverage or through coverage transfers within hydrologically-related areas, with no overrides of the Bailey coefficients for any reason. The alternative also requires reductions in excess coverage on improved parcels as a condition of project approval for future improvements or modifications.

TABLE 23

Additional Land Coverage Summary, by Alternative

Category	Alternative 1		Alternative 2		Alternative 3		Alternative 4	
	acres	LCC	acres	LCC	acres	LCC	acres	LCC
Single-family	---	---	516	4-7	344	4-7	308	4-7
							36	1-3
Commercial, Multi-Family, Tourist	---	---	80	4-7	80	4-7	80	4-7
							(48)	1-3
Public Service (non-transp.)	---	---	18	4-7	18	4-7	18	4-7
			12	1-3	12	1-3	12	1-3
					(18)	1-3	(18)	1-3
Public Service (transportation)	---	---	---	---	34	4-7	34	4-7
					29	1-3	29	1-3
					(34)	4-7	(34)	4-7
					(44)	1-3	(44)	1-3
Recreation	---	---	24	4-7	24	4-7	24	4-7
			12	1-3	12	1-3	12	1-3
					(18)	1-3	(18)	1-3
Excess Coverage Mitigation	(60)	1-3	---	---	(60)	1-3	(60)	1-3
TOTALS								
LC 1-3	(60)		24		(87)		(99)	
LC 4-7	--		638		466		430	
LC 1-7	(60)		662		379		331	

C. STREAM ENVIRONMENT ZONES

1. Applicable Standards

The TRPA thresholds (see Attachment 1) include several standards applicable to stream environment zones (SEZs). The soil conservation thresholds set the following standard:

> Preserve existing naturally functioning SEZ lands in their natural hydrologic condition, restore all disturbed SEZ lands in undeveloped, unsubdivided lands, and restore 25 percent of the SEZ lands that have been identified as disturbed, developed, or subdivided, to attain a 5 percent increase in the area of naturally functioning SEZ lands.

The vegetation thresholds call for the maintenance of existing species richness by providing for the perpetuation of nine plant associations, including the deciduous riparian association, the meadow associations, and the wetland associations, and require that at least four percent of the total undisturbed vegetation in the Region remain deciduous riparian vegetation.

The TRPA wildlife threshold states that a nondegradation standard shall apply to significant wildlife habitat consisting of deciduous trees, wetlands, and meadows while providing for opportunities to increase the acreage of such riparian associations.

2. Existing Situation

The Setting (Section I, Chapter II) and the problem assessment (Section I, Chapter III) discuss the importance of stream environment zones to water quality and the other values of the Tahoe Region. The Lake Tahoe Basin Water Quality Management Plan, Volume I, Water Quality Problems and Management Program (TRPA, 1977b) estimated that of about 9200 naturally-occurring acres of SEZ in the urbanized portions of the Tahoe Region, 4400 had been developed, disturbed, or subdivided. Therefore, the threshold requirement to restore 25 percent of SEZs in those categories is equivalent to 1100 acres of SEZ restoration.

As mentioned under Soils, existing land coverage in SEZs is approximately 10 times greater than the 1 percent the Bailey coefficients would allow. All of the watershed associations studied in the EIS for Adoption of a Regional Plan for the Lake Tahoe Basin had excess impervious coverage in SEZs, with the highest ratios of excess coverage occurring in the Carnelian Bay and Incline associations (TRPA, 1983, pp. 171-183).

The existing situation in the Region includes many examples of encroachment on SEZs. Dredging and filling have created marinas and residential developments in ecologically-important marshes. The regional transportation system, including the airport and the street and highway network, makes use of many SEZ areas, often with the addition of fill in SEZs or channelization of SEZs. Residential subdivisions sometimes cross SEZs without consideration of natural drainageways and land contours. Some SEZs have been drained to allow urban land uses, reducing the area of SEZ in the Region. And outdoor recreational uses such as ski areas, campgrounds, and trails have damaged riparian vegetation and contributed to channel instability.

The existing regulations which apply to SEZs are the policies of the 1981 208 plan. The identification of SEZs follows the system of the BMP Handbook (TRPA, 1978), which relies on the following four indicators: alluvial soils, riparian vegetation, 100-year flood plain, and minimum buffer strip. Construction, grading, and vegetation removal are prohibited in SEZs, with exceptions only for environmental projects, public outdoor recreation, and public health, safety, and welfare. (For details, see Chapter I, p 199.)

Several significant restoration projects have occurred in the urbanized portions of the Region since the adoption of the TRPA threshold, including the Sawmill Pond project of the LTBMU. The California Tahoe Conservancy has purchased and targeted for restoration a 200-acre site at the mouth of the Upper Truckee River.

In the undeveloped portions of the Region, the LTBMU also carries out restoration projects, including the Blackwood Canyon project. The USFS has a separate SEZ restoration program for lands under its control (USFS, 1987b).

Acquisition of parcels containing SEZs has been a high priority of those agencies acquiring sensitive lands in the Tahoe Region in recent years. The Forest Service, through the Burton-Santini acquisition program, has acquired about 300 acres of SEZ lands. The California Tahoe Conservancy has acquired about 400 acres, plus the Cove East site on the Upper Truckee River.

3. Anticipated Impacts on SEZs

a. No-Growth Alternative

The No-Growth Alternative, Alternative 1, would allow no additional land coverage in the Region, and no new encroachment in SEZs. SEZ identification criteria and offset policies for SEZ encroachment would be moot, since this alternative calls for no new coverage and no coverage transfers.

The SEZ restoration program (Volume III) would bring about a large positive impact on SEZs in developed areas, with the restoration of approximately 1100 acres. The LTBMU also plans to restore approximately 200 acres of SEZs in undeveloped areas (USFS, 1987b).

The TRPA program (Volume III) identifies, to date, 48 specific projects, including 20 in El Dorado County, 9 in Placer County, 10 in Washoe County, and 9 in Douglas County. The distribution of these projects around the Region reflects both the extent of urbanization and the relative area of natural SEZs. They include approximately 202 acres of potential restoration in El Dorado County, which has the largest population and the largest area of natural SEZs. By contrast, they include 80 acres in Douglas County, which has the smallest population and smallest area of natural SEZs.

The LTBMU inventory of disturbed SEZs is combined with the inventory of other disturbed lands on National Forest lands. The inventory identifies 125 restoration projects in 40 watersheds in all parts of the Tahoe Region. Phasing and timing of restoration projects depend on annual LTBMU budgets. According to LTBMU watershed staff, SEZ restoration is their top priority, and the target of 200 acres of additional restoration is attainable, possibly within the next two years at the present rate of restoration.

The effectiveness of SEZ restoration projects at restoring the water quality, vegetation, wildlife, scenic, and other values of SEZs is readily observable, but has not been quantified. The LTBMU has produced a videotape on the Sawmill Pond project documenting the restoration methods and benefits (USFS, 1987a). Where restoration projects involve large areas relatively free from structures, the benefits of restoration will be high, with results approaching natural conditions. Where restoration projects include areas developed with streets, drainage systems, and houses or businesses, the benefits will be lower, with results representing essentially a partial mitigation of the development impact.

Some restoration projects, for example the projects planned for the meadows of Trout Creek and the Upper Truckee River, involve primarily changes in land management. Other projects involve mechanical slope stabilization, drainage improvements and modifications, and other structural practices which overlap with the Capital Improvements Program for erosion and runoff control (Volume IV). Where such overlaps occur, the SEZ Restoration Program (Volume III) makes note of them.

Other water quality control measures of the No-Growth Alternative, Alternative 1, will benefit stream environment zones in the Region. The program of BMP implementation for existing development and natural areas will increase infiltration of runoff, reduce peak flows and sediment loads, and contribute to channel stability and aesthetic quality in both urbanized and natural areas. The coverage mitigation program will result in the removal and restoration of disturbance in SEZs. Requirements to use native and adapted plants for revegetation will promote natural values of restored SEZs.

With respect to the applicable standards, the No-Growth Alternative will preserve natural SEZs in their natural condition, perpetuate and maintain the vegetation associations found in SEZs, and not degrade wildlife habitat areas of deciduous trees, wetlands, and meadows. This alternative will also bring about the restoration of disturbed SEZs in both urban and natural areas. This alternative will attain and maintain the TRPA thresholds, provided that, with TRPA's assistance, the LTBMU, the states, and local government continue to identify and implement SEZ restoration projects to meet the specific restoration goals of the thresholds--restoration of all disturbed SEZs in natural areas and 25 percent (about 1100 acres) of the disturbed SEZs in urbanized areas. Refer to Table 27 for a comparison of the SEZ impacts of the four alternatives.

b. No-Action Alternative (1981 208 Plan)

The 1981 208 plan, Alternative 2, prohibits construction, grading, and vegetation removal within SEZs. Exceptions to this policy are allowed for approved erosion control projects, projects necessary to implement the approved air quality nonattainment plan or the transportation element of the Regional Plan, public outdoor recreation, and the public health, safety, and welfare, provided all other feasible alternatives have been considered. When exceptions to the prohibition are allowed, mitigation is required, which may or may not involve offsetting restoration of SEZ lands.

Considering proposed public service and recreation facilities in the Region which TRPA is aware of, it is impossible to say at this time, without more-detailed designs, which facilities may encroach in SEZs. However, it is likely that water and sewer projects, which tend to be located near or adjacent to SEZs, and some recreation projects will involve SEZ encroachment. Since the 1981 208 plan includes no transportation element, no additional coverage is attributed to transportation facilities. TRPA estimates that the 1981 208 plan could allow about 10 acres of SEZ encroachment.

A stream environment zone is defined in the BMP Handbook (TRPA, 1978, p. III-3) as that region: (1) which surrounds a stream, including major streams, minor streams and drainageways, which owes its biological and physical characteristics to the presence of water, (2) which may be inundated by a stream, or (3) 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. In the BMP Handbook, the 1981 Plan identifies the boundary of an SEZ as the outermost boundary of the minimum buffer strip, alluvial soil types, riparian vegetation, and the 100-year flood plain. (For details, see p. 199.)

The criteria for SEZ identification themselves have potential impacts on SEZs in two areas: (1) the buffers, which are based on stream order, do not provide setbacks in situations where a channel is absent or where riparian vegetation extends beyond the minimum buffer strip, and do not rationally relate the width of the buffer to the stability of the channel, and (2) they may not identify as SEZs certain soils with high groundwater.

The 25-, 50-, and 100-foot minimum buffer zones of the 1981 plan's criteria (TRPA, 1978, p. III-6) frequently do not extend to the outer limit of the existing riparian vegetation surrounding stream channels. (See, for example, the Draft Land Capability Verification for Portions of Plan Areas 089A, 080, and 076, Resource Concepts, Inc., 1988.)

Where SEZs exist in the absence of a channel, such as a pond or marsh, there is no buffer. In such cases, protection of the edge zone between the SEZ and the surrounding vegetation is omitted, and development may occur immediately adjacent to the SEZ. The edge zone is important for wildlife habitat and scenic values (TRPA, 1982d).

In addition, since the buffer zone is intended to protect the biological and hydrological functions of the SEZ, the width of the buffer zone should be related to the sensitivity of the SEZ.

Wide buffers should be provided for channels which are unstable, such as meandering channels and channels with eroding banks. More narrow buffers are sufficient where channels are stable and confined (Rosgen, 1985). In this alternative, the widths of the buffers are based on stream order alone and do not reflect the stability of the channel. For additional discussion of this point, see the discussion of SEZ impacts of the proposed 208 amendments, below; the Technical Appendix; and the Responsiveness Summary and Response to Comments, Volume VI.

Where field investigation shows soils to be wetted, or subject to periods of high groundwater, they should be provided the protection associated with an SEZ designation because the soils at the surface may become saturated with water during snowmelt, creating a variable source area for nutrient and sediment discharges (Skau, 1988). (For a discussion of variable source areas, see Section I, p. 54.) However, under the SEZ identification criteria of the 1981 plan, they are not considered SEZs since they do not have channels present.

Since the No-Action Alternative (the 1981 plan) allows SEZ encroachment for certain projects in excess of the standards set forth in the Bailey Report, without explicit requirements for offsetting restoration, it does not attain and maintain the TRPA thresholds calling for preservation of natural SEZs and nondegradation of deciduous trees, wetlands, and meadows. The amount of encroachment involved, about 10 acres, is not large enough to significantly affect attainment of the thresholds calling for perpetuation of the wet vegetative associations.

This alternative will not bring about the restoration of disturbed SEZs in both urban and natural areas. This alternative will not attain and maintain the TRPA restoration thresholds--restoration of all disturbed SEZs in natural areas and 25 percent (about 1100 acres) of the disturbed SEZs in urbanized areas. Refer to Table 27 for a summary of the SEZ impacts of the four alternatives.

c. The Hybrid Plan (Alternative 3)

The hybrid plan, Alternative 3, prohibits construction, grading, and vegetation removal within SEZs. Exceptions to the policy would be allowed for approved erosion control projects, projects necessary to implement the approved air quality nonattainment plan or the transportation element of the Regional Plan, public outdoor recreation, and the public health, safety, and welfare, provided all other feasible alternatives have been considered, and provided a 1.5:1 offset is provided.

The Final EIR/EIS, Regional Transportation Plan: Lake Tahoe Basin (TRPA, 1988b) reported that transportation improvements will create 19.4 acres of SEZ encroachment, 11 acres for highways and other motorized transportation facilities, and 8.4 acres for bicycle and pedestrian facilities. Thus, the hybrid plan could allow about 20 acres of SEZ encroachment for transportation facilities, and an additional 10 acres of encroachment for other public service and recreation facilities over 20 years, with the required 1.5:1 restoration offsets. With the offsets, this alternative would bring about the restoration of about 45 acres of SEZ, and a net increase of about 15 acres of SEZ in the Region.

The most significant SEZ encroachments from transportation facilities will occur in Tahoe City (6 acres), Incline Village (2.1 acres), and the south stateline area (6 acres). The encroachment in Tahoe City affects SEZ adjacent to the Truckee River. The encroachment in Incline Village affects SEZs adjacent to Wood, Third, Incline, and Mill Creeks where they cross Nevada 28. The encroachment in the south stateline area affects SEZs adjacent to Edgewood Creek and in the large intervening area known as the Wildwood Bijou watershed (Jorgensen, et al., 1978, watershed no. 69.)

Under the hybrid plan, the criteria for SEZ identification would be the same as under Alternative 2, the 1981 208 plan. The criteria would have impacts on SEZs in the same two areas as Alternative 2: they do not provide adequate and rational setbacks in all situations and they may not identify as SEZs certain soils with high groundwater.

The hybrid plan includes the SEZ restoration programs of TRPA and the LTBMU, and the BMP implementation, revegetation, and coverage mitigation programs of the No-Growth Alternatives, with impacts as described under that alternative.

Since the hybrid plan allows SEZ encroachment in excess of the standards set forth in the Bailey Report only with explicit requirements for offsetting restoration, it does attain and maintain the TRPA thresholds calling for preservation of natural SEZs and nondegradation of deciduous trees, wetlands, and meadows. This alternative will also attain and maintain the TRPA restoration threshold which calls for restoration of all disturbed SEZs in natural areas and 25 percent (about 1100 acres) of the disturbed SEZs in urbanized areas, provided that, with TRPA's assistance, the LTBMU, the states, and local governments continue to identify and implement restoration projects. Refer to Table 27 for a summary of the SEZ impacts of the four alternatives.

d. The Proposed 208 Amendments (Alternative 4)

The proposed 208 amendments, Alternative 4, permit no new land coverage or other permanent disturbance in SEZs except (1) facilities for public health, safety, environmental protection, and outdoor recreation with required findings and 1.5:1 offsetting restoration, and (2) for projects which require access across SEZs to otherwise buildable sites, with required findings and 1.5:1 offsetting restoration. (For details, see Section I, p. 129.)

Considering the proposed public service and recreation facilities in the Region which TRPA is aware of, it is impossible to say at this time, without more-detailed designs, which facilities may encroach in SEZs. However, as in Alternative 3, it is likely that water and sewer projects, which tend to be located near or adjacent to SEZs, and some recreation and transportation projects will involve SEZ encroachment. Planned transportation improvements would create 19.4 acres of SEZ encroachment (TRPA, 1988c), and other public service and recreation projects could create another 10 acres of encroachment. Thus, the proposed amendments could allow about 30 acres of SEZ encroachment, but with 1.5:1 offsetting restoration. With the offset, these transportation, public service and recreation projects would bring about the restoration of about 45 acres of SEZ, and a net increase of about 15 acres of restored SEZ in the Region.

The most significant SEZ encroachment from transportation facilities will occur in Tahoe City (6 acres), Incline Village (2.1 acres), and the south stateline area (6 acres). The encroachment in Tahoe City affects SEZ adjacent to the Truckee River. The encroachment in Incline Village affects SEZs adjacent to Wood, Third, Incline, and Mill Creeks where they cross Nevada 28. The encroachment in the south stateline area affects SEZs adjacent to Edgewood Creek and in the large intervening area known as the Wildwood-Bijou watershed (Jorgensen et al., 1978, watershed no. 69).

With respect to access across SEZs to otherwise buildable sites, it is likely that most such situations will involve development of new single-family homes reviewed under IPES. Based on a sample of over 10,000 parcels evaluated by IPES field crews in the 1987 field season, approximately 2390 of the 13,000 IPES parcels have some SEZ within the parcel. About 1090 are 100 percent SEZ. Thus, the maximum number of buildable IPES parcels which could require access across an SEZ is approximately 1300. If the average SEZ encroachment for access were 400 square feet, the maximum amount of encroachment for access would be about 12 acres. It is reasonable to assume that the actual amount will be far less, probably under 5 acres. With the required 1.5:1 offset, these projects would bring about the restoration of about 7.5 acres, and a net change of about 2.5 acres of additional SEZ.

The proposed 208 amendments, Alternative 4, utilize updated criteria for the identification of SEZs, as described in Section I (p. 132) and in the SEZ Protection and Restoration Program (Volume III). An SEZ is determined to be present if any one of the following key indicators is present or, in the absence of a key indicator, if any three of the following secondary indicators are present or, where Lo, Co, or Gr soils are found, any two of the secondary indicators are present:

-- Key Indicators: evidence of surface water flow, including perennial, ephemeral, and intermittent streams; primary riparian vegetation; near-surface groundwater; lakes, ponds, or lagoons; beach (Be) soils; or one of the following alluvial soils: Ev and Mh.

-- Secondary Indicators: designated 100-year flood plain; groundwater between 20 and 40 inches; secondary riparian vegetation; and one of the following alluvial soils: Lo, Co, or Gr. (For details, see Section I, p. I-20.)

Although it is difficult to quantify, the consensus of the technical experts associated with IPES is that the refined criteria, above, will identify more wetted soils and soils with high groundwater as SEZs (Skau, 1988; Davis, 1988, Shelton, 1988.) The IPES field crews have found this phenomenon to be especially true for parcels mapped land capability 5. Over 30 percent of parcels found in the field to be 100 percent SEZ were mapped in capability district 5. (For more information, see the Technical Appendix.)

Although Lo, Co, and Gr soils and certain types of riparian vegetation become secondary SEZ indicators under the proposed criteria, this does not result in large numbers of parcels which would have been identified as SEZs under the criteria of the 1981 208 plan being given a less sensitive designation. Of 870 parcels which the IPES field crews found to be capability 1b under the criteria of the 1981 plan, or by virtue of the presence of high groundwater, 851 remain SEZs under the proposed criteria. The 19 other parcels did not exhibit the physical or biological indications of an SEZ. (See the IPES frequency distribution plots in the Technical Appendix.)

Based on a data set of 10,139 parcels with IPES scores as of June 1988, IPES field crews found 1865 parcels with some evidence of SEZ. The total acreage of those parcels is about 3000 acres. Applying the proposed criteria for identification of SEZs results in 360 acres of SEZ and 52 acres of setback area, totalling 14 percent of the total acreage of the 1865 parcels. Applying the criteria from the 1981 208 plan results in 380 acres of SEZ, which includes the buffer zone, or 13 percent of the total acreage of the 1865 parcels. (For details, see the Technical Appendix.)

TRPA also analyzed the protection of SEZs under both the criteria of the 1981 plan and the proposed criteria on a sample of 55 parcels the IPES crews found to contain SEZs in the 1987 field season. The criteria of the 1981 plan and the proposed criteria were used to delineate the area of SEZ. For SEZs without channels and for first and second order streams, the proposed criteria protected more area than the criteria of the 1981 plan. For third order streams, the proposed criteria protected less area. Both systems identified the critical wet, riparian areas that remove sediments and dissolved nutrients from runoff, but differed in their application of setbacks.

Although the presence of the 100-year flood plain, alone, would not constitute an SEZ under this alternative, development in the flood plain is still restricted under the proposed amendments, as described in Section I (p. 132). Thus, although the proposed criteria for SEZ identification identify less SEZ area in the vicinity of a third order stream, both the 1981 208 plan and the proposed 208 amendments protect the entire 100-year flood plain.

The proposed amendments establish setbacks of different widths for six classes of SEZs representing different classes of stability and sensitivity: confined perennial streams, unconfined perennial streams, confined ephemeral or intermittent streams, unconfined ephemeral or intermittent streams, situations where a channel is absent, and man-made channels. (See Table 15.) Setbacks for confined channels are further divided into categories for good, average, and poor slope condition. The widest setback, 60 feet, is for a confined perennial stream with poor slope condition. The narrowest setback, 10 feet, is for situations where a channel is absent or for man-made channels.

Unlike the buffers in Alternatives 2 and 3, which vary in width depending on stream order, the proposed setbacks in Alternative 4 are dependent on the condition and sensitivity of the SEZ, particularly in terms of channel type and stability. The widest setbacks are provided for the most unstable channels, and the narrowest setbacks for the most stable SEZs. Alternative 4 provides setbacks from all SEZs, protecting the scenic and wildlife values of the edge zone as well as the SEZ itself.

This alternative also includes the SEZ restoration programs of TRPA and the LTBMU, and the BMP implementation, revegetation, and coverage mitigation programs of the No-Growth Alternative, with impacts as described above under that alternative.

Since the proposed 208 amendments (Alternative 4) require 1.5:1 offsets for all SEZ encroachment in excess of the standards set forth in the Bailey Report, they increase the amount of naturally-functioning SEZs and attain and maintain the TRPA thresholds calling for preservation of natural SEZs and nondegradation of deciduous trees, wetlands, and meadows. TRPA recognizes that restored SEZs may or may not perform the same water quality functions as an undisturbed SEZ. The contribution to water quality management of a restored SEZ will depend upon its location, the nature of the restoration, and long-term maintenance of the site.

This alternative will also bring about the restoration of disturbed SEZs in both urban and natural areas. This alternative will attain and maintain the TRPA restoration thresholds, provided that, with TRPA's assistance, the LTBMU, the states, and local governments continue to identify and implement projects to meet the specific goals of the thresholds--restoration of all disturbed SEZs in natural areas and 25 percent (about 1100 acres) of the disturbed SEZs in urbanized areas.

The offset requirements and restoration programs, together, will increase the amount of naturally-functioning SEZ in the Region and contribute to the attainment and maintenance of the thresholds relating to preservation of the wet vegetation associations. See Table 27 for a comparison of the SEZ impacts of the four alternatives.

D. TRANSPORTATION

1. Applicable Standards

The Tahoe Regional Planning Compact, in Article V, requires TRPA to prepare an integrated transportation plan for the Region with the goals of reducing dependency on the automobile by making more effective use of existing transportation modes and of public transit to move people and goods within the Region, and reducing, to the extent feasible, air pollution caused by motor vehicles. The TRPA thresholds include two standards which apply to transportation: a requirement to reduce peak summer day vehicle-miles-travelled (VMT) by 10 percent from 1981 values, and a requirement to reduce traffic volumes on U.S. 50, in the winter, from 4 p.m. to midnight, by 7 percent. (See Attachment 1.) TRPA adopted the VMT threshold to encourage a reduction in dependency on private automobiles consistent with the Compact, to help control local emissions of oxides of nitrogen (NOx), and to help control atmospheric deposition of algal nutrients on Lake Tahoe.

The TRPA Goals and Policies (TRPA, 1986a, p. III-24) also set standards for level of service (LOS), a measure of traffic congestion or volume/capacity ratios, as follows:

-- level of service "C" on rural scenic/recreational roads,

-- level of service "D" in rural developed areas and on urban roads, and

-- level of service "D" for signalized intersections, although level of service "E" may be acceptable during peak periods not to exceed four hours per day.

See Table 24 for level of service definitions.

2. Existing Situation

Much of the following information is summarized from the Regional Transportation Plan, Lake Tahoe Basin (TRPA, 1988c). For more-detailed information, see that document.

Highways. The private automobile is the primary transportation mode in the Region. The major federal and state highways (U.S. 50; California 28, 88, 89, and 267; Nevada 28, 207 and 431) skirt the perimeter of the Lake and allow travel to and from the Tahoe Region. U.S 50 through the South Shore is a major 5-lane highway with intense commercial strip development, signalized intersections, and numerous conflicting turning movements that deteriorate traffic flow. Congestion is common in both the summer and winter and, near U.S. 50 and Park Avenue, exceedences of the federal and state carbon monoxide standards (CO) are also common, leading to the designation of the urbanized portion of the South Shore as a non-attainment area for the federal CO standard (TRPA, 1982a).

1981 traffic volumes at Park Avenue and U.S. 50 on the South Shore during peak winter periods were between approximately 36,000 and 38,700 vehicles per day. 1987 volumes ranged from about 36,250 to 37,700 vehicles per day.

Another heavily travelled route is California 28, especially in the Tahoe City area. Tahoe City, Kings Beach, and Tahoe Vista are seriously congested during the summer and winter peak periods. Parking in the right-of-way and conflicting turning movements to access commercial development restrict traffic flow in these areas.

Volume/capacity ratios, which are used to evaluate level of service for key intersections and links, range from 0.6 to 1.3 during peak summer days. The highest ratio, 1.3, occurs at Park Avenue and U.S. 50 in the South Shore. See Table 25 for a summary of LOS at key intersections and links.

There are six major entry points to the Tahoe Region, three in California and three in Nevada. From 1981 to 1985, California-side traffic volumes (average peak summer day) decreased, while Nevada-side traffic volumes increased.

In 1981, there were approximately 1.70 million vehicle miles travelled (VMT) in the Tahoe Region on an average summer day, and in 1985 approximately 1.65 million, according to TRPA traffic models. See Table 26 for a disaggregation of VMT by travel segment.

Transit. A contractor to the City of South Lake Tahoe operates buses in the City under the name South Tahoe Area Ground Express (STAGE). Present annual STAGE ridership is approximately 445,000 passengers. The Tahoe Area Regional Transit (TART) system serves the north shore from Tahoma to Incline Village (winter) and from Meeks Bay to Sand Harbor State Park (summer). 1986 TART annual ridership was approximately 135,000 passengers.

Almost all ski areas in and around the Tahoe Region provide ski shuttles. Service is provided at no charge or for a nominal fee. Transfer opportunities are offered at STAGE and TART stops, and the Tahoe Queen ferry connects the south shore with buses in the Tahoe City area. Total annual patronage of the ski shuttles is approximately 235,000 passengers.

Intercity bus service has the largest annual transit ridership. Approximately 1.35 million visitors arrive in the Region by bus each year, on an average of about 92 buses per day. About 714,000 of these riders are from Northern California, and about 409,000 from Southern California.

TABLE 24

Level-of-Service Definitions

Level	
A	no vehicle waits longer than one red indication (up to 67% of capacity)
B	occasionally the green phase is fully utilized (67% to 77% of capacity)
C	occasionally drivers may have to wait for more than one red indication, with some back-up (77% to 87% of capacity)
D	approaching instability, with substantial delays during short peaks within peak hour conditions (87% to 97% of capacity)
E	at capacity, with full utilization of every green phase, substantial dependence on good coordination between adjacent signals, long queues of waiting vehicles, and delays up to several cycles (97% to 107% capacity)
F	jammed conditions with long delays (over 107% capacity)

Source: Regional Transportation Plan, Lake Tahoe Basin (April, 1988)

TABLE 25

Level-of-Service Summary
(1985)

Intersection or Segment	Volume/ Capacity Ratio
U.S. 50 at Kingsbury	0.75
U.S. 50 at Park Ave.	1.30
U.S. 50 at Pioneer (east)	0.87
U.S. 50 at Al Tahoe	0.88
South Tahoe Wye	0.91
Tahoe City Wye	0.75
California 28 at Tahoe City	0.93
California 28 at Fabian	0.63
California 28 and 267	0.70
California 28 at Kings Beach	0.63
California 28 at N. Stateline	0.73
Nevada 28 at Mt. Rose Hwy.	1.00
Nevada 28 at Village Rd.	0.69
Nevada 28 at Country Club	0.69

Source: Regional Transportation Plan (TRPA, 1988)

TABLE 26

VMT Disaggregated by Travel Segment
(1985)

	Internal	External
Resident	667,572	103,386
Visitor	468,389	407,122
Total	1,135,961	510,508

Internal VMT is associated with vehicle trips which begin and end within the Region.

External VMT is associated with vehicle trips which either begin or end outside the Region.

Waterborne Service. Lake Tahoe offers a good opportunity to utilize waterborne transportation services. Four craft presently provide regular excursion service on Lake Tahoe, primarily during the summer months for visitors to the Region.

One such craft, the M.S. Dixie moored at Zephyr Cove, Nevada, carried over 100,000 passengers in 1985, and accounted for a savings of about 1300 VMT on a peak summer day. Additional smaller charter services operate out of marinas around the Lake.

Aviation. There are four recognized aviation facilities in the Tahoe Region, including the Lake Tahoe Airport in South Lake Tahoe, a heliport, a helipad, and a seaplane base. The Airport, the primary aviation facility in the Region, enplaned 79,254 passengers in 1985.

Non-motorized Transportation. The Lake Tahoe Region has an incomplete Region-wide bikeway system. Bicycle facilities have improved in recent years, and serve both utility and recreational trip purposes. Pedestrian facilities are discontinuous and sporadically located. Pedestrians often must walk on dirt paths or road shoulders. Pedestrian travel can be hazardous during periods of heavy traffic, especially during winter periods, when snow removal is not always adequate. The RTP (TRPA, 1988c) contains maps of both pedestrian and bicycle facilities.

Transportation Systems Management (TSM). TSM measures such as home mail delivery, carpooling, parking management, staggered work hours, employer programs, and public awareness programs are one means of achieving transportation goals. TRPA encourages home mail delivery as a means of eventually reducing peak summer day VMT by over 50,000 miles. However, because of the Region's high average vehicle occupancies, the potential benefit of carpooling is considered to be small. Employer programs associated with the gaming and ski industries are in effect, however, and do result in small increases in transit usage.

Regional Transportation Plan. Under the terms of the Tahoe Regional Planning Compact, TRPA's Regional Transportation Plan (RTP) guides the planning and implementation of transportation improvements in the Region. TRPA is also a designated Regional Transportation Planning Agency (RTPA) in California. The RTP, adopted by TRPA in 1984 and revised in April, 1988 (TRPA, 1988c), calls for over $250 million of improvements over 20-years, including:

-- the provision of intensive bus service on the South Shore, with reduced headways; continuation of ski shuttles; expansion of transit service into new areas

- street and highway improvements in the South Shore, Tahoe City, Kings Beach, North Stateline, and Incline Village, to alleviate congestion hot-spots, and including major improvements in the City of South Lake Tahoe redevelopment area and in Tahoe City,

- expanded TSM measures,

- aviation facilities as set forth in the future airport master plan,

- continuation of waterborne excursion services and initiation of point-to-point waterborne transportation services, and

- expanded and enhanced bicycle and pedestrian facilities.

Air Quality Plan. The Tahoe Basin is a non-attainment area for the National Ambient Air Quality Standard (NAAQS) for carbon monoxide. Only the El Dorado and Douglas County portions of the Region are currently considered in non-attainment. Violations of the NAAQS are monitored near the intersection of U.S. 50 and Park Avenue in the City of South Lake Tahoe, most commonly on winter nights with high traffic volumes while a thermal inversion is present. Summer violations are not as common as winter violations (TRPA, 1986b).

On August 26, 1982, the TRPA adopted the 1982 Air Quality Plan (AQP) as part of the Regional Plan. The 1982 AQP outlined implementation strategies and programs to attain the NAAQS for CO by 1987, including four transportation measures: computerized traffic signalization on the U.S. 50 corridor; 18 traffic flow improvements at intersections to increase average vehicle speeds; a short-range transit expansion program; and home mail delivery in the El Dorado County portion of the Region. Most of the traffic signalization and the majority of the traffic flow improvements have been implemented, and home mail delivery via neighborhood delivery centers (NDCs) has been initiated in El Dorado County (TRPA, 1986b).

Because violations of the NAAQS are still common (although less frequent) at the Stateline California station, and the 1987 deadline of the Clean Air Act has passed, TRPA is revising the 1982 AQP, updating emission rates and forecasts, and identifying other control measures which can be implemented. (See additional discussion under Air Quality.)

Analytical Techniques. TRPA uses modeling to quantify the travel demand generated by different land use scenarios and the impact of that demand on existing and proposed transportation systems. Using data on the amount and distribution of population, employment, income levels, traffic volumes, and other factors, TRPA simulates existing and future scenarios using the Quick Response System (QRS) model. The QRS model has four parts: trip generation, trip distribution, traffic assignment, and modal split.

3. Anticipated Transportation Impacts

a. No-Growth Alternative (Alternative 1)

The No-Growth Alternative, which allows no new impervious coverage and no coverage transfers, would allow no new transportation improvements that require new coverage. All improvements that require coverage would have to convert another existing use.

The No-Growth Alternative would hamper programs in the Regional Plan to reduce VMT in the Region. Without allowances for additional coverage, it will be difficult to locate new transit facilities, and difficult for transit to operate with prevailing levels of congestion. Types of VMT-reducing facilities that would be affected are transit terminals on the north and south shores, aerial trams to the ski areas from Stateline and Tahoe City, waterborne transit facilities, and neighborhood mail delivery centers. Also, as discussed under Land Use, this alternative would remove most of the incentives for redevelopment and community planning, and forfeit the anticipated transportation improvements: improved auto and pedestrian circulation, improved transit, fewer trips generated, and more pedestrian trips.

Under this alternative, peak summer day VMT would nevertheless be lower than recent (1981-1985) values, since the No-Growth Alternative would affect travel demand only slightly and VMT reductions will still be accomplished through improved transit and shuttle service, employer vanpool programs, airport operations, waterborne service, home mail delivery, incentives, and education programs. Long-range plans to consider a railway system on the South Shore would be neither necessary or appropriate under this alternative. Based on the FEIS for the TRPA Code and Plan Area Statements (TRPA, 1987a), the total projected VMT reductions in the long term for the No-Growth Alternative would be 139,000 to 166,500. (For details, see the Technical Appendix.) Assuming no growth in travel demand, and subtracting these savings from the estimated 1985 VMT of 1.65 million, the net peak summer day VMT would be approximately 1.48 to 1.51 million, compared to the threshold target of 1.53 million.

Despite the improvements in VMT, this alternative would not significantly decrease peak traffic volumes and, therefore, not bring about improvements in the existing levels of service (LOS) in the Region. Without intersection improvements, LOS will improve or degrade proportionally to population, economic activity, and entry traffic volumes. Under the No-Growth Alternative, changes in these areas would be slow. The intersection of U.S. 50 and Park Avenue in the South Shore would continue to operate at level-of-service E during peak periods.

This alternative will attain and maintain the TRPA threshold for VMT, but will not attain the threshold for U.S. 50 winter-evening traffic volumes or the standard for LOS at Park Avenue and U.S. 50.

b. No-Action Alternative (1981 208 Plan)

The policies of Alternative 2, the 1981 208 plan, will result in intensified land use and increased population, as described under Land Use. The additional travel demand generated by this alternative will increase peak summer day VMT from the 1985 level of 1.65 million to approximately 1.96 million. Since the 1981 208 plan does not include transit improvements and other improvements to reduce VMT, the resulting ultimate VMT for a peak summer day would be 1.96 million, compared to the threshold target of 1.53 million.

The increased travel demand of Alternative 2 will also result in increased peak traffic volumes at key intersections and highway links. Peak summer day level-of-service would exceed level D (i.e., exceed 97 percent capacity) at the intersections of U.S. 50 with Park Avenue, Pioneer Trail (east), and Al Tahoe Boulevard; the South Wye; the Tahoe City business corridor; and Nevada 28 and the Mount Rose Highway (NV 431).

With respect to winter-evening traffic volumes on the U.S. 50 Corridor under Alternative 2, peak period volumes at the intersection of U.S. 50 and Park Avenue will increase by 15 percent or more from the 1985 levels, taking into account the population growth of this alternative.

Alternative 2 would not attain the TRPA VMT reduction threshold, and would not meet the LOS standards for six major signalized intersections and key links.

c. The Hybrid Plan (Alternative 3)

The hybrid plan, Alternative 3, will have similar impacts on transportation as Alternative 4, the proposed 208 amendments, since, as a hybrid of the 1981 208 plan and TRPA's recently-amended Regional Plan, including the 1988 RTP, it results in about the same regional population as Alternative 4 and includes most of the same transportation control measures. See the discussion of Alternative 4, below.

However, the reductions in VMT achieved under Alternative 3 will be lower than under Alternative 4, since Alternative 3 will not achieve the 40,000 to 60,000 reduction in VMT attributed to community planning and redevelopment. The resultant ultimate VMT for a peak summer day would be 1.56 to 1.68 million, compared to the threshold target of 1.53 million.

d. Proposed 208 Amendments (Alternative 4)

The proposed 208 amendments, Alternative 4, allow additional impervious coverage consistent with the Bailey coefficients. In addition, the policies of this alternative allow coverage transfers resulting in coverage over the Bailey coefficients for certain projects, including projects necessary for the public health and safety, and environmental protection. (For details, see Section I, p. 121.) Compared to Alternative 2, the costs of transportation improvements will be higher, since impervious coverage in excess of the Bailey coefficients must be obtained by transfer.

The policies of Alternative 4 will result in intensified land use and increased population, as described under Land Use. The additional travel demand generated by this alternative will increase peak summer day VMT (prior to mitigation) from the 1985 level of 1.65 million to approximately 1.88 million. Considering the projected long-term VMT reductions of 237,000 to 375,000 due to mass transit improvements, community planning, and other improvements (TRPA, 1987a, Technical Appendix), the resultant ultimate VMT for a peak summer day would be 1.64 to 1.50 million, compared to the threshold target of 1.53 million.

The increased travel demand of Alternative 4 will also result in increased peak traffic volumes at key intersections and highway links. However, with the control measures incorporated in the Regional Transportation Plan, all the key intersections and links in the Region will meet their LOS standards. (For additional information, see the FEIS for the RTP (TRPA, 1988b)).

With respect to winter-evening traffic volumes on the U.S. 50 Corridor under Alternative 4, peak period volumes at the intersection of U.S. 50 and Park Avenue will be reduced approximately 30 percent from the 1985 levels, taking into account both population growth and the traffic control measures of the Regional Plan.

Alternative 4 would attain the TRPA VMT reduction threshold, and will meet the LOS standards for the major signalized intersections and key links (see the LOS standards at p. 241). However, Alternative 4 provides little "headroom" in meeting the VMT threshold. (See the discussion in TRPA, 1987a, p. IV-28.) With implementation of the control measures of the Regional Transportation Plan, winter-evening traffic volumes at U.S. 50 and Park Avenue will meet the required 7 percent reduction.

E. AIR QUALITY

1. Applicable Standards

The TRPA thresholds and state and federal standards establish about 23 separate air quality standards for 14 air quality parameters including carbon monoxide (CO), ozone, particulate matter less than 10 microns in size (PM10), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), visibility, lead, hydrocarbons, sulfates, hydrogen sulfide, oxides of nitrogen (NOx) emissions, wood smoke, suspended soil particles, and NOx transport. (See Attachments 1 and 2.)

2. Existing Situation

Carbon Monoxide (CO). The following information is summarized from the 1982 Air Quality Plan (TRPA, 1982a) and the Annual Report on Air Quality (TRPA, 1986b). For more-detailed discussions, see those documents.

CO is a colorless, odorless gas which is a product of incomplete combustion of fuels, and which replaces oxygen in the bloodstream. It disperses rapidly outdoors, and is strongly associated with motor vehicle emissions, especially in areas of traffic congestion and slow vehicle speeds. Combustion heaters also contribute to CO levels.

State and federal standards for CO exist to protect the public health and safety. In 1978, USEPA designated the Tahoe Basin a non-attainment area for the National Ambient Air Quality Standard (NAAQS) for CO. Only the El Dorado and Douglas County portions of the Region are currently considered in non-attainment.

There are four permanent CO monitoring stations in the Region. (See Figure 17.) Violations of the federal 8-hour CO standard (9.3 ppm) are common at the Stateline, California station. Violations have not been observed at the Bijou School, Lake Tahoe Boulevard, or Stateline, Nevada stations. The Stateline, California station exceeded the 8-hour standard on 28 days in 1984 and 27 days in 1985. The highest 8-hour concentration monitored at Stateline, California since 1981 was 17.4 ppm, approximately twice the federal standard.

California, Nevada, and TRPA have adopted more stringent CO standards than USEPA. The States and TRPA require 8-hour average concentrations not to exceed 6 ppm. (See Attachments 1 and 2.)

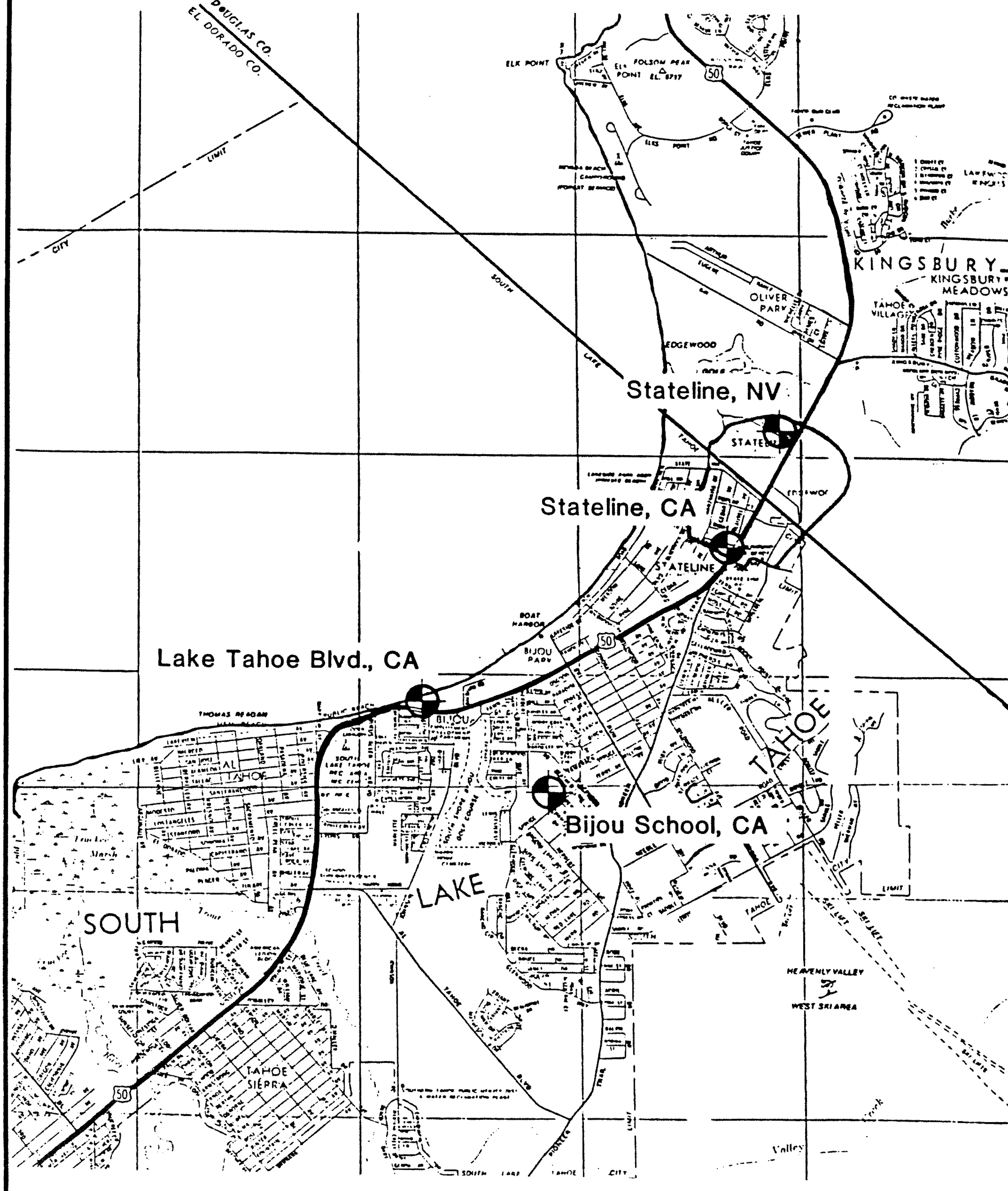


FIGURE 17 Carbon Monoxide Monitoring Locations

Average CO concentrations at Stateline, California are steadily decreasing. This can be traced mainly to a cleaner vehicle fleet, since traffic volumes have not decreased as much. However, the decreases in CO concentrations were not large enough to reach the federal standard by December 31, 1987, and USEPA has notified TRPA it should begin to revise its non-attainment plan to comply with the standard.

In 1979, TRPA adopted the Lake Tahoe Air Quality Nonattainment Plan, which was incorporated into the Nevada State Implementation Plan (SIP) (NDEP, 1979). Monitoring by NDEP indicates that Nevada demonstrated attainment of the CO standard in Nevada by December 31, 1982.

On August 26, 1982, TRPA adopted the 1982 Air Quality Plan (AQP) as part of the Regional Plan. California submitted the 1982 AQP to EPA as a revision to the State Implementation Plan in December 1983, and EPA approved it as a California SIP revision in February, 1984.

In the 1982 AQP, the following control measures, ranked in order of their impact on CO concentrations, were selected for implementation: (1) federal and state auto emission standards, (2) inspection/maintenance programs in major urban areas in California and Nevada, and in the South Shore of the Tahoe Basin, and (3) the transportation improvements discussed under Transportation, above. The federal and state emission standards, as noted, have resulted in a cleaner fleet and are improving CO concentrations in the South Shore. Inspection/maintenance has not been implemented, due largely to technical uncertainties regarding its effectiveness, and will be re-evaluated as part of the AQP revisions.

According to CO modeling conducted for the FEIS: Plan Area Statements and Implementing Ordinances of the Regional Plan (TRPA, 1987a) and the Final EIR/EIS for the Regional Transportation Plan, Lake Tahoe Basin (TRPA, 1988b), it will be necessary to divert traffic from U.S. 50 in the vicinity of Park Avenue to meet the federal and state CO standards at the Stateline, California station.

Ozone. Ozone is a bluish gas (O_3), an unstable, poisonous oxidizing agent with an irritating odor. The states, the federal government, and TRPA have set ozone standards to protect the public health and safety and to protect vegetation. Ozone is a secondary pollutant, formed from the combination of oxides of nitrogen, hydrocarbon gases, and sunlight, and is normally found in the summer, downwind of sources of NOx and hydrocarbons, such as major highways. There is also evidence to suggest that ozone concentrations in the Region can be influenced by long-range transport of precursor compounds, since the highest 1985 concentration coincided with transport from a forest fire on the western slope.

In 1985, the California Air Resources Board (CARB) reported one ozone observation that equalled or exceeded the state's 0.10 ppm 1-hour standard, at the Bijou School monitor. There have been no reports of violations of the 0.12 ppm federal 1-hour standard. TRPA's 0.08 ppm 1-hour standard was met or exceeded 10 times in 1985 at either Bijou School or the Lake Tahoe Boulevard monitor.

In a recent study of possible ozone damage to trees in the Sierra Nevada, researchers from the University of California found ozone damage at locations in the Tahoe Region (Pedersen, 1988).

Programs to reduce vehicle-miles-travelled (VMT) are effective at controlling ozone concentrations, since they reduce emissions of both precursors, NOx and hydrocarbons. Alternative fuel programs, especially those which replace diesel fleets with fleets that create low NOx emissions, are also effective. These programs are adopted in the TRPA Goals and Policies (TRPA, 1986a).

Visibility. Good visual range, or visibility, is one of the Tahoe Region's most outstanding features. TRPA adopted visibility thresholds to preserve the existing visibility. (See Attachment 1.) The states and USEPA have also adopted standards designed to protect visibility, such as standards for PM10.

Visibility degradation is an extremely complex phenomenon involving many natural and man-made variables. In general, particles and gases in the atmosphere degrade visibility by scattering and absorbing light. These particles and gases, in turn, come from blowing dust, natural emissions from vegetation, automobile and airplane emissions, combustion heaters, industrial emissions, and other sources, both distant and local. TRPA is establishing a visibility monitoring program in the Tahoe Region in 1988 and will, over time, develop additional technical data for evaluating and assessing compliance with the thresholds, and for refining control measures.

In general, control measures which reduce blowing dust, auto emissions, and emissions from stationary sources and combustion heaters will contribute to improved visibility, and are included in the TRPA Goals and Policies (TRPA, 1986a) and Code of Ordinances (TRPA, 1987b).

Oxides of Nitrogen. Oxides of nitrogen are gases and particles from motor vehicle emissions, combustion heaters, industry and other sources, known collectively as NOx. They occur in the Tahoe Region from both local and distant sources. (See Section I, Chapter II.) TRPA has set thresholds for NOx emissions to reduce direct atmospheric loading of inorganic nitrogen on Lake Tahoe. NOx is also an ozone precursor, and a factor in visibility degradation. The thresholds call for both the reduction of transport and a reduction in local emissions consistent with the water quality thresholds. (See Attachment 1.)

Mobile sources represent the largest in-Region source of NOx emissions. However, TRPA does not have an accurate emissions inventory for NOx. Combustion heaters and other stationary sources also contribute to the emissions inventory. Recent decreases in VMT have decreased NOx emissions from mobile sources, and future VMT decreases will also decrease NOx emissions, in combination with improvements resulting from the cleaner vehicle fleet nationally.

Regulatory Controls. CARB, NDEP, county air pollution control districts in California, units of local government, and TRPA regulate air quality in the Tahoe Region. TRPA has adopted controls in the Code of Ordinances for motor vehicles, combustion appliances, open burning, stationary sources, and idling motors (TRPA, 1987b, Chapter 91) and implements these controls in cooperation with the entities above.

Analytical Techniques. TRPA and other agencies responsible for air quality use computerized cause-effect models to predict concentrations of pollutants under various land use, transportation, and meteorological scenarios. TRPA uses the CALINE4 model of CARB to predict carbon monoxide concentrations, as documented in the 1987 EIS on the Code and Plan Area Statements (TRPA, 1987d).

With respect to ozone and visibility, TRPA has not used predictive models. Instead, TRPA relies on analysis of trends in key indicators such as VMT, implementation of BMPs for dust control, and wood smoke emissions. TRPA has prepared a simple model of upwind NOx emissions, set forth in the Technical Appendix. CARB, NDEP, TRPA, and the Tahoe Research Group conduct regular air quality monitoring in the Region.

3. Anticipated Air Quality Impacts

a. No-Growth Alternative (Alternative 1)

The No-Growth Alternative, Alternative 1, which permits no additional impervious coverage and no transfers of existing coverage, would, as discussed under Transportation, decrease peak summer day VMT in the Tahoe Region by over 10 percent from the 1981 value. This VMT reduction, combined with the cleaner vehicle fleet, would have a beneficial impact on NOx emissions, visibility, and ozone concentrations. The controls on blowing dust that would be achieved through implementation of BMPs and the Capital Improvements Program (CIP) would also be beneficial to visibility.

Since peak traffic volumes in the vicinity of the Stateline, California monitor would not change significantly under this alternative, and since the intersection of Park Avenue and U.S. 50 would continue to operate at level-of-service "E" during peak periods (see p. 248), this alternative would not meet the federal and state standards for carbon monoxide, although average concentrations would continue to decrease in response to the cleaner fleet.

In summary, Alternative 1 would not attain and maintain the TRPA, state, and federal standards for carbon monoxide, but would contribute to the attainment and maintenance of thresholds and standards for ozone, visibility, and NOx emissions, and attain and maintain the TRPA threshold of a 10 percent VMT reduction. To attain and maintain the CO standards, the No-Growth Alternative would have to be modified to provide for some diversion of traffic from the U.S. 50 Corridor. TRPA should continue to monitor and evaluate visibility thresholds, cause-effect relationships, and control measures to ensure attainment and maintenance of the visibility thresholds.

Carbon monoxide, ozone, visibility, and NOx emissions are the major air quality parameters of concern in the Tahoe Region, and include all those parameters which would be affected by the water quality management measures of the 208 plan.

b. No-Action Alternative (1981 208 Plan)

Alternative 2, the No-Action Alternative, could increase VMT by about 19 percent, since it increases Regional population and includes no VMT reduction programs. Because of the cleaner vehicle fleet, NOx and hydrocarbon emissions will probably decrease under this alternative over 20 years, with positive effects on visibility, ozone production, and atmospheric deposition of nitrogen on Lake Tahoe.

The controls on blowing dust that will be achieved through implementation of BMPs and the Capital Improvements Program (CIP) will be beneficial to visibility and atmospheric deposition of nutrients such as phosphorus and iron on Lake Tahoe.

Under Alternative 2, ultimate peak traffic volumes in the vicinity of the Stateline, California monitor will increase 15 percent or more from the 1985 levels. (See Transportation, p. 248.) Despite the cleaner fleet and other programs, such as alternative fuels, this alternative will not meet the federal and state standards for carbon monoxide (TRPA, 1987a, Technical Appendix).

Alternative 2, the 1981 Plan, will not meet the TRPA threshold requiring a 10 percent VMT reduction as described under Transportation (p. 248). It will not contribute to the attainment and maintenance of thresholds for ozone, visibility, and NOx emissions. This alternative will not meet the state and federal CO standards.

c. The Hybrid Plan (Alternative 3)

The hybrid plan, Alternative 3, will have similar impacts on air quality as Alternative 4, the proposed 208 amendments, since, as a hybrid of the 1981 208 plan and TRPA's recently-amended Regional Plan, including the 1988 RTP, it results in about the same regional population as Alternative 4 and includes most of the same transportation and air quality control measures. See the discussion of Alternative 4, below.

However, since the VMT reductions under Alternative 3 will be lower than Alternative 4 by 40,000 to 60,000 miles, decreases in NOx and hydrocarbon emissions will also be lower, with somewhat less beneficial effects on visibility, ozone production, and atmospheric deposition of nitrogen on Lake Tahoe.

d. Proposed 208 Amendments (Alternative 4)

Alternative 4, the proposed 208 amendments, will decrease VMT by the required 10 percent. (See discussion under Transportation, p. 249.) With the cleaner vehicle fleet, NOx and hydrocarbon emissions will decrease even more than 10 percent under this alternative, with beneficial effects on visibility, ozone production, and atmospheric deposition of nitrogen on Lake Tahoe.

The controls on blowing dust that will be achieved through implementation of BMPs, restoration projects, and the Capital Improvements Program (CIP) will also be beneficial to visibility and atmospheric deposition of nutrients such as phosphorus and iron on Lake Tahoe.

Under Alternative 4, ultimate peak traffic volumes in the vicinity of the Stateline-California monitor will be reduced approximately 30 percent from the 1985 levels, taking into account both population growth and the traffic control measures of the Regional Plan. (See Transportation, p. 249.) Combined with the cleaner fleet and other programs, such as alternative fuels, this alternative will meet the federal and state standards for carbon monoxide (TRPA, 1987a, Technical Appendix).

Alternative 4, the proposed amendments, will meet the TRPA threshold requiring a 10 percent VMT reduction, as described under Transportation (p. 249). It will contribute to the attainment and maintenance of thresholds for ozone, visibility, and NOx emissions, and meet the state and federal CO standards.

F. WATER QUALITY

1. Applicable Standards

The TRPA thresholds and state water quality standards establish over 30 separate water quality standards for Lake Tahoe and its tributaries. As discussed in the Setting (Section I, Chapter II), the standards address algal growth potential, plankton count, clarity, turbidity, phytoplankton productivity, phytoplankton biomass, zooplankton biomass, periphyton biomass, dissolved inorganic nitrogen (DIN) loading, nutrient loading in general, tributary water quality, surface runoff quality, and the quality of other lakes in the Tahoe Region. (See Attachments 1 and 2.)

The TRPA thresholds call for reductions in DIN loads from tributaries by approximately 50 percent, from groundwater by approximately 30 percent, and from atmospheric sources by approximately 20 percent of the 1973-1981 annual average, for an overall reduction in annual loads to Lake Tahoe of 25 percent.

Since many of the applicable state and TRPA standards overlap, the following analysis focuses on the nutrient loading thresholds and the ambient quality standards in the following seven areas: turbidity of the shallow waters of Lake Tahoe, winter clarity of pelagic Lake Tahoe, phytoplankton primary productivity in Lake Tahoe, tributary water quality, runoff water quality, groundwater quality, and the quality of other lakes in the Region.

California and Nevada have both adopted statewide antidegradation policies consistent with federal requirements. These policies require the maintenance of existing high quality waters. (See Attachment 2.) Federal regulations (40 CFR 131.12) also require the maintenance of existing high quality waters, and specifically state that in waters which constitute an outstanding national resource, such as Lake Tahoe, water quality shall be maintained and protected.

2. Existing Situation

The Setting (Section I, Chapter II) describes the existing water quality situation in detail, and the reader should refer to the Setting for detailed information. Recent water quality data appear in both the Setting and the Technical Appendix, Volume VII.

a. Lake Tahoe

Where data are sufficient to assess compliance with standards related to the trophic status (i.e., level of algal productivity) of Lake Tahoe, the Lake does not attain the standards. Algal productivity will continue to increase, and clarity will continue to decrease, until the nutrient budget of Lake Tahoe is balanced, a goal that will take many years to reach under any feasible water quality management policies. The increasing algal productivity of Lake Tahoe results from accelerating eutrophication of the Lake, which in turn is the result of liberation and reduced filtration of nutrients in the watershed; altered hydrology; vegetation displacement; addition of nutrients from fertilizer and sewage; and atmospheric deposition.

b. Tributary Water Quality

The status of compliance with state water quality standards for the tributaries varies from stream to stream, where data are sufficient to assess compliance. In general, exceedences of the state standards are common.

With respect to the California tributary standards, it is not known whether California streams attain the total nitrogen standards, since data for total nitrogen have not been reported for California streams in the TRG/USGS monitoring program. California streams in the TRG/USGS monitoring program do not meet the total phosphorus standard. Total phosphorus concentrations from monitored streams generally exceed the standard by a factor of about 2. California streams in the TRG/USGS monitoring program do not meet the total iron standard. Total iron concentrations for monitored streams in California generally exceed the standard by an order of magnitude.

With respect to the Nevada tributary standards, streams in the TRG/USGS monitoring program appear to be at or near attainment of the soluble phosphorus standard and in attainment of the soluble inorganic nitrogen standard, based on a very short period of record. Additional monitoring will be necessary to confirm this.

With respect to TRPA's suspended sediment threshold, annual average concentrations of suspended sediment for streams in the TRG/USGS monitoring program are generally less than the 60 mg/l threshold. However, the threshold is a more-stringent 90th percentile standard, and 90th percentile data have not been reported.

Reviewing the tributary data as a whole, it appears that the TRPA suspended sediment threshold (60 mg/l) is generally attainable, and that the California tributary standards for total phosphorus, while frequently exceeded, are also attainable over the long term with application of remedial measures. Nevada standards for dissolved inorganic nitrogen and soluble phosphorus appear to be attainable, based on a short period of record. The California total iron standards may set unrealistically high goals for tributary water quality and should be reviewed.

c. Quality of Surface Runoff

The thresholds, the 1981 208 plan, and the Lake Tahoe Basin Water Quality Plan (SWRCB, 1980), all set maximum concentrations for pollutants in discharges of runoff to surface waters and groundwater, as discussed in the Setting. (See also Attachments 1 and 2.) Surface runoff is localized surface flow from rainfall and snowmelt draining small sub-watersheds (TRPA, 1982d).

Observed 90th percentile concentrations of nitrate, dissolved phosphorus, and dissolved iron in four studies from 1969 to 1982 equalled or exceeded the TRPA and state guidelines for discharges of runoff to surface waters (TRPA, 1982d, pp. 4-103 to 4-105). However, the 90th percentile concentrations met the TRPA and state guidelines for discharges of runoff to groundwater, with the exception of runoff from urbanized areas, which exceeded the phosphorus guideline by a factor of about two.

TRPA and the Lahontan Board in California generally apply the surface runoff standards on a site-specific or project-specific basis in response to identified erosion or runoff problems. The status of compliance varies from site to site but, in general, urban runoff exceeds the TRPA and state guidelines for discharge to surface waters in greater than 90 percent of the samples taken. The 90th percentile concentrations for dissolved phosphorus exceed the guidelines for discharge to surface waters by a factor greater than 10 (TRPA, 1982d, pp. 4-103 to 4-105).

Exceedences of the standards are generally caused by impervious coverage, loss of vegetative uptake, hydrologic short-circuiting, fertilizer over-use, soil disturbance, and poor housekeeping practices.

d. Groundwater Quality

Groundwater quality and the contribution of groundwater to the nutrient budget of Lake Tahoe have not been widely investigated. The Thresholds Study Report (TRPA, 1982d) estimated the average annual DIN load from groundwater at approximately 10 metric tons, based on a study of nutrients in groundwater in the Ward Valley on Lake Tahoe's west shore (Loeb and Goldman, 1979). (For additional discussion of groundwater, see the Setting.)

Loeb's study of groundwater in the Tahoe Region (1987) is the most-complete study to-date of the role of groundwater in the water and nutrient budgets of Lake Tahoe. Loeb concluded that groundwater contamination appeared to be significant in some locations, threatening the environmental health of Lake Tahoe.

In three major groundwater aquifers in the Tahoe Basin, Loeb found that the overall slope of the groundwater hydraulic gradient was toward Lake Tahoe. Nitrate-nitrogen concentrations were lower up-gradient in the watershed, and higher down-gradient toward Lake Tahoe. Up-gradient concentrations were lower by a factor of two to ten. From this information, one may conclude that urbanization adjacent to Lake Tahoe is responsible for significantly increasing nitrate-nitrogen concentrations in groundwater by addition of fertilizers, irrigation, sewer line exfiltration, sewage spills, infiltration of urban runoff, and leachate from abandoned septic systems.

Loeb estimated that five to 20 percent of the total nitrate loading (streams and groundwater) from the Upper Truckee-Trout Creek drainage enters Lake Tahoe via groundwater, and that two percent of the total soluble reactive phosphorus loading was from groundwater. He estimated that 60 percent of the total nitrate loading from the Ward Valley entered Lake Tahoe from groundwater, and 44 percent of the total soluble reactive phosphorus.

e. Quality of Other Lakes

There are more than 170 ponds or small lakes within the Tahoe Region. Data describing the quality of these lakes is very limited, and is presented in the Threshold Study Report (TRPA, 1982d). The largest of the other lakes are Cascade (85 hectares), Upper and Lower Echo (133 hectares), Marlette (142 hectares), and Fallen Leaf (567 hectares). Clarity measurements in Fallen Leaf Lake in 1975 showed lower clarity than Lake Tahoe for the same period (TRPA, 1982d). In recent years, there have been complaints about taste and odor problems in domestic water supplies drawn from Fallen Leaf Lake. These problems have been attributed to the colonial algae, Volvox. Despite the lack of comprehensive data, there are also concerns about the water quality of Cascade Lake, at which there are a number of residences not presently connected to the sewer, and Echo Lakes, where the TRPA Plan Area Statements recommend a nitrogen study be conducted before allowing further development.

f. Regulatory Controls on Water Quality

Under the federal Clean Water Act, California and Nevada set water quality standards for the waters of the Lake Tahoe Region, subject to USEPA approval. These standards are contained in state plans developed under section 303 of the Clean Water Act, specifically the Water Quality Control Plan for the North Lahontan Basin (SWRCB, 1975), the Lake Tahoe Basin Water Quality Plan (SWRCB, 1980), and the Nevada 303 plan. TRPA has also set water quality standards in the thresholds. (See Attachments 1 and 2.)

The 1981 208 plan, described in detail in Section II, Chapter I, contains the applicable water quality management policies in the Tahoe Region, supplemented by the TRPA Goals and Policies (TRPA, 1986a) and Code of Ordinances (TRPA, 1987b). Where policies are inconsistent, the most-stringent policy is applied.

g. Analytical Techniques

Key Indicators of Water Quality. To conveniently assess the potential water quality impacts of various land use scenarios and water quality management policies, TRPA uses key indicators which are important to tributary water quality and nutrient and sediment loads to Lake Tahoe. These indicators are: (1) the area of stream environment zones (SEZs)--natural, disturbed, and restored, (2) the total area of impervious coverage for the various land capability districts and the Region as a whole, (3) developed drainage density, an indicator and integrator of the four major variables which control sediment and nutrient yields from the watershed: soils, geology, precipitation, and development, (4) average IPES scores of parcels with potential for single-family development, and (5) local NOx emissions, an indicator of trends in direct nitrogen deposition from local sources on Lake Tahoe.

Evaluating these key indicators does not give TRPA a predictive model of water quality, but does allow a side-by-side comparison of alternative management plans. The five indicators, above, give TRPA relative information for the four alternatives on the cleansing power of SEZs; the degree of hydrologic modification; the sensitivity of developing parcels; and the degree of local contributions to atmospheric deposition of nutrients on Lake Tahoe.

TRPA uses the IPES ratings, described in Section I (p. 116) as an indicator of the relative sensitivity of parcels to be developed with single-family homes. IPES was developed by TRPA and the IPES technical committee for exactly that purpose, and the extensive data base gathered by TRPA in 1987, covering over 10,000 parcels, is useful for analyzing the water quality impacts of the various alternatives.

Predicting Sediment and Nutrient Loads from the Watershed. To predict sediment and nutrient loads from the watershed of Lake Tahoe under various land use and water quality management alternatives, several researchers have attempted to derive useful models in the last 15 years (SWRCB, 1980; White and Franks, 1979; Brown and Skau, 1973; Byron and Goldman, 1987; TRPA, 1983). Each of these models attempts to relate data describing the watershed to tributary nutrient and sediment data through the mathematical process of regression analysis. Each model is limited in its predictive power because of the relatively small sizes of the data sets, high degree of variability in the water quality data, weak mathematical correlations between watershed and water quality data and, in some cases, the omission of variables needed to evaluate different management strategies.

As is often the case with attempts to model natural systems through regression analysis, the regression equations are more useful to explain and understand watershed processes than to predict future sediment and nutrient yields. TRPA has used the equations to help develop the description of runoff processes in the Setting (Section I, Chapter II), a conceptual model which helps TRPA analyze the impacts of different alternatives in a qualitative sense.

Despite the shortcomings of the predictive models for the watershed of Lake Tahoe, it would be desirable to utilize models from previous 208 analyses to establish a consistent analytical framework for the users of these documents. Thus, TRPA has evaluated the sediment and nutrient yield model of the Lake Tahoe Basin Water Quality Plan (SWRCB, 1980, Appendix B) and the nutrient and sediment load estimating procedures of the EIS for the Adoption of a Regional Plan for the Lake Tahoe Basin (TRPA, 1983), with the following results:

-- The SWRCB model relates land capability classification to sediment and nutrient yield rates based on data from 19 watersheds in the Tahoe Region from 1972 to 1974. Although it estimates dissolved nutrient yields as a function of sediment yields, which is not consistent with the systems model, does not recognize differences in precipitation or stream discharge among watersheds, and does not include a component which allows TRPA to model the contributions of Best Management Practices (BMPs) to water quality, it is still useful for predicting approximate suspended sediment yields, prior to application of BMPs, from small watersheds. It also has the advantage of being sensitive to the location of impervious coverage within the watershed.

-- The TRPA procedure, used in the 1983 and 1987 EISs (TRPA, 1983; TRPA, 1987a) predicts DIN and suspended sediment loads independent of each other; recognizes the differences in precipitation and stream discharge in predicting sediment and nutrient loads; and allows TRPA to model the contributions of Best Management Practices (BMPs). The analysis of water quality herein incorporates previous modeling using the TRPA procedure (TRPA, 1983, p. 199; TRPA, 1987a, Technical Appendix) and employs the procedure for additional analysis.

See the Technical Appendix for additional discussion of estimates of nutrient and sediments yields from the watershed using the TRPA and SWRCB procedures.

Predicting Changes in Atmospheric Deposition. Appel and Tokiwa (1984) developed a quantitative model to predict approximate values of atmospheric deposition of nutrients on Lake Tahoe. (See Table 12.) To predict changes in atmospheric deposition, TRPA will rely on information reported in Table 12 and the Technical Appendix regarding: (1) the relative contributions of local and distant sources of nitrate-nitrogen, (2) estimated changes in local vehicle-miles-travelled (VMT), an indicator of the magnitude of changes in the local contribution, (3) projected decreases in in-Basin and upwind per-vehicle NOx emissions resulting from the nationwide cleaner fleet, and (4) projected population increases in contributing areas upwind.

Predicting Changes in Groundwater Quality. TRPA does not have a quantitative model to predict changes in nutrient concentrations in groundwater, or the contributions of groundwater nutrients to Lake Tahoe. Data on groundwater quality and quantity in the Region are sparse, and modeling of groundwater quality and flow rates demands much data. The most-recent study of groundwater in the Region (Loeb, 1987) did not attempt to apportion the increased nutrient loads from development to the various sources: fertilizer, urban runoff, sewage spills, sewer exfiltration, and abandoned sewage disposal systems. Therefore, to evaluate changes in groundwater quality, TRPA will assume that the increases in groundwater nutrients observed by Loeb in areas adjacent to Lake Tahoe are the general result of urbanization of the watershed, and that source controls, over the long-term, can significantly reduce nutrient contributions from the urbanized areas.

Predicting Lake Tahoe's Trophic Status. With respect to predicting phytoplankton primary productivity and winter clarity in Lake Tahoe, TRPA relies on the analysis in the Threshold Study Report, which found a strong relationship between primary productivity and storage of DIN in Lake Tahoe, and a somewhat weaker relationship between primary productivity and winter clarity. (See TRPA, 1982d, pp. 4-52 to 4-58.) Based on these relationships, TRPA concluded that reductions in long-term annual loads of DIN of at least 20 to 25 percent would be required to return primary productivity, turbidity, and clarity to the average 1968-71 conditions and comply with the state nondegradation standards (TRPA, 1982d, p. 4-113). The TRPA thresholds for DIN load reductions were based on this conclusion.

Predicting Changes in Tributary Water Quality. TRPA has not developed quantitative models to predict changes in tributary water quality in response to alternative management strategies. Although such models are available at the national level (see Linsley, et al., 1982, p. 433) they have not been applied or calibrated on any of the 63 major streams in the Tahoe Region.

The combined water quality management programs of the 208 plan can, at best, cause tributary water quality to approach natural conditions, since it is unreasonable to expect management programs to improve on natural conditions. Since studies of BMPs have demonstrated that they can reduce yields of suspended sediment from small urbanized areas by 80 to 100 percent, and yields of phosphorus and nitrogen by 40 to 80 percent (Schueler, 1987), application of BMPs and the Capital Improvements Program for erosion and runoff control will significantly improve tributary water quality.

<u>Predicting Changes in the Quality of Surface Runoff</u>. A variety of techniques are available to predict concentrations of sediment and nutrients in surface runoff (localized surface flow from rainfall and snowmelt) associated with specific projects or capital improvements. Typically, sediment and nutrient yields from small basins or subbasins are estimated before and after treatment, and routed through the basin or subbasin for a simulated design storm. In the Tahoe Region, the most detailed analysis of this type has been performed in support of the erosion and runoff control project in the Bijou-Wildwood area, City of South Lake Tahoe, by Brown and Caldwell Engineers (1985). The Brown and Caldwell project was designed to meet the threshold standards for discharge of surface runoff to surface waters.

A similar analysis was completed for the Draft EIR/EIS: South Lake Tahoe Redevelopment Plan (Brady and Associates, 1988). Edwards and Skau (1987) analyzed the stormwater management component of the proposed Redevelopment Plan. They concluded that discharges from the stormwater management system would meet the state and TRPA standards for suspended sediments and turbidity, but fail to meet the standards for nitrogen and phosphorus, assuming a discharge to surface waters. Discharges from the system would easily meet all standards for discharges to groundwater, however. The proposed system was designed to treat the "first flush" of pollutants.

As mentioned above, studies of BMPs have demonstrated that they can reduce yields of suspended sediment from small urbanized areas by 80 to 100 percent, and yields of phosphorus and nitrogen by 40 to 80 percent (Schueler, 1987). Application of BMPs and the Capital Improvements Program for erosion and runoff control will improve the quality of surface runoff from small areas, with proper design and maintenance, and generally meet the state and TRPA quality standards for surface runoff. This assumption is supported by the detailed models discussed above.

<u>Predicting Changes in the Quality of Other Lakes</u>. Since the data regarding water quality in the other lakes of the Tahoe Region are very incomplete, TRPA relies on qualitative analysis based on the systems model to predict changes in the quality of these lakes and to evaluate the relative impacts of the four alternatives.

3. Anticipated Water Quality Impacts

a. No-Growth Alternative (Alternative 1)

The No-Growth Alternative, Alternative 1, allows no new impervious coverage or transfers of existing coverage in the Region. It does include, however, the program of BMP implementation found in Alternative 4, implementation of the Capital Improvements Program (CIP) for erosion and runoff control, the excess coverage mitigation program, the SEZ restoration and protection program, use of discharge standards and permits, land use planning and controls, transfers of development rights, provided no new coverage is created; native and adapted plant requirements; fertilizer reporting requirements; improved mass transit; combustion heater rules and related rules; waste management provisions; restrictions on shoreline encroachment and vegetation alteration; and restrictions on dredging and filling.

Impacts on Key Water Quality Indicators. By evaluating the effects of the No-Growth Alternative on the key water quality indicators, and comparing those effects under all alternatives, one can evaluate the relative impact of this alternative on water quality. Since the No-Growth Alternative allows no additional impervious coverage and no coverage transfers, the resulting impervious coverage will be the same as or less than existing conditions. Existing impervious coverage in the Region is approximately as follows (TRPA, 1983, p. 171, adjusted to reflect growth since 1982):

Land capability districts 1a, 1c, 2	1,400 acres
Land capability district 1b (SEZ)	1,200 acres
Land capability districts 3, 4	950 acres
Land capability districts 5, 6, 7	3,050 acres
TOTAL	6,600 acres

Since, over a 20-year period, excess coverage mitigation programs will reduce impervious coverage by about 60 acres, primarily in land capability districts 1, 2, and 3, (see Soils) the total resulting coverage under this alternative would be approximately 6,540 acres.

In 1983, TRPA estimated the total existing acreage of disturbance (i.e., compacted and denuded areas not developed with structures) at about 7,200 acres (TRPA, 1983). Since TRPA's goal is to reduce existing disturbance by 80 percent through BMP and CIP implementation, the resulting total disturbance under this Alternative will be approximately 1,400 acres.

The SEZ Restoration Program, set forth in Volume III of this plan, will bring about a large positive impact on water quality through the restoration of approximately 1100 acres of SEZs in urbanized portions of the Tahoe Region, and approximately 200 acres in the undeveloped portions of the Region. (See SEZs, p. 230.)

This alternative will create few or no new drainage conveyances in the watershed of Lake Tahoe and, by encouraging infiltration of surface water through the programs of BMP and CIP implementation, will significantly reduce the existing developed drainage density, with a corresponding positive impact on water quality. Of the four alternatives, the No-Growth Alternative has the most positive impact on developed drainage density.

As discussed under Transportation, the No-Growth Alternative will reduce regional VMT by over 10 percent from the 1981 value, to approximately 1.48 to 1.51 million VMT, peak summer day. This reduction in VMT will reduce local NOx emissions and, in combination with lower per-vehicle NOx emission rates, will reduce direct deposition of nitrogen on Lake Tahoe from local sources.

Refer to Table 27 for a comparison of the key water quality indicators under the four alternatives.

Sediment and Nutrient Loads from the Watershed. The TRPA procedure used to predict DIN and sediment loads in previous TRPA EISs (TRPA, 1983; TRPA, 1984a; TRPA, 1987a) was used to estimate load reductions under the No-Growth Alternative. With no increases in DIN load attributable to new development, the application of BMPs and implementation of the CIP will reduce DIN loads approximately 49 percent. With the addition of SEZ restoration and fertilizer management, this alternative will reduce DIN loads from tributary streams by 55 to 60 percent over 20 years (TRPA, 1984a, p. 23).

The more-detailed watershed simulations of the Tahoma and Incline Village areas (TRPA, 1987a), which were also based on the TRPA procedure, predicted that the No-Growth Alternative (without SEZ restoration and fertilizer management) would reduce existing DIN loads in Tahoma by about 51 percent and in Incline by about 40 percent. The No-Growth Alternative would reduce existing suspended sediment loads in Tahoma by about 62 percent and in Incline by about 16 percent. (See TRPA, 1987a, Technical Appendix). The Tahoma and Incline simulations were conducted, in part, to determine whether modeling of individual watersheds or study areas gave similar results to the Region-wide modeling described above. The results are similar.

The No-Growth Alternative will attain and maintain the TRPA threshold which calls for a 50 percent reduction in DIN loading to Lake Tahoe from tributary streams.

Changes in Atmospheric Deposition. The No-Growth Alternative will reduce VMT by more than 10 percent and, with the cleaner vehicle fleet, will reduce local NOx emissions by about 43 percent over 20 years. Since local sources represent only 20-40 percent of atmospheric deposition of nitrate-nitrogen on Lake Tahoe (see Table 12), implementation of control measures within the Tahoe Region will reduce atmospheric deposition of nitrate-nitrogen by about 9 to 17 percent over 20 years. Changes in deposition due to distant sources are difficult to predict, but will be about the same for all four alternatives in any case. According to recent TRPA projections, upwind NOx emissions will decrease 13 to 17 percent over 20 years (see the Technical Appendix), with a corresponding effect on transport of nitrogen compounds.

With cooperation from upwind areas to reduce the transport of nitrate-nitrogen into the Tahoe Region, the No-Growth Alternative will attain and maintain the TRPA threshold which calls for a 20 percent reduction in DIN loading to Lake Tahoe from atmospheric deposition. The CARB should provide TRPA with regular progress reports on programs to reduce NOx emissions in areas upwind from the Tahoe Region.

Changes in Groundwater Quality. The No-Growth Alternative will control the existing sources of elevated nutrient levels in groundwater through its fertilizer management, sewage exfiltration control, sewage spill control, and native and adapted plant requirements, and through revegetation and restoration projects in areas of groundwater recharge. Care must be taken to emphasize vegetative treatment of surface runoff routed to infiltration facilities, so that infiltration practices do not surcharge the groundwater with additional nutrients. One source of elevated nutrients in groundwater, leachate from abandoned sewage disposal sites, will naturally decrease over time as nutrients are flushed from the groundwater system.

Since Loeb (1987) reported that nutrient concentrations in groundwater in urbanized areas adjacent to Lake Tahoe are 2 to 10 times higher than upgradient concentrations, and since the sources of these higher concentrations of nutrients are known and controllable, it is reasonable to predict that a 30 percent reduction in nitrogen loads from groundwater is feasible to achieve in the long term with source control programs. Thus, the No-Growth Alternative will attain and maintain the TRPA threshold calling for a 30 percent reduction in DIN loads to Lake Tahoe from groundwater, although it should be recognized that these reductions will take many years and elevated nutrient levels in groundwater will continue to impact Lake Tahoe for many years also.

Algal Productivity and Clarity of Lake Tahoe. The preceding paragraphs describe predicted changes in the three main nutrient inputs to Lake Tahoe--tributary flow from the watershed, atmospheric deposition, and groundwater. These analyses indicate that the No-Growth Alternative will attain the threshold goals of a 50 percent reduction in surface water inputs of DIN, a 30 percent reduction in groundwater inputs of DIN and, with assistance and cooperation from upwind areas, a 20 percent reduction in atmospheric deposition of nitrogen.

The overall threshold goal of a 25 percent reduction in annual DIN loading to Lake Tahoe would, therefore, be achieved, and the thresholds for phytoplankton primary productivity, winter clarity of the pelagic zone, and turbidity of the shallow waters of Lake Tahoe would, over the long-term, be attained and maintained.

Tributary Water Quality. Given the combination of no additional development and application of remedial measures under the No-Growth Alternative, tributary water quality will improve throughout the Tahoe Region. As discussed under Tributary Water Quality (p. 261), the TRPA suspended sediment threshold, the California total phosphorus standards, and the Nevada tributary standards for dissolved nutrients seem to be attainable, but the California total iron standards do not seem to be attainable, and should be reviewed.

Quality of Surface Runoff. Monitoring indicates that surface runoff will generally meet the TRPA and state guidelines for discharge to groundwater, although runoff in heavily urbanized areas of the Region should be pretreated prior to discharge into infiltration facilities. Discharges to surface waters of untreated surface runoff will generally not meet the state and TRPA guidelines, and should either be eliminated and replaced with discharges to groundwater or routed through treatment systems designed, constructed, and operated to meet the standards, prior to discharge.

Water Quality of Other Lakes. The remedial programs of the No-Growth Alternative will improve the water quality of the other lakes in the Tahoe Region. Unless water quality monitoring programs reveal specific problems in the future, the quality of the other lakes should equal or exceed the applicable state standards.

b. No-Action Alternative (1981 208 Plan)

The No-Action Alternative, Alternative 2, calls for Region-wide application of BMPs and implementation of the Capital Improvements Program for erosion and runoff control and the SEZ restoration program. It includes the water quality mitigation program, discharge standards and permits for urban drainage problems and other problems, limitations on new subdivisions, limitations on fertilizer use, waste management provisions, and controls on practices in natural areas, vessel wastes, and dredging and construction in Lake Tahoe. (For details, see Section II, Chapter I.)

This alternative also requires future development and construction activities to comply with the Bailey coverage coefficients on a parcel-by-parcel basis, and prohibits construction, grading, and vegetation removal within SEZs. Exceptions to these requirements are allowed for approved erosion control projects, projects necessary to implement the air quality non-attainment plan or the transportation element of the Regional Plan, public outdoor recreation, and public health, safety, and welfare.

Impacts on Key Water Quality Indicators. As discussed under Soils (p. 222), this alternative will result in approximately 662 acres of additional impervious coverage in the Region, with certain new public service and recreation coverage in land capability districts 1 through 3. Given that approximately 6,600 acres of impervious coverage exist in the Region today, the net ultimate coverage under Alternative 2 will be approximately 7,262 acres. See Table 23 for a comparison of impervious coverage under the four alternatives.

As discussed under Alternative 1, TRPA estimates there are approximately 7,200 acres of existing disturbance (i.e., compacted and denuded areas) in the Region. Although the No-Action Alternative (the 1981 plan) does not include an explicit program to achieve retroactive application of BMPs to existing development in the Region, voluntary application of BMPs and actions by TRPA under Ordinance 82-4 will gradually reduce the amount of existing disturbance.

The No-Action Alternative could allow about 10 acres of new SEZ encroachment. (See SEZs, p. 233.) Also, the No-Action Alternative does not include an SEZ restoration program.

This alternative will create new drainage conveyances in the watershed of Lake Tahoe by allowing additional residential, commercial, tourist, public service, and recreation development to occur. Since this alternative does not allow new subdivisions in undeveloped areas, there will be no new street networks established. Instead, new drainage conveyances will result primarily from the placement of driveways and structures in existing urbanized areas of the Region. The implementation of BMPs and the CIP will reduce the overall developed drainage density more than the additional development will increase it. But since the No-Action Alternative would result in the most impervious coverage and the most new single-family homes of all the alternatives, and since it does not include explicit provisions for retroactive application of BMPs, its impacts on drainage density--while positive--are the smallest of the four alternatives.

Using the average IPES scores of parcels which would be developed with single-family homes, TRPA has evaluated the relative sensitivity of developing parcels under Alternatives 2, 3, and 4. See Table 27 and the discussion under Alternative 4.

As discussed under Air Quality, the No-Action Alternative would result in about a 19 percent increase in peak summer day VMT, but will decrease local NOx emissions and direct deposition of nitrogen on Lake Tahoe because of the cleaner vehicle fleet. (See Table 27 for a comparison of key indicators.)

Sediment and Nutrient Loads from the Watershed. Since Alternative 2 will allow additional development in the Region as described under Land Use, there will be increases in nutrient and sediment loads from the watershed attributable to new development. These increases will be offset by reductions from application of BMPs, implementation of the CIP, and fertilizer management. Based on the TRPA procedure for estimating DIN loads (TRPA, 1983), for the Region as a whole, the net reduction in DIN loads from tributary streams, not including fertilizer management, would be about 44 percent, compared to 49 percent for the No-Growth Alternative. The additional development, therefore, increases regional DIN loads about 5 percent before taking credit for the reductions.

The more-detailed watershed simulations of the Tahoma and Incline Village areas (TRPA, 1987a), predicted that implementation of the 1981 208 Plan, without fertilizer management, would reduce existing DIN loads in Tahoma by about 40 percent (compared to 51 percent for the No-Growth Alternative) and in Incline by about 35 percent (compared to 40 percent for the No-Growth Alternative). This alternative would reduce existing suspended sediment loads in Tahoma by 48 percent and in Incline by 9 percent (compared to 62 percent and 16 percent for the No-Growth Alternative).

Since the No-Action Alternative does not include an SEZ restoration program; since the estimates of DIN load reductions, above, fall short of the TRPA threshold of a 50 percent reduction; and since the only control measure not included in the estimates is fertilizer management; it does not appear that the No-Growth Alternative will attain and maintain the TRPA threshold for reductions in DIN loading to Lake Tahoe from tributary streams.

Changes in Atmospheric Deposition. The No-Action Alternative (1981 208 plan) will increase local VMT by approximately 19 percent, but with the cleaner vehicle fleet, will decrease local NOx emissions by about 25 percent and decrease direct deposition of nitrogen on Lake Tahoe by about 5 to 10 percent. Cooperation from upwind areas to reduce the transport of nitrate-nitrogen into the Tahoe Region would be necessary to attain and maintain the TRPA threshold which calls for a 20 percent reduction in DIN loading to Lake Tahoe from atmospheric deposition.

Changes in Groundwater Quality. Like the No-Growth Alternative, the No-Action Alternative will control existing sources of elevated nutrient levels in groundwater. The additional development associated with the No-Action Alternative should not significantly increase nutrient loading to the groundwaters, provided fertilizer management BMPs are applied to all new development and care is taken to emphasize vegetative treatment of surface runoff routed to infiltration facilities. The impacts of the No-Action Alternative will be similar to the impacts of the No-Growth Alternative, and the No-Action Alternative will attain and maintain the TRPA threshold calling for a 30 percent reduction in DIN loads to Lake Tahoe from groundwater, although elevated nutrient levels in groundwater will impact Lake Tahoe's water quality for many years to come.

Algal Productivity and Clarity of Lake Tahoe. The preceding paragraphs describe predicted changes in the three main nutrient inputs to Lake Tahoe (tributary flow, atmospheric deposition, and groundwater) and indicate that the No-Action Alternative probably will not attain the threshold goals of a 50 percent reduction in surface water inputs of DIN. Thus, the overall goal of a 25 percent reduction in annual DIN loading to Lake Tahoe would not be achieved, and the thresholds for phytoplankton primary productivity, winter clarity of the pelagic zone, and turbidity of the shallow waters of Lake Tahoe would not be attained and maintained.

Tributary Water Quality. Even with the additional development anticipated under the No-Action Alternative, the application of BMPs and the Capital Improvements Program for erosion and runoff control will improve tributary water quality throughout the Tahoe Region. As discussed on p. 261, the TRPA suspended sediment threshold, the California tributary standards for total phosphorus, and the Nevada standards for dissolved nutrients appear to be attainable in the long term, but the California tributary standards for total iron do not seem to be attainable, and should be reviewed.

Since Alternative 2, the No-Action Alternative results in the largest number of additional single-family homes and the most impervious coverage; since it has the least-beneficial impact on drainage density; and since it lacks both an SEZ restoration program and an explicit requirement for retroactive application of BMPs to existing development, the impacts of Alternative 2, the No-Action Alternative, on tributary water quality will be the least positive of the four alternatives.

Quality of Surface Runoff. Since all new development under the No-Action Alternative must employ BMPs and adhere to limitations on impervious coverage, the impacts of the No-Action Alternative on localized surface runoff from rainfall and snowmelt should be very similar to the No-Growth Alternative. Surface runoff will generally meet the TRPA and state guidelines for discharge to groundwater, although runoff from heavily urbanized areas of the Region should be pretreated prior to infiltration. Discharges to surface waters of untreated surface runoff will generally not meet the state and TRPA guidelines, and should either be eliminated or treated prior to discharge.

Water Quality of Other Lakes. The No-Action Alternative should have a positive effect on water quality in the other lakes of the Tahoe Region, to the extent that BMPs and the Capital Improvements Program are applied in areas which contribute to these lakes. Very little of the new development projected under this alternative would be in areas contributing to these other lakes. Unless water quality monitoring programs reveal specific problems in the future, the quality of the other lakes should equal or exceed the applicable state standards.

c. The Hybrid Plan (Alternative 3)

The hybrid plan, Alternative 3, calls for Region-wide application of BMPs and implementation of the Capital Improvements Program for erosion and runoff control and the SEZ restoration program. It includes the excess coverage mitigation program, water quality mitigation program, discharge standards and permits for urban drainage problems and other problems, limitations on new subdivisions, land use planning and controls, limitations on fertilizer use, waste management provisions, and controls on practices in natural areas, vessel wastes, and dredging and construction in Lake Tahoe. (For details, see Section II, Chapter I.)

The hybrid plan requires new development to comply with the Bailey coverage coefficients on a parcel-by-parcel basis, and does not allow new uses to exceed the Bailey coefficients without direct transfers. Projects allowed overrides of the Bailey coefficients under Alternative 2 would be allowed to increase their base coverage only by transfer within hydrologically-related areas up to the limits set forth in Table 15.

Impacts on Key Water Quality Indicators. As discussed under Soils, this alternative will result in approximately 379 acres of additional impervious coverage in the Region, with only certain projects by public entities in land capability districts 1 through 3. Given that approximately 6,600 acres of impervious coverage exist in the Region today, the net ultimate coverage under Alternative 3 will be approximately 6,979 acres. See Table 23 for a comparison of impervious coverage under the three alternatives.

As discussed under Alternative 1, TRPA estimates there are approximately 7,200 acres of existing disturbance (i.e., compacted and denuded areas) in the Region. Since TRPA's goal is to reduce existing disturbance by 80 percent through BMP and CIP implementation, the resulting total disturbance under Alternative 3 will be approximately 1,400 acres.

Under Alternative 3, the hybrid plan, the SEZ Restoration Program (Volume III) will bring about a large positive impact on water quality through the restoration of approximately 1100 acres of SEZs in urbanized portions of the Tahoe Region, and approximately 200 acres in the undeveloped portions of the Region. Also, as discussed under SEZs, offsets of projects by public entities in SEZs will result in a net increase of about 15 acres of SEZ. See Table 27 for a comparison of the impacts of the four alternatives on SEZs.

Alternative 3 will create new drainage conveyances in the watershed of Lake Tahoe by allowing additional residential, commercial, tourist, public service, and recreation development to occur. Since this alternative does not allow new subdivisions in undeveloped areas, there will be no new street networks established. Instead, new drainage conveyances will result primarily from the placement of driveways and structures in existing urbanized areas of the Region. The implementation of BMPs and the CIP will reduce the overall developed drainage density more than additional development will increase it.

Since the IPES rating process can be used as an indicator of the sensitivity of single-family parcels to development, it is also useful to consider the average IPES scores of parcels which would be developed under Alternative 3, and to compare these average scores to Alternatives 2 and 4. See Tables 27 and 22 for a summary of average IPES scores and numbers of affected parcels by county for Alternatives 2, 3, and 4. See Alternative 4, the proposed 208 amendments, for a discussion of the results.

As discussed under Air Quality, Alternative 3 will reduce peak summer day VMT by about 8 percent, and further reduce NOx emissions because of the cleaner vehicle fleet, for a net reduction in NOx emissions of about 42 percent.

Refer to Table 27 for a comparison of the key water quality indicators under the four alternatives.

<u>Sediment and Nutrient Loads from the Watershed</u>. Since the hybrid plan will allow additional development in the Region as described under Land Use, there will be increases in nutrient and sediment loads from the watershed attributable to new development. These increases will be offset by reductions from application of BMPs, implementation of the CIP, SEZ restoration, and fertilizer management. Based on the TRPA procedures for estimating DIN loads (TRPA, 1983), for the Region as a whole, the net reduction in DIN loads from tributary streams would be the same under the hybrid plan as under the proposed 208 amendments, Alternative 4. Not including SEZ restoration and fertilizer management, the reduction under Alternative 3 would be about 47 percent, compared to 49 percent for the No-Growth Alternative and 44 percent for the No-Action Alternative. With the application of SEZ restoration and fertilizer management, TRPA estimates the Region-wide DIN load reduction from the watershed would be about 57 percent.

<u>Changes in Atmospheric Deposition</u>. Alternative 3, the hybrid plan, will reduce peak summer day VMT by about 8 percent, and will further reduce NOx emissions and direct deposition of nitrogen on Lake Tahoe because of the cleaner vehicle fleet. Total direct deposition of nitrogen will be reduced approximately 8 to 17 percent by controls within the Region. With cooperation from upwind areas to reduce the transport of nitrate-nitrogen into the Tahoe Region, the hybrid plan will attain and maintain the TRPA threshold which calls for a 20 percent reduction in DIN loading to Lake Tahoe from atmospheric deposition. The CARB should provide TRPA with regular progress reports on programs to reduce NOx emissions in areas upwind from the Tahoe Region.

Changes in Groundwater Quality. Like the other three alternatives, Alternative 3 will control existing sources of elevated nutrient levels in groundwater. The additional development associated with Alternative 3 should not significantly increase nutrient loading to the groundwaters, provided fertilizer management BMPs are applied to all new development and care is taken to emphasize vegetative treatment of surface runoff routed to infiltration facilities. The impacts of Alternative 3 will be similar to the impacts of the other alternatives, and Alternative 3 will attain and maintain the TRPA threshold calling for a 30 percent reduction in DIN loads to Lake Tahoe from groundwater, although water quality impacts of elevated nutrient levels in groundwater will continue for many years.

Algal Productivity and Clarity of Lake Tahoe. The preceding paragraphs describe predicted changes in the three main nutrient inputs to Lake Tahoe (tributary flow, atmospheric deposition, and groundwater) and indicate that the hybrid plan, Alternative 3, will attain the threshold goals of a 50 percent reduction in surface water inputs of DIN to Lake Tahoe, a 30 percent reduction in groundwater loads of DIN, and a 20 percent reduction in atmospheric deposition. Thus, the overall goal of a 25 percent reduction in annual DIN loading to Lake Tahoe will be achieved, and the thresholds for phytoplankton primary productivity, winter clarity of the pelagic zone, and turbidity of the shallow waters of Lake Tahoe will be attained and maintained.

Tributary Water Quality. Even with the additional development anticipated under the Alternative 3, the application of BMPs and the Capital Improvements Program for erosion and runoff control will improve tributary water quality throughout the Tahoe Region. As discussed on p. 261, the TRPA suspended sediment threshold, the California tributary standards for total phosphorus, and the Nevada tributary standards for total dissolved nutrients appear to be attainable in the long term, but the California tributary standards for dissolved iron do not seem to be attainable, and should be reviewed.

Since Alternative 3 includes both an SEZ restoration program and an explicit requirement for retroactive application of BMPs to existing development, the impacts of Alternative 3, the hybrid plan, on tributary water quality will more positive than the impacts of the No-Action Alternative, Alternative 2.

Quality of Surface Runoff. Since all new development under Alternative 3 must employ BMPs and adhere to limitations on impervious coverage, the impacts of Alternative 3 on localized surface runoff from rainfall and snowmelt should be very similar to the other alternatives. Surface runoff will generally meet the TRPA and state guidelines for discharge to groundwater, although runoff from heavily urbanized areas of the Region should be pretreated prior to infiltration. Discharges to surface waters of untreated surface runoff will generally not meet the state and TRPA guidelines, and should either be eliminated or treated prior to discharge.

Water Quality of Other Lakes. Alternative 3 should have a positive effect on water quality in the other lakes of the Tahoe Region, to the extent that BMPs and the Capital Improvements Program are applied in areas which contribute to these lakes. Very little of the new development projected under this alternative would be in areas contributing to these other lakes. Unless water quality monitoring programs reveal specific problems in the future, the quality of the other lakes should equal or exceed the applicable state standards.

d. Proposed 208 Amendments (Alternative 4)

The proposed 208 amendments, Alternative 4, call for Region-wide application of BMPs and implementation of the Capital Improvements Program for erosion and runoff control and the SEZ restoration program. They include the excess coverage mitigation program, water quality mitigation program, discharge standards and permits for urban drainage problems and other problems, limitations on new subdivisions, land use planning and controls, limitations on fertilizer use, waste management provisions, and controls on practices in natural areas, vessel wastes, and dredging and construction in Lake Tahoe. (For details, see Section II, Chapter I.)

Alternative 4 uses IPES to direct new single-family development. It requires future development to comply with the Bailey coverage coefficients on a parcel-by-parcel basis, with the option of increasing allowed coverage by transfer in limited situations. Disturbance within land capability districts 1, 2 and 3 is limited to public outdoor recreation, public health and safety, and environmental protection projects, with required findings and offsets, and single-family homes approved under IPES. No exceptions to or overrides of the Bailey coefficients are allowed, except by transfer or direct offset.

Alternative 4 prohibits construction, grading, and vegetation removal within SEZs, with exceptions for public outdoor recreation, public health and safety, environmental protection projects, and access to otherwise buildable sites, with required findings and 1.5:1 offset.

Impacts on Key Water Quality Indicators. As discussed under Soils, Alternative 4 will result in approximately 331 acres of additional impervious coverage in the Region, with only certain public service and recreation coverage, and single-family homes approved under IPES, in land capability districts 1 through 3. Given that approximately 6,600 acres of impervious coverage exist in the Region today, the net ultimate coverage under Alternative 3 will be approximately 6,931 acres. See Table 23 for a comparison of impervious coverage under the three alternatives.

As discussed under Alternative 1, TRPA estimates there are approximately 7,200 acres of existing disturbance (i.e., compacted and denuded areas) in the Region. Since TRPA's goal is to reduce existing disturbance by 80 percent through BMP and CIP implementation, the resulting total disturbance under this Alternative will be approximately 1,400 acres.

The SEZ Restoration Program (Volume III) will bring about a large positive impact on water quality through the restoration of approximately 1100 acres of SEZs in urbanized portions of the Tahoe Region, and approximately 200 acres in the undeveloped portions of the Region. Also, as discussed under SEZs, offsets of public outdoor recreation, public health and safety, and environmental protection projects and access across SEZs will result in a net increase of about 17.5 acres of SEZ. See Table 27 for a comparison of the impacts of the four alternatives on SEZs.

Alternative 4 will create new drainage conveyances in the watershed of Lake Tahoe by allowing additional residential, commercial, tourist, public service, and recreation development to occur. Since this alternative does not allow new subdivisions in undeveloped areas, new drainage conveyances will result primarily from the placement of driveways and structures in existing urbanized areas of the Region. The implementation of BMPs and the CIP will reduce the overall developed drainage density more than additional development will increase it.

Since IPES ratings can be used as indicators of the sensitivity of single-family parcels to development, it is also useful to consider the average IPES scores of parcels which would be developed under Alternative 4, and to compare these average scores to Alternatives 2 and 3. See Tables 27 and 22 for a summary of average IPES scores and numbers of affected parcels by county for Alternatives 2, 3, and 4.

Table 27 indicates that in El Dorado County, Placer County, and Washoe County, the average IPES score of parcels developed for single-family homes under the proposed amendments equals or exceeds the average IPES score of parcels developed under the 1981 208 plan or the hybrid plan. From this one can reasonably conclude that the average developed parcel under Alternative 4 is no more sensitive than the average parcel developed under the 1981 208 plan or the hybrid plan. Thus, in those three counties, the sediment and nutrient loads from individual new single-family homes will be no higher under IPES.

In Douglas County, Table 27 shows that the average IPES score of parcels developed for single-family homes under the proposed amendments is lower than the average IPES score of parcels developed under the 1981 plan by 150 points. One can conclude that in Douglas County the average parcel developed for single-family homes is more sensitive than the average parcel developed under the 1981 plan. Therefore, in Douglas County, sediment and nutrient loads from individual new homes will be higher under IPES. The estimates of sediment and nutrient loads reflect this difference. The watersheds of Douglas County contribute only about 3 percent of the tributary flow and six percent of the total DIN load to Lake Tahoe, according to the TRPA estimates. By contrast, the watersheds of El Dorado County contribute about 50 percent of the tributary flow and 46 percent of the DIN load. (See the Technical Appendix.)

As discussed under Air Quality, the proposed amendments reduce peak summer day VMT by about 10 percent, and would further reduce NOx emissions and direct deposition of nitrogen on Lake Tahoe because of the cleaner vehicle fleet.

Refer to Table 27 for a comparison of the key water quality indicators under the four alternatives.

Sediment and Nutrient Loads from the Watershed. Since this alternative will allow additional development in the Region as described under Land Use, there will be increases in nutrient and sediment loads from the watershed attributable to new development. These increases will be offset by reductions from application of BMPs, implementation of the CIP, SEZ restoration, and fertilizer management. Based on the TRPA procedures for estimating DIN loads (TRPA, 1983), for the Region as a whole, the net reduction in DIN loads from tributary streams, not including SEZ restoration and fertilizer management, would be about 47 percent, compared to 49 percent for the No-Growth Alternative and 44 percent for the No-Action Alternative. With the application of SEZ restoration and fertilizer management, TRPA estimates the Region-wide DIN load reduction from the watershed would be about 57 percent.

The more-detailed watershed simulations of the Tahoma and Incline Village areas (TRPA, 1987), predicted that implementation of the proposed 208 amendments, without SEZ restoration and fertilizer management, would reduce existing DIN loads in Tahoma by about 40 percent (compared to 51 percent for the No-Growth Alternative and 40 percent for the No-Action Alternative) and in Incline by about 36 percent (compared to 40 percent for the No-Growth Alternative and 35 percent for the No-Action Alternative). This alternative would reduce existing suspended sediment loads in Tahoma by 49 percent and in Incline by 11 percent (compared to 62 percent and 16 percent for the No-Growth Alternative, and 48 percent and 9 percent for the No-Action Alternative).

Some persons have expressed a concern that the coverage transfer provisions concentrate land coverage in commercial core areas, causing higher sediment and nutrient loads from the watershed than if the coverage were more evenly dispersed.

In fact, there are both advantages and disadvantages to the concentration of impervious coverage. Concentration of coverage will result in lower relative drainage densities since it also concentrates land use, and will enhance the effectiveness of programs to reduce VMT. TRPA attributes approximately 17 percent of the projected VMT reductions in the Region to transportation improvements associated with community planning (TRPA, 1987a, Technical Appendix), which will probably not occur under Alternatives 2 and 3.

On the other hand, concentration of coverage may cause elevated nutrient and sediment yields from development if care is not taken to provide adequately-sized BMPs to mitigate the impacts of development.

Of the 22 community plans areas where the TRPA Regional Plan may concentrate coverage, ten pose little risk of increasing sediment and nutrient loads to Lake Tahoe because they are not drained by a tributary to Lake Tahoe or are greater than 1/2 mile from the nearest tributary. Four areas are within 1/4 mile of a tributary stream, seven have tributary streams flowing through them, and one (Tahoe City) straddles the outlet of Lake Tahoe, the Truckee River. (See Table 28.)

Those areas which would pose the greatest risk of increasing sediment and nutrient loads to Lake Tahoe are the South Wye and Meyers (Upper Truckee River), Bijou/Al Tahoe (Trout Creek), Incline Village Commercial (Wood Creek, Third Creek, Incline Creek), and Incline Village Industrial (Mill Creek). Since community planning has not yet commenced in any of these areas, the programs of work for the areas should stress stream setbacks, controls on fertilizer and irrigation, native and adapted plant materials, BMPs, capital improvements, and SEZ restoration projects to reduce sediment and nutrient discharges from the area and enhance uptake and filtration in SEZs.

As discussed elsewhere in this plan, the analytical tools available to TRPA to evaluate the water quality impacts of land coverage transfers are limited. Nevertheless, TRPA has applied the TRPA and SWRCB models of nutrient and sediment yields in two separate analyses, documented in the Technical Appendix, and concludes that the proposed rules which allow for transfers of land coverage have virtually the same impacts on sediment and nutrient loads as the rules in the 1981 plan and the hybrid plan. In the detailed simulations of nutrient and sediment generation from the Tahoma and Incline Village watersheds using the TRPA model, loads from the 1981 plan and the proposed 208 plan differed by no more than one percent.

In simulations of sediment generation from two watersheds, one in Kings Beach and one in Douglas County, using the SWRCB model, loads from the proposed 208 plan were exactly the same as from the 1981 plan in the Burke Creek watershed (Douglas County) and about three percent higher in the small watershed encompassing the heart of Kings Beach, prior to the application of BMPs. Both the Burke Creek and Kings Beach watersheds encompass community plan areas which will be receiving zones for coverage transfers.

One should keep in mind that, given the margin of error inherent in these models, the results from application of the 1981 plan and the proposed amendments should be considered about equal. For details on these simulations, see the Technical Appendix.

If one applies a common-sense analysis to the issue of land coverage transfers, starting with the assumption that concentration of land coverage increases yields of sediments and dissolved nutrients from a given area, one concludes that there is a beneficial impact on sediment and nutrient yields from the donor location, and an adverse impact on sediment and nutrient yields from the receiving location. In both cases, the impacts are localized to the vicinity of the donor or receiver location. It is important to understand that localized impacts at the receiving site will be mitigated by BMPs and--for transfers into community plan areas--by community drainage, stabilization, and rehabilitation plans.

If the transfer involves transfer of potential land coverage, the beneficial impact on the donor location involves avoidance of a possible future impact, rather than an actual decrease in sediment and nutrient yields. Transfers of potential coverage have the effect of consolidating non-contiguous parcels for purposes of coverage calculations, a concept not far removed from the 1981 208 plan, which encouraged parcel consolidations to meet the land coverage constraints and actually permitted such transfers for commercial purposes within single watersheds in Nevada (TRPA Ordinance 81-5).

Since the 1981 208 plan allowed overrides of the Bailey coefficients for creation of coverage by a public entity where necessary for the implementation of the air quality nonattainment plan or the transportation element of the regional plan, public recreation, or protection of the public health, safety, and welfare, provided all feasible alternatives were exhausted and mitigation was provided, the 1981 208 plan actually allowed de facto coverage transfers for implementation of the air quality and transportation plans and for public health, safety, welfare, and recreation projects. Thus, except for transfers of coverage into approved community plan areas for commercial, tourist, and multi-family projects and transfers for single-family dwellings reviewed and approved pursuant to IPES, the 1981 208 plan, the hybrid plan, and the proposed 208 amendments are very similar. Since the proposed 208 amendments are more explicit regarding transfer requirements, they are in some respects more stringent.

With respect to transfers of existing coverage into community plan areas for commercial, tourist, or multi-family projects, it is important to keep the relative scope of the transfer program in mind. Region-wide, under either the No-Action, Hybrid, or proposed alternative additional commercial, multi-family, and tourist land coverage will involve approximately 80 acres of new coverage, which represents an increment of only 1.1 to 1.2 percent over existing coverage in the Region today. Under the No-Action or Hybrid alternatives, that coverage would be distributed around the Region on vacant commercial, multi-family, and tourist parcels. Under the proposed amendments, about 90 percent of that coverage will be directed to the 23 community plan areas.

The 23 community plan areas represent a total land area of about 2540 acres and about 1720 acres of existing coverage. If two-thirds of the commercial, tourist, and multi-family coverage directed to these areas is provided by virtue of transfers of existing coverage, the increment of coverage created by transferred coverage is about 48 acres, or less than 3 percent over the existing land coverage. (Note the similarity between this conclusion and the simulation of the Kings Beach watershed.)

Since TRPA cannot approve coverage transfers into community plan areas until it adopts community plans which must include schedules for implementation of remedial water quality projects that achieve applicable goals and water quality standards, and since the increment of transferred coverage is small, it is reasonable to conclude that community-wide BMPs and restoration programs will still attain and maintain water quality standards and thresholds. Furthermore, the 48 acres transferred into the community plan areas would be offset by retirement of existing land coverage elsewhere, with benefits to water quality not realized under the No-Action or Hybrid alternatives. (For further documentation of this analysis, see the Technical Appendix.)

Even the above estimates of coverage which will be transferred into community plan areas may be high, since much of the anticipated additional commercial floor area in the Region will probably be utilized on sites with existing land coverage, either as rehabilitations or second-story commercial areas.

Changes in Atmospheric Deposition. Alternative 4, the proposed amendments, will reduce peak summer day VMT by about 10 percent, and will reduce NOx emissions by about 43 percent because of the cleaner vehicle fleet. Total direct deposition of nitrogen will be reduced approximately 8 to 17 percent by controls within the Region. With cooperation from upwind areas to reduce the transport of nitrate-nitrogen into the Tahoe Region, the proposed 208 amendments will attain and maintain the TRPA threshold which calls for a 20 percent reduction in DIN loading to Lake Tahoe from atmospheric deposition. The CARB should provide TRPA with regular progress reports on programs to reduce NOx emissions in areas upwind from the Tahoe Region.

Changes in Groundwater Quality. Like the other three alternatives, the Alternative 4 will control existing sources of elevated nutrient levels in groundwater. The additional development associated with Alternative 4 should not significantly increase nutrient loading to the groundwaters, provided fertilizer management BMPs are applied to all new development and care is taken to emphasize vegetative treatment of surface runoff routed to infiltration facilities. The impacts of Alternative 4 will be similar to the impacts of the other alternatives, and Alternative 4 will attain and maintain the TRPA threshold calling for a 30 percent reduction in DIN loads to Lake Tahoe from groundwater. As with the other alternatives, it should be recognized that elevated nutrient levels in groundwater will have impacts on water quality for many years.

Algal Productivity and Clarity of Lake Tahoe. The preceding paragraphs describe predicted changes in the three main nutrient inputs to Lake Tahoe (tributary flow, atmospheric deposition, and groundwater) and indicate that the proposed 208 amendments, Alternative 4, will attain the threshold goals of a 50 percent reduction in surface water inputs of DIN to Lake Tahoe, a 30 percent reduction in groundwater loads of DIN, and a 20 percent reduction in atmospheric deposition. Thus, the overall goal of a 25 percent reduction in annual DIN loading to Lake Tahoe will be achieved, and the thresholds for phytoplankton primary productivity, winter clarity of the pelagic zone, and turbidity of the shallow waters of Lake Tahoe would be attained and maintained. For additional discussion of consistency of the proposed 208 amendments with federal and state antidegradation policies, see the Responsiveness Summary in Volume VI of this plan, at page 19.

Tributary Water Quality. Even with the additional development anticipated under the Alternative 4, the application of BMPs and the Capital Improvements Program for erosion and runoff control will improve tributary water quality throughout the Tahoe Region. As discussed on p. 261, the TRPA suspended sediment threshold, the California tributary standards for total phosphorus, and the Nevada tributary standards for dissolved nutrients appear to be attainable in the long term, but the California tributary standards for total iron do not seem to be attainable, and should be reviewed.

Since Alternative 4 includes both an SEZ restoration program and an explicit requirement for retroactive application of BMPs to existing development, the impacts of Alternative 4, the proposed 208 amendments, on tributary water quality will more positive than the impacts of the No-Action Alternative, Alternative 2.

With respect to possible impacts on tributary water quality from concentrating land coverage in commercial core areas, ten of the 22 community plan areas pose little risk to tributary water quality because they are not drained by a tributary to Lake Tahoe or are greater than 1/2 mile from the nearest tributary. As discussed above, four areas are within 1/4 mile of a tributary stream, seven have tributary streams flowing through them, and one (Tahoe City) straddles the outlet of Lake Tahoe, the Truckee River. (See Table 28.) California has not established water quality objectives for two minor streams in California which flow through the Lake Forest and Kings Beach community plan areas.

Those tributary streams most likely to be affected by concentration of coverage in commercial areas are the Upper Truckee River, Trout Creek, Heavenly Valley Creek, Bijou Creek, Edgewood Creek, Carnelian Creek, Griff Creek, Baldy Creek, Wood Creek, Third Creek, Incline Creek, and Mill Creek. The Truckee River downstream from the dam at Tahoe City could also be affected. Since community planning has not yet commenced in any area affecting these streams, except Tahoe City, the programs of work for those areas should stress stream setbacks, controls on fertilizer and irrigation, native and adapted plant materials, BMPs, capital improvements, and SEZ restoration projects to protect tributary water quality.

Quality of Surface Runoff. Since all new development under Alternative 4 must employ BMPs and adhere to limitations on impervious coverage, the impacts of Alternative 4 on localized surface runoff from rainfall and snowmelt should be very similar to the other alternatives. Surface runoff will generally meet the TRPA and state guidelines for discharge to groundwater, although runoff from heavily urbanized areas of the Region should be pretreated prior to infiltration. Discharges to surface waters of untreated surface runoff will generally not meet the state and TRPA guidelines, and should either be eliminated or treated prior to discharge.

Water Quality of Other Lakes. Alternative 4 should have a positive effect on water quality in the other lakes of the Tahoe Region, to the extent that BMPs and the Capital Improvements Program are applied in areas which contribute to these lakes. Very little of the new development projected under this alternative would be in areas contributing to these other lakes. Unless water quality monitoring programs reveal specific problems in the future, the quality of the other lakes should equal or exceed the applicable state standards.

TABLE 27

Comparison of Key Water Quality Indicators, by Alternative

Indicator	Alternative 1	Alternative 2	Alternative 3	Alternative 4
SEZ (acres)				
(a) disturbed	---	(10)	(30)	(35)
(b) restored	1300	---	1345	1352.5
(c) net change	1300	(10)	1315	1317.5
Area of Additional Land Coverage (acres)				
(a) LC 1-3	(60)	24	(87)	(99)
(b) LC 4-7	--	638	466	430
(c) LC 1-7	(60)	662	379	331
Developed Drainage Density	best	good	better	better
Average IPES Score of Developing Parcels				
(a) El Dorado	---	875	875	875
(b) Placer	---	766	766	789
(c) Washoe	---	769	769	791
(d) Douglas	---	867	867	716
Local NOx Emissions	-43%	-25%	-42%	-43%

G. SEWAGE COLLECTION AND TREATMENT

1. Applicable Standards

As discussed in Section I (p. 144), the discharge of wastewater to the surface waters or groundwaters of the Tahoe Region is prohibited, with certain exceptions for existing alternative treatment systems authorized and approved under state law.

National Pollutant Discharge Elimination System (NPDES) permits or Waste Discharge Requirements issued by the Lahontan Board or NDEP set the effluent limitations for the four sewage treatment plants serving the Tahoe Region, all of which discharge their effluent outside the Region.

To avoid a discharge of wastewater, TRPA allows holding tanks or other no-discharge systems as temporary measures associated with temporary uses, or as permanent measures associated with remote recreation sites and summer home tracts where connection to a sewer system is infeasible or would create excessive adverse environmental impacts (Code, Subsection 81.2.C).

2. Existing Situation

There are five major wastewater treatment districts in the Tahoe Region, as depicted in Figure 18. The administrative and financial capabilities of the wastewater collection and treatment agencies are discussed in Section I, Chapter V.

STPUD, IVGID, and DCSID treat sewage at plants within the Region, as depicted in Figure 18. NTPUD and TCPUD do not provide treatment, but contract with TTSA for treatment outside the Region. All four treatment plants provide standard primary and secondary treatment. TTSA, STPUD, and IVGID provide tertiary (advanced) treatment, although STPUD will phase out advanced treatment after January, 1989. Sewage sludge disposal is accomplished by incineration at DCSID and STPUD, and by land disposal outside the Tahoe Region by IVGID and TTSA. Table 29 summarizes the available capacity and existing demand for the four treatment systems.

All of the collection and treatment districts have reserve capacity, as shown in Table 29. STPUD, however, has committed all of its reserve capacity and is not issuing any new sewer units. STPUD is pursuing financing and required permits to upgrade and expand its collection, treatment, and export systems.

STPUD plans to expand its sewage treatment plant by 0.2 MGD in 1989 to meet short-term growth anticipated under the Regional Plan. STPUD also plans to construct an 18 million gallon emergency retention basin in 1989 to prevent spills, at a cost of about $2.5 million.

TABLE 28

Community Plan Areas and Affected Tributaries

Group I -- Not drained by a tributary to Lake Tahoe or greater than 1/2 mile from nearest tributary

South Wye Industrial (El Dorado)
Tahoma (Placer)
Homewood (Placer)
Sunnyside (Placer)
Tahoe Vista (Placer)
Round Hill (Douglas)
Stateline Point (Washoe)

Group II -- Within 1/4 mile of a tributary to Lake Tahoe

South Wye Commercial, Upper Truckee River (El Dorado)
Meyers, Upper Truckee River (El Dorado)
Bijou, Trout Creek and Heavenly Creek (El Dorado)
Kingsbury, Edgewood Creek (Douglas)

Group III -- Tributary channel runs through community plan area

Stateline, minor tributary of Edgewood Creek (Douglas)
Tahoe City, Truckee River (Placer)
Lake Forest, unnamed stream No. 8 (Placer)
Carnelian Bay, Carnelian Canyon Creek (Placer)
Kings Beach Industrial, Griff Creek (Placer)
Kings Beach Commercial, Griff Creek, Baldy Creek (Placer)
Incline Commercial; Wood, Third, and Incline Cr. (Washoe)
Incline Industrial, Mill Creek (Washoe)

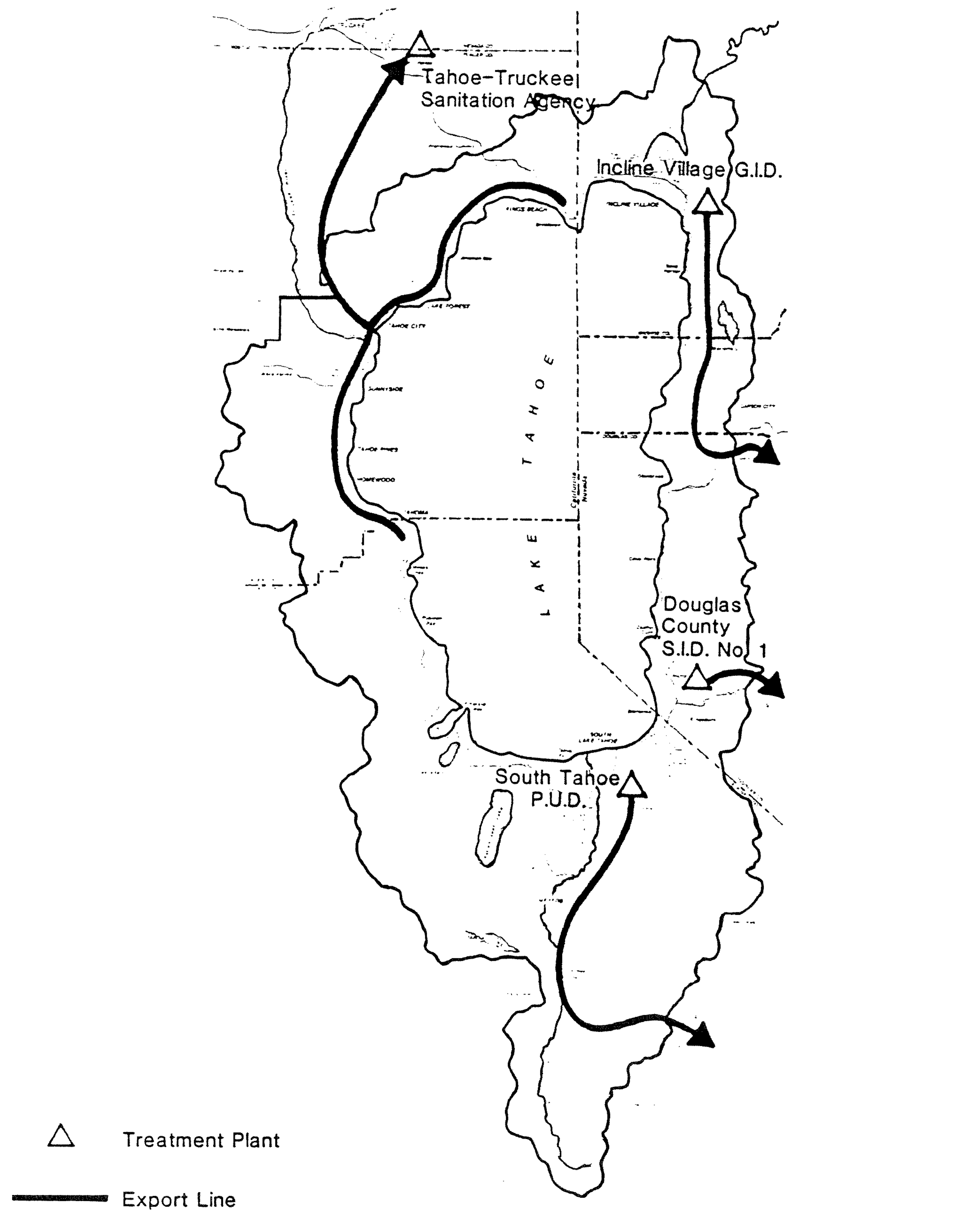


FIGURE 18

Sewer Treatment Districts and Locations of Main Facilities

TABLE 29

Sewage Treatment Capacity and Demand

1. <u>Douglas County Sewer Improvement District (DCSID)</u>

a.	collection	no known capacity problems
b.	treatment	secondary treatment at plant, 3.75 mgd capacity (30-day average)
c.	sludge disposal	incineration by natural gas; ash is disposed of outside the Tahoe Region
d.	export	effluent pumped over Daggett Pass for irrigation use in the Carson Valley, NV; 4.2 mgd capacity
e.	demand	2.5 mgd, 30-day average flow 3.1 mgd, reported high flow 4.2 mgd, estimated high flow
f.	reserve	3.75 - 2.5 = 1.25 mgd (33%) 3.75 - 3.1 = 0.65 mgd (17%)

2. <u>Incline Village General Improvement District (IVGID)</u>

a.	collection	no known capacity problems
b.	treatment	secondary treatment at plant with tertiary treatment at Carson Valley wetlands; 3.0 mgd capacity (30-day average)
c.	sludge disposal	land disposal outside Tahoe Region
d.	export	effluent pumped over Spooner Summit, 3.0 mgd capacity
e.	demand	1.2 mgd (annual average) 1.7 to 1.9 mgd (avg. peak summer day, August) 2.16 mgd (February, 1986)
f.	reserve	3.0 - 1.9 = 1.1 mgd (37%) 3.0 - 2.16 = 0.84 mgd (28%)

Table 29, cont.

3. South Tahoe Public Utility District (STPUD)

a.	collection	no known capacity problems
b.	treatment	tertiary treatment at plant until Jan., 1989, when STPUD will provide secondary treatment; capacity is 7.0 mgd (maximum day); contract with USEPA limits STPUD to 73,777 sewer units (SU) or, at 90 gpd/SU, 6.640 mgd, with 0.36 mgd reserved by Fallen Leaf Lake, USFS, and Cal. State Parks
c.	sludge disposal	incineration; ash disposed of outside the Tahoe Region
d.	export	effluent pumped over Luther Pass for disposal to Indian Creek Reservoir (capacity 7.44 mgd, approx.) until Jan., 1989, when STPUD will pump to Harvey Place Reservoir (capacity 8.7 mgd); capacity of export line is 7.8 mgd
e.	demand	6.44 mgd (1986 monthly peak avg.) 17.29 mgd (February, 1986)
f.	reserve	0.36 mgd, allocated to Fallen Leaf Lake, USFS, California State Parks

4. Tahoe-Truckee Sanitation Agency (TTSA)

a.	collection	by NTPUD and TCPUD, no known capacity problems
b.	treatment	tertiary treatment at plant; capacity is 7.25 mgd (7-day avg.) plus storage for 41-43 mgd; disposal to leach fields
c.	sludge disposal	filter press, land disposal at Eastern Regional landfill; in 1987, 380 tons of digested sludge disposed of
d.	demand--Tahoe only	2.353 mgd/62.3% (average) 8.5 mgd (February, 1986)
e.	demand--total	3.79 mgd (average) 5.389 mgd (9-year avg. peak) 19.96 mgd (February, 1986)
f.	reserve	7.25 - 5.39 mgd = 1.86 mgd (26%)

In the upcoming five years, the districts, other than STPUD, plan only minor alterations to their collection and treatment systems. There are two other wastewater-related projects proposed, a 3,300-foot force main in the vicinity of Dollar Hill in Placer County (NTPUD), and six emergency detention ponds to prevent potential sewage overflows in Douglas County (DCSID).

On June 26, 1981, in response to litigation involving the SWRCB, Caltrans, and the League to Save Lake Tahoe, the Superior Court, County of Nevada, California, issued a Stipulation for Judgment (#26658) that limits new connections tributary to the TTSA plant in the Tahoe Region to 3500 residential parcels. Since June, 1981, approximately 225 parcels in the Tahoe Region have been connected to the TTSA plant. Before the limit of 3,500 new connections can be exceeded, a new environmental review process would be required. However, the ultimate wastewater flows from the Tahoe Region into the TTSA facility will be determined based upon the limits of the TRPA Regional Plan. (See TRPA, 1984a, p. 118.)

Although all sewage treatment plants require large amounts of energy, STPUD, IVGID, and DCSID have exceptionally high energy requirements since they pump their sewage over the rim of the Tahoe Basin for disposal.

3. Anticipated Impacts on Sewage Collection and Treatment

a. No-Growth Alternative

The No-Growth Alternative would freeze existing land use types, locations, and intensities, except as they would be affected by rehabilitation and transfer of development. TRPA projects that Regional population would be stable under this alternative (see Table 21), leading to no significant change in average or peak demand for sewage collection and treatment. See also Table 30 for population projections specific to the sewage collection and treatment districts.

Assuming that increases in demand for sewage collection and treatment are proportional to the increases in population, all of the collection and treatment districts except STPUD would have excess capacity to meet all future demand. STPUD could provide service to its existing commitments, but would have no reserve capacity.

With respect to the costs of providing sewage collection and treatment, the No-Growth Alternative would, in general, have financial impacts on the sewage collection and treatment districts by: (1) freezing the number of in-Region users who can absorb increased costs of operation, (2) eliminating connection fee revenue, and (3) causing excess capacity to be maintained at three of the four treatment plants, which capacity has an economic cost. The districts would have to increase service charges over time to keep pace with increasing costs, although expansion of the user base outside the Tahoe Region could lessen the impact for some districts such as TTSA and KGID, an improvement district in Douglas County which contracts with DCSID for treatment and which straddles the boundary of the Region. Although it has an economic cost, excess capacity does provide a margin of safety for emergency situations. For more discussion of fiscal impacts, see the discussion in EIS for Adoption of a Regional Plan for the Lake Tahoe Basin: Response to Comments (TRPA, 1983, pp. 25 to 27), incorporated herein by reference.

b. No-Action Alternative (1981 208 Plan)

The 1981 208 plan, Alternative 2, will maintain the existing boundaries of the urban area within the Region, will result in the in-fill of property in land capability districts 4 through 7, and result in expanded use of non-urban areas for recreation and resource management, consistent with the TRPA Regional Plan.

As discussed under Land Use, TRPA estimates that the ultimate population of residents and overnight visitors will increase about 35 percent over 1985 levels under this alternative. See Table 21 for estimates of ultimate population, by county, and Table 30 for population projections specific to the sewage collection and treatment districts.

Assuming that increases in demand for sewage collection and treatment are proportional to increases in population, IVGID and DCSID would have adequate capacity to meet the demand for 20 years, based on the capacity and demand information in Table 29. STPUD would face an immediate need to expand. It is difficult to predict future demand for treatment at TTSA, since it will be affected by growth outside the Tahoe Region, but development in the Tahoe Region will remain within the court-ordered limit of 3,500 new residential parcels for the next 20 years.

With respect to the costs of providing sewage collection and treatment, the No-Action Alternative would, in general, have financial impacts on the sewage collection and treatment districts by: (1) increasing the number of in-Region users who can absorb increased costs of operation and (2) providing regular connection fee revenue. As a result, the districts would not have to increase service charges as much as they would under Alternative 1. Expansion of the user base outside the Tahoe Region would further lessen the impacts for some districts such as TTSA and KGID. For additional discussion of fiscal impacts, see the discussion in EIS for Adoption of a Regional Plan for the Lake Tahoe Basin: Response to Comments (TRPA, 1983, pp. 25 to 27).

c. The Hybrid Plan (Alternative 3)

The hybrid plan, Alternative 3, will maintain the existing boundaries of the urban area within the Region, will result in the in-fill of property in land capability districts 4, 5, 6 and 7, and result in expanded use of non-urban areas for recreation and resource management, consistent with the TRPA Regional Plan.

As discussed under Land Use, TRPA estimates that the ultimate population of residents and overnight visitors will increase about 27 percent over 1985 levels under this alternative. See Table 21 for estimates of ultimate population, by county, and Table 30 for estimates of ultimate population for the sewage collection and treatment districts.

Assuming that increases in demand for sewage collection and treatment are proportional to increases in population, IVGID and DCSID would have adequate capacity to meet the demand for at least 20 years, based on the capacity and demand information in Table 29. STPUD would face an immediate need to expand. It is difficult to predict future demand for treatment at TTSA, since it will be affected by growth outside the Tahoe Region, but development in the Tahoe Region will remain well within the court-ordered limit of 3,500 new connections for the next 20 years, and approach the limit less rapidly than under Alternative 2.

With respect to the costs of providing sewage collection and treatment, Alternative 3 would, in general, have financial impacts on the sewage collection and treatment districts by: (1) increasing the number of in-Region users who can absorb increased costs of operation and (2) providing regular connection fee revenue. As a result, the districts would not have to increase service charges as much as they would under Alternative 1. Expansion of the user base outside the Tahoe Region would further lessen the impacts for some districts such as TTSA and KGID. For additional discussion of fiscal impacts, see the discussion in EIS for Adoption of a Regional Plan for the Lake Tahoe Basin: Response to Comments (TRPA, 1983, pp. 25 to 27).

d. Proposed 208 Amendments (Alternative 4)

The proposed 208 amendments, Alternative 4, will maintain the existing boundaries of the urban area within the Region; result in the in-fill of property in land capability districts 4, 5, 6 and 7 and approval of some single-family homes under IPES in land capability districts 1, 2, and 3; and create expanded use of non-urban areas for recreation and resource management, consistent with the TRPA Regional Plan. Alternative 4 would result in significantly fewer single-family homes than Alternative 2, as explained under Land Use.

TRPA estimates that the ultimate population of both residents and overnight visitors will increase about 27 percent over 1985 levels under this alternative.

Assuming that increases in demand for sewage collection and treatment are proportional to increases in population, IVGID and DCSID would have adequate capacity to meet the demand for approximately 20 years, based on the capacity and demand information in Table 29. STPUD would face an immediate need to expand. It is difficult to predict future demand for treatment at TTSA, since it will be affected by growth outside the Tahoe Region, but development in the Tahoe Region will remain well within the court-ordered limit of 3,500 new connections for the next 20 years, and approach the limit less rapidly than under Alternatives 2 and 3.

With respect to the costs of providing sewage collection and treatment, the impacts of this alternative would be similar to the impacts of Alternatives 2 and 3. Alternative 4 would, in general, have financial impacts on the sewage collection and treatment districts by: (1) increasing the number of in-Region users who can absorb increased costs of operation and (2) providing regular connection fee revenue. As a result, the districts would not have to increase service charges as much as they would under Alternative 1. Expansion of the user base outside the Tahoe Region would further lessen the impacts for some districts such as TTSA and KGID.

Since Alternative 4 would allow a higher proportion of the additional single-family homes to be built in Nevada than Alternatives 2 and 3, the positive financial impacts of this Alternative would be spread more evenly throughout the Region. KGID is felt to be one of the districts in the Region most-impacted by the growth management policies of the Regional Plan, since it has significant sunk costs on which debt is still being retired, and it has a high proportion of land in capability districts 1, 2 and 3 (TRPA, 1983, pp 26, 27). Alternative 4 would have the strongest positive financial benefit on KGID.

TABLE 30

2005 Population Projections--Sewage Treatment and Collection Districts

District	Alternative 1	Alternative 2	Alternative 3	Alternative 4
STPUD				
Total	47,292	66,289 (+40%)	61,173 (+29%)	61,316 (+30%)
Resident	25,292	38,231	34,323	34,431
Visitor	21,999	28,057	26,850	26,886
TTSA (TCPUD, NTPUD)				
Total	21,944	30,267 (+38%)	28,129 (+28%)	27,355 (+25%)
Resident	9,403	12,807	11,728	11,326
Visitor	12,540	17,460	16,401	16,029
DCSID				
Total	11,156	13,386 (+20%)	13,386 (+20%)	13,812 (+24%)
Resident	5,084	5,375	5,375	5,691
Visitor	6,073	8,011	8,011	8,122
IVGID				
Total	11,698	14,122 (+21%)	14,122 (+21%)	14,261 (+22%)
Resident	5,861	7,321	7,321	7,414
Visitor	5,837	6,801	6,801	6,846
TOTAL				
Total	92,090	124,063 (+35%)	116,810 (+27%)	116,746 (+27%)
Resident	45,641	63,734	58,747	58,862
Visitor	46,450	60,330	58,063	57,884

H. WATER SUPPLY

1. Applicable Standards

Federal and state agencies set standards for the quality of drinking water. USEPA is in the process of promulgating new regulations for safe drinking water to take effect in 1988.

The 1969 California-Nevada Interstate Compact limits diversions for use from the Truckee River system, including Lake Tahoe. That Compact was never ratified by the U.S. Congress. The interstate allocations of water specified in the Compact provide the best available basis for determining water availability in the Tahoe Region (SWRCB, 1979). The Compact states, "The total annual gross diversions for use within the Lake Tahoe Basin from all natural sources including ground water . . . shall not exceed 34,000 acre-feet annually," of which 23,000 acre-feet is allocated to California and 11,000 acre-feet to Nevada.

With respect to expansion of water supply systems, TRPA's goal is to allow facilities to upgrade and expand to support existing and new development consistent with the Regional Plan. Expansion should be phased in to meet the needs of new development without creating inefficiencies from over-expansion or under-expansion (Goals and Policies, p. VI-1).

However, expansion of water supplies may not violate TRPA's fisheries threshold for in-stream flows, which establishes a nondegradation standard for instream flows until instream flow standards are established in the Regional Plan. It is TRPA's policy to seek transfers of existing points of water diversion from streams to Lake Tahoe. (See Attachment 1.)

TRPA requires all projects proposing a new structure, reconstruction, or expansion of an existing structure, designed or intended for human occupancy, to have adequate water rights and water supply systems. Additional development requiring water cannot be approved unless it has, or provides, an adequate water supply within a water right recognized under state law (Code, Subsection 27.3.A).

TRPA also requires all additional development requiring water to have systems to deliver an adequate quantity and quality of water for domestic consumption and fire protection. Applicable local, state, federal, or utility district standards determine adequate fire flows, but where no such standards exists, the TRPA Code provides minimum fire flow requirements (Code, Subsection 27.3.B). TRPA may waive the fire flow requirements for conservation and recreation plan areas and single-family development if fire departments serving the development meet the requirements of the Code (Code, Subsection 27.3.B).

2. Existing Situation

There are approximately 57 (California) and 28 (Nevada) water companies, utility districts, independent domestic suppliers, and private suppliers providing water to development within the Tahoe Region. For convenience, previous analyses of water use and water rights (SWRCB, 1979; SWRCB, 1984; NTPUD, TCPUD, and STPUD, 1984; Duncan and Jones, 1983) have broken the water suppliers into zones, as depicted in Figure 19 and Table 31. There are approximately 17 suppliers in California and seven suppliers in Nevada who use over 100 acre-feet annually.

Water supplies are obtained from public and private wells, Lake intakes, and surface water diversions. In general, well water is not treated prior to distribution, although chlorination may be provided at certain times of the year. Drinking water from surface water intakes (both from streams and Lake Tahoe) is normally filtered and chlorinated prior to distribution. Surface water intakes will be the most affected by the new USEPA regulations, and water suppliers using surface waters may have to provide additional treatment to meet the regulations or seek alternative groundwater supplies.

Estimates of existing water diversions for use are presented in Table 32. Existing California and Nevada diversions are well within the maximum diversions specified in the Interstate Compact, and additional diversions can be accommodated without exceeding the maximums (SWRCB, 1984; NTPUD, TCPUD, and STPUD, 1984; Duncan and Jones, 1983).

Annual water use for the three zones in California increased from 1974 to 1983 by approximately 11 to 48 percent (NTPUD, TCPUD, STPUD, 1984, pp. 5-4 to 6). Water use in Nevada increased by about 30 to 40 percent from 1974 to 1979 (Duncan and Jones, 1983). The largest increases during these periods occurred in zones A (California, North Shore) and D (Douglas County). These increases are associated with periods of relatively rapid growth, and the rates of increase are presumably lower today.

Many supply systems in both California and Nevada are in need of upgrading to insure delivery of adequate quantities of water for domestic and fire suppression purposes. Needed improvements include water lines, storage facilities, and additional hydrants (TRPA, 1983).

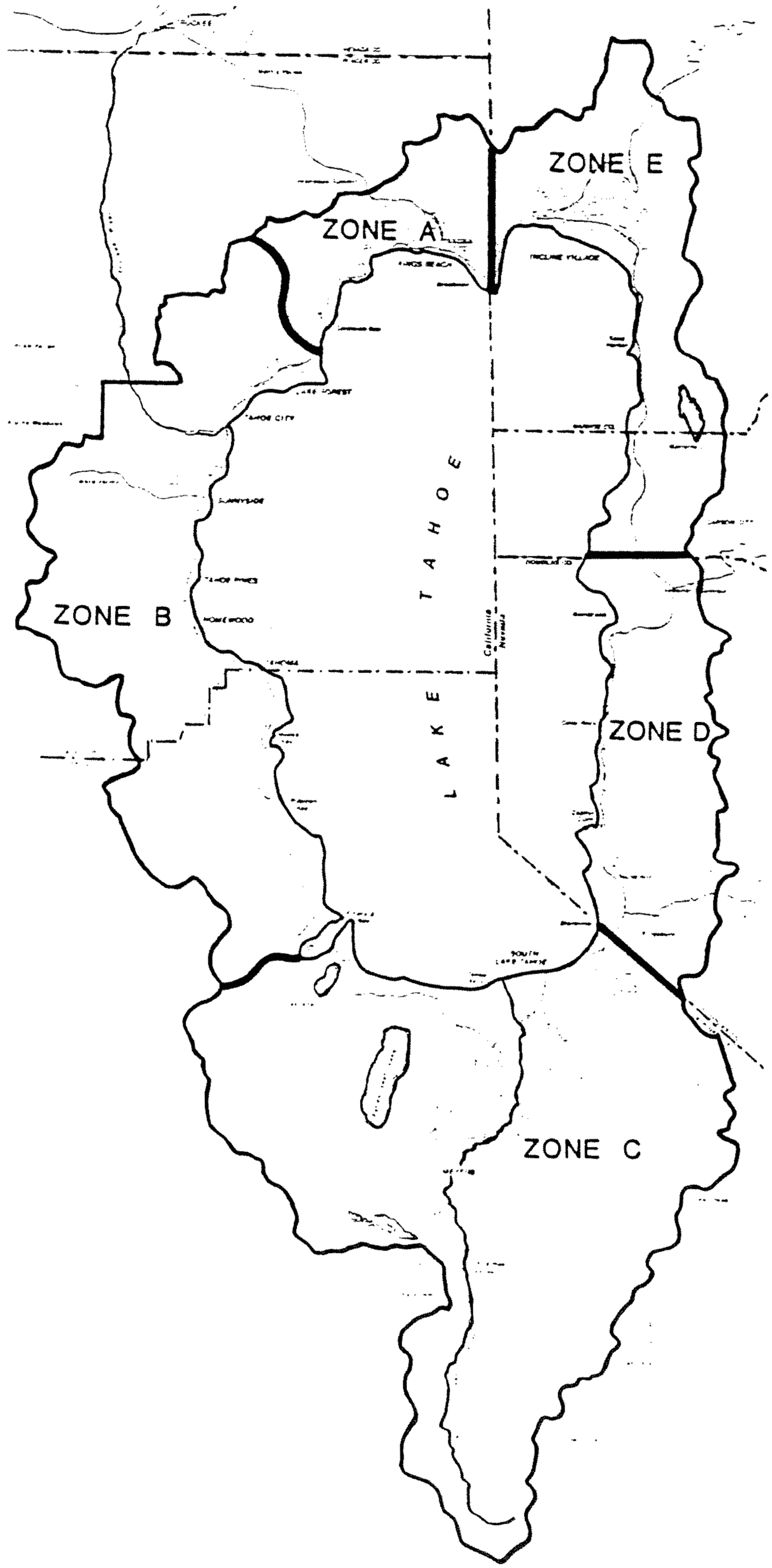


FIGURE 19 Water Supply Zones

TABLE 31

Municipal and Domestic Water Use Areas, by Zone

Zone A (North Tahoe)

Fulton Water Company
- Links System
- Cedar Flat System

Agate Bay Water Co.
North Tahoe PUD
- Dollar Cove System
- Carnelian System
- Tahoe Marina/Estates
- Tahoe Vista, Kings Beach, Brockway System

Miscellaneous Domestic Water Systems

Zone B (Tahoe City-West Shore)

Tahoe City PUD
- Dollar Point
- Tahoe City
- Rubicon Properties
- Alpine Peaks
- McKinney Shores
- Rubicon Palisades/Tahoe Hills

Fulton Water Company-Panorama
Lake Forest
Tahoe Sierra Estates
Timberland
Skyland
Glenridge
Lakeview Water Co.
Lake Park Terrace
Tahoe Park
Tahoe Park Heights
Talmont Estates
Ward Creek
Ward Well
Tahoe Pines
Tahoe Swiss Village
Madden Creek
Quail Lake
McKinney Water District
Tahoma Meadows
Tahoe Cedars
Waters Edge Condominiums
Meeks Bay Vista
Tamarack
Miscellaneous and private water systems
State Parks
USFS

Table 31, continued

Zone C (South Tahoe)

South Tahoe PUD Service Area
Lakeside Service Area
Tahoe Keys Service Area
Lukins Service Area
Angora Service Area (now owned by STPUD)
TPW&G Service Area (now owned by STPUD)
N. Fallen Leaf Lake Area
S. Fallen Leaf Lake Area
Echo Lake Area
Miscellaneous private users

Zone D (Douglas County)

Kingsbury Water Co.
Edgewood Water Co.
Round Hill General Improvement District
Elk Point County Club
U.S. Foest Service, Nevada Beach
Camp Galilee
Presbyterian Conference Point
Zephyr Cove Water Co.
Zephyr Cove Lodge
Skyland Water Company
Eickmeyer Water Company
Snug Harbor Water Company
Zephyr Cove Schools
Zephyr Cove Fire Station
Cave Rock Water Company
Logan Creek Water Compnay
Glenbrook Co.
S. Tahoe Properties Utility Co.

Carson City

None

Zone E (Washoe County)

Nevada State Park, Sand Harbor
Incline Village General Improvement District
Crystal Bay Water Co.
Incline Beach Assn.

Source: SWRCB, 1979

TABLE 32

Estimated Water Diversions for Use

California[a]	
Domestic/Municipal (1982)	13,060 afa
Irrigation/stock watering	714
Private lake storage	112
Infiltration/inflow	1,321
TOTAL	15,207 afa
Nevada[b]	
Washoe County	2,445 afa
Douglas County	4,412
TOTAL	6,857 afa

Source: (a) NTPUD, TCPUD, STPUD, 1984
(b) Duncan and Jones, 1983

STPUD plans three projects to provide backup water supply, provide additional storage to meet fire flow and peak demand, and accommodate future growth, including a new well. TCPUD plans eight projects to meet fire flow requirements and peak demand, including two wells. The largest project proposed is the Zephyr Cove Water System upgrade, scheduled for 1989 at a cost of approximately $4.5 million.

3. Anticipated Impacts on Water Supply

a. No-Growth Alternative

The No-Growth Alternative would maintain the existing pattern and intensity of land use and population levels in the Tahoe Region, leading to no significant changes in peak or average demand for water supply. Total diversions for use in both California and Nevada would be well within the limitations of the 1969 Interstate Compact.

Individual water suppliers will have to maintain their existing water supply systems, and upgrade them as appropriate to meet fire flow requirements, peak demand, and the need for backup supplies. Water suppliers will also have to provide treatment for drinking water from surface diversions in accordance with state and federal standards and regulations.

b. No-Action Alternative (1981 208 Plan)

The 1981 208 plan, Alternative 2, will maintain the existing boundaries of the urban area within the Region, will result in the in-fill of property in land capability districts 4, 5, 6 and 7, and result in the expanded use of non-urban areas for recreation and resource management, consistent with the TRPA Regional Plan.

NTPUD, TCPUD, and STPUD (1984) conducted an analysis of projected water use in California under the 1981 208 plan, in response to the analysis in Draft Environmental Impact Report: Policy for Water Allocation in the Lake Tahoe Basin (SWRCB, 1984). Using an estimated ultimate occupancy rate of residential units of 78 percent, including an allowance to account for annual variations in water use, treating net depletions for nonconsumptive uses as charges against the limits of the 1969 Interstate Compact, but not including infiltration/inflow into sewer lines, they projected the maximum annual water use for the California side of the Region at about 23,157 afa, or 157 afa more than the 23,000 afa annual allocation to California. If all the infiltration/inflow were added, the total use would exceed the 23,000 afa annual allotment by about 1234 afa.

If only gross diversions for consumptive uses were treated as charges against the compact, the above projections would be decreased by 177 afa (NTPUD, TCPUD, and STPUD, 1984). The SWRCB's projections in the 1984 DEIR were higher in both the public and private categories. The SWRCB projected maximum water use (including net depletions and infiltration/inflow) at 25,785 afa, 2,785 afa more than the California side allocation of 23,000 afa.

Thus, the utility districts and the SWRCB estimate that ultimate water use under the 1981 208 plan will range from 22,980 afa to 25,785 afa, compared to the California-side allocation in the 1969 Interstate Compact of 23,000 afa.

Duncan and Jones (1983) analyzed water use and water rights for the portions of the Region in Nevada. The Duncan and Jones analysis assumed full build-out of all subdivided parcels, 75 percent occupancy in Washoe County, and 90 percent occupancy in Douglas County. Adjusting the Duncan and Jones estimates downward to account for levels of buildout and occupancy rates consistent with the population estimates of Table 21, TRPA estimates maximum water use, including infiltration/inflow, at approximately 11,400 afa, or about four percent more than the Nevada-side allocation of 11,000 afa. Of the projected 11,400 afa, 2,391 afa represents water rights in Nevada controlled by the U.S. Forest Service. However, present Forest Service use is under 100 afa (Duncan and Jones, 1983, p. 28).

Individual water suppliers throughout the Tahoe Region will have to maintain their existing water supply systems, and upgrade them as appropriate to meet fire flow requirements, peak demand, and the need for backup supplies. Water suppliers will also have to provide treatment for drinking water from surface diversions in accordance with state and federal standards and regulations.

c. Hybrid Plan (Alternative 3)

The hybrid plan, Alternative 3, will maintain the existing boundaries of the urban area within the Region, will result in the in-fill of property in land capability districts 4, 5, 6 and 7, and result in the expanded use of non-urban areas for recreation and resource management, consistent with the TRPA Regional Plan.

Under the hybrid plan, the amount of additional residential development in California will be less than under Alternative 2, the 1981 208 plan, resulting in lower ultimate populations by about seven percent. Demand for private water supply on the California side will, therefore, be lower under Alternative 3, the hybrid plan, than under Alternative 2 by about seven percent, and total water use (public and private) will be lower by about 6 percent. The range of ultimate demand for water supply on the California side would be approximately 21,600 to 24,200 afa, compared to the allocation in the 1969 Interstate Compact of 23,000 afa.

Under the hybrid plan, the level of Nevada-side buildout is the same as in Alternative 2, the 1981 208 plan, since additional development is limited to parcels in land capability districts 4, 5, 6 and 7. As discussed under Alternative 2, TRPA estimates maximum water use, including infiltration/inflow, at approximately 11,400 afa, or about four percent more than the Nevada-side allocation of 11,000 afa. Of the projected 11,400 afa, 2,391 afa represent water rights in Nevada controlled by the U.S. Forest Service. However, present Forest Service use is under 100 afa (Duncan and Jones, 1983, p. 28).

Individual water suppliers throughout the Tahoe Region will have to maintain their existing water supply systems, and upgrade them as appropriate to meet fire flow requirements, peak demand, and the need for backup supplies. Water suppliers will also have to provide treatment for drinking water from surface diversions in accordance with state and federal standards and regulations.

d. Proposed 208 Amendments (Alternative 4)

The proposed 208 amendments, Alternative 4, will also maintain the existing boundaries of the urban area within the Region, will result in the in-fill of property in land capability districts 4, 5, 6 and 7, and result in the expanded use of non-urban areas for recreation and resource management, consistent with the TRPA Regional Plan. Like the hybrid plan (Alternative 3), the total number of additional single-family homes is limited to 6,000, but a portion of those will be approved under IPES for construction in land capability districts 1, 2 and 3.

Under the proposed amendments, the amount of additional residential development in California will be less than under Alternatives 2 and 3. Demand for private water supply on the California side will be lower under Alternative 4, the proposed amendments, than under Alternative 2 by about seven percent, and total water use (public and private) will be lower by about seven percent. The range of ultimate demand for water supply on the California side would be approximately 21,600 to 24,200 afa, compared to the allocation in the 1969 Interstate Compact of 23,000 afa.

Under the proposed 208 amendments, even with the constraint on the total number of additional single-family homes, the amount of additional residential development and the resulting populations are higher on the Nevada side than they are under Alternatives 2 and 3. Adjusting the Duncan and Jones estimates to account for levels of buildout and occupancy rates consistent with the population estimates of Table 21, TRPA estimates maximum water use, including infiltration/inflow, at approximately 11,400 afa, or about four percent more than the Nevada-side allocation of 11,000 afa. Of the projected 11,400 afa, 2,391 afa represents water rights in Nevada controlled by the U.S. Forest Service. However, present Forest Service use is under 100 afa (Duncan and Jones, 1983, p. 28).

Individual water suppliers throughout the Tahoe Region will have to maintain their existing water supply systems, and upgrade them as appropriate to meet fire flow requirements, peak demand, and the need for backup supplies. Water suppliers will also have to provide treatment for drinking water from surface diversions in accordance with state and federal standards and regulations.

I. THE ECONOMY

1. Applicable Standards

In the Tahoe Regional Planning Compact, the legislatures of Nevada and California, as well as the U.S. Congress noted the relationship between the economy and the environment in this finding:

> Maintenance of the social and economic health of the region depends on maintaining the significant scenic, recreational, education, scientific, natural and public health values provided by the Lake Tahoe Basin (Compact, Article I(a)(7)).

The legislatures and the Congress also directed the TRPA:

> to establish environmental carrying capacities and to adopt and enforce a regional plan and implementing ordinances which will achieve and maintain such capacities while providing opportunities for orderly growth and development consistent with such capacities (Compact, Article I(b)).

The TRPA Goals and Policies (TRPA, 1986a) set forth a number of general standards related to the economy of the Tahoe Region. The Plan shall seek to maintain a balance between economic health and the environment and shall give a high priority to correcting past deficiencies in land use (Goals and Policies, p. II-2).

The Goals and Policies encourage redevelopment in designated areas to improve environmental quality and community character. The purpose of redevelopment is to:

> make more efficient use of existing development, improve environmental quality, improve the efficiency of transportation systems, provide high quality facilities to residents and visitors, improve the economy, and improve the general safety, health, and welfare of the people of the Region (Goals and Policies, p. II-12).

As recommended by the Consensus Building Workshop, TRPA shall conduct a continuing study of the cause-effect relationships related to the Region's economy, to promote a better understanding of the possible economic impacts of the Regional Plan, and establish a socio-economic advisory panel to help develop a monitoring program and review and report on the Region's economy (Goals and Policies, pp. VII 25, 26).

2. Existing Situation

Much of the following information is summarized from the final report of the Economic Technical Committee, prepared for the Consensus Building Workshop and the TRPA (Economic Technical Committee, 1986). The reader should refer to that report for additional detail.

The Tahoe Region's economy is highly dependent on tourism. As of 1986, there were 2.8 million sq. ft. of retail commercial floor area; 800,000 sq. ft. of service commercial; 400,000 sq. ft. of office; and 500,000 sq. ft. of gaming. There were approximately 12,000 tourist accommodation units.

The principal market areas for the Tahoe Region are the San Francisco metropolitan area and the Sacramento metropolitan area. Secondary markets include northern Nevada and California and the Los Angeles-Orange County area (TRPA, 1984a). Recent promotional efforts have addressed these and other markets, including foreign visitors. Visitation to the Region shows strong seasonal trends, with the highest peak in the summer, another peak in the winter, and low visitation in the spring and fall.

According to the review of the data by the Economic Technical Committee, the economic data suggest that the Region's economy has declined in the past 10 years. Retail sales in South Lake Tahoe declined over 20 percent (constant dollars), while retail sales in California as a whole increased 12 percent, a differential of 32 percent.

Hotel and motel properties have also experienced lower revenues. Many hotels and motels are economically marginal because of low room rents and occupancy rates. A large percentage of hotels and motels in the Region are in bankruptcy or foreclosure procedings (Johnson, 1987).

Low retail sales and occupancy rates reflect the declining tourist visitation to the Region. Many of the hotels, motels, and other tourist facilities were built in the 1940's and 1950's, and do not meet the needs of the current and potential markets. Resort areas with newer and better facilities place the Tahoe Region at a competitive disadvantage for destination visitors.

Both the Economic Technical Committee (1988) and the Urban Land Institute (1985) found that the existing commercial and tourist facilities could accommodate significant growth in revenues without requiring additional floor area. However, "the local economy could be enhanced by selected revitalization (ULI, 1985)."

The Region's visitor profile is dominated by day and overnight use. These short-term visitors spend less and have more environmental impact than destination visitors. However, property owners have been discouraged from making the necessary improvements to attract destination visitors.

According to the Urban Land Institute study panel report (1985):

> Selective redevelopment of existing facilities under a flexible-plan approach--but not one resulting in environmental deterioration or significant numbers of additional visitors--can expand the local economy by attracting visitors who will spend significantly more money that do the visitors now coming into the [B]asin.

Reversing the economic trends will require a coordinated effort between the public and private sectors to improve visitor-serving facilities. The Economic Technical Committee (1986) felt that the major factors in the current economic condition were:

-- Reduced private investment in commercial projects due to economic uncertainty, land use restrictions, and building moratoria,

-- A shift of visitors toward day and overnight visits and lower expenditures per visitor,

-- Capacity constraints of existing public facilities and visitor facilities during peak visitor periods, and

-- Shrinkage of the resident-based economy, due to contraction in visitor dollars, aging of households, and lack of construction activity.

The amount of future tourist revenues depends on the quality of recreational opportunities and facilities that attract and serve visitors. Unless a substantial reversal is achieved, visitor numbers and expenditures could continue to decline. The rehabilitation of existing tourist facilities and construction of new facilities, particularly for destination visitors, is a necessary part of any reversal, according to the Economic Technical Committee (1986).

Economically-feasible and well-conceived land use and environmental regulations, consistently implemented, are also necessary to improve economic conditions. Marketing is also important.

A small increase in total visitors, a different mix of visitors, and more visitors in the fall and spring months could contribute significantly to the economy of the Region. If the average per-visitor-day expenditure were increased 10 percent, $125 million would be added to the Region's economy. Current average per-visitor-day expenditures are about 30 percent lower than competitive destination resort areas.

Growth in the resident economy depends partially upon employment growth in the Region, which is also related to increases in visitors and visitor expenditures.

3. Anticipated Impacts on the Economy

a. No-Growth Alternative

The No-Growth Alternative (Alternative 1), with its policies of no new coverage and no transfers of existing coverage, would not be likely to significantly affect the four causative factors, above, contributing to the decline in the Tahoe Region's economy. Although regulatory uncertainty would diminish, the lack of opportunity for additional development of any type would dampen investment in the Tahoe Region. As discussed under Land Use, Alternative 1 removes most of the incentives for redevelopment and community planning and would, therefore, not contribute to the revitalization of visitor-serving facilities needed to improve economic conditions.

The No-Growth Alternative would not ease capacity constraints which could be eased through utilization of allowed land coverage, such as additional beach recreation facilities, or transfers of land coverage, such as traffic congestion and carbon monoxide standards violations in the South Shore redevelopment area. The construction sector of the resident economy would contract, further weakening the resident economy. Construction employment would be limited to rehabilitation, including not only structural rehabilitation but also erosion and runoff control and SEZ restoration.

b. No-Action Alternative (1981 208 Plan)

The No-Action Alternative (Alternative 2) would improve some of the four factors contributing to the current economic conditions in the Region. Implementation of the 1981 208 plan would reduce regulatory uncertainty and allow additional development in all categories (residential, commercial, tourist, recreation, and public service), bringing new investment into the Region. The resident economy would benefit from the construction employment that would accompany this development.

However, like the No-Growth Alternative, Alternative 2 tends to reduce the incentives for redevelopment and community planning, since it does not allow most coverage transfers. This, in turn, will hinder local efforts to revitalize tourist facilities, to alter the visitor mix toward more destination visitors, and to increase the amount of visitation in the spring and fall.

Some peak period capacity constraints could be reduced or eliminated under Alternative 2, such as the lack of additional sewage treatment capacity within the STPUD service area, while others, such as traffic congestion and air pollution in the South Shore redevelopment area, would remain. (See Transportation and Air Quality.)

c. The Hybrid Plan (Alternative 3)

The economic impacts of the hybrid plan (Alternative 3) would be similar to those of Alternative 2, the 1981 208 plan. However, compared to Alternative 2, there would be a lower overall level of additional development (thus, investment) in the Region. (See Table 21.)

Also, under the hybrid plan, more peak period capacity constraints could be reduced or eliminated, including circulation improvements in the vicinity of the south stateline, through implementation of TRPA's Regional Transportation Plan. (See Transportation.)

d. Proposed 208 Amendments (Alternative 4)

The proposed 208 amendments (Alternative 4) will tend to improve all four causative factors, above, affecting the economic conditions of the Tahoe Region. Implementation of the plan would reduce regulatory uncertainty, and create opportunity for additional investment and development in the residential, commercial, tourist, recreation, and public service categories.

As discussed under Land Use, the transfer of coverage provisions of Alternative 4, which will be facilitated by land banks, will create incentives to rehabilitate or replace obsolete uses, reduce unconsolidated strip development, and contribute to upgrading of the built environment and economic recovery. This, in turn, will help create the quality of visitor-serving facilities necessary to change the visitor mix toward more destination visitors and fill in the "shoulder seasons."

Alternative 4, the proposed 208 amendments, would ease peak-period capacity constraints in the areas of transportation, sewage capacity, and recreation which, in turn, will have beneficial impacts on tourism and the economy of the Region.

The hoped-for improvements in tourist visitation and spending patterns would have beneficial effects on the resident economy, and the construction sector of the local economy would benefit from the anticipated additional development and rehabilitation projects--both structural and environmental.

Overall, Alternative 4 has the most-positive effect on the economy of the four alternatives, since it gives good results in the four categories of increasing investment in the Region, achieving a shift in visitor patterns, reducing capacity constraints during peak periods, and strengthening the resident economy.

Note. The following parts of this chapter cover the probable environmental impacts of the proposed 208 amendments and the alternatives in the following categories: community design; cultural resources; energy; fish; housing; natural hazards; noise; public health, safety, and welfare; recreation; scenic resources; shorezone; vegetation; and wildlife. In these categories, there are fewer differences in impacts among the alternatives. Where appropriate, the discussion has been condensed. The list of impact areas is alphabetized for the convenience of the reader.

J. COMMUNITY DESIGN

1. Applicable Standards

The TRPA thresholds (Attachment 1) state that TRPA shall ensure, in cooperation with local government, that the height, bulk, texture, form, materials, colors, lighting, signing, and other design elements of new, remodeled, and redeveloped buildings are compatible with the natural, scenic, and recreational values of the Region.

The Goals and Policies call for establishment of regional community design criteria to ensure maintenance of community character (Goals and Policies, p. II-47). TRPA is presently developing design review guidelines.

Local governments have also adopted design standards for the Tahoe Region.

2. Existing Situation

Community design is primarily a concern in the urbanized areas of the Region. (Related concerns in non-urban areas are discussed under Scenic Resources.) With some exceptions, existing community design is undistinguished architecturally, and is also affected by reflecting surfaces, poor signage, and gaudy colors (TRPA, 1987a). The Urban Land Institute study panel (1985) commented on the obsolesence of many tourist facilities, and said, "The inadequacies of the built environment are detrimental to the economic vigor of the Basin."

The redevelopment and community planning processes consider community design within the context of modernization and rehabilitation in the Region. The South Lake Tahoe Redevelopment Plan, Draft EIR/EIS (Brady and Associates, 1988) contains a discussion of community design in the

Redevelopment Area. The following summary, paraphrased from the draft EIR/EIS, was written for the redevelopment area, but applies generally throughout the urbanized areas of the Region:

Typical of strip commercial development, the design character in the area is geared to attract the attention of the passing motorist. This has resulted in structures and signs pushed as close to the roadway as possible, creating a tunnel-like visual effect. Bright colors on buildings and signs are used to attract attention. Together, the buildings, the signs, and the many garish colors result in a cluttered and confusing foreground which visually dominates the natural landscape. The heavy traffic on the highway adds to the clutter and detracts from community character.

The architecture of the existing commercial structures tends to be utilitarian and mundane, with little or no visual interest. Few properties are landscaped between building and roadway, and little internal landscaping exists. Parking areas are not separated from the highway, and parked vehicles and vacant parking lots are highly visible from the road.

3. Anticipated Impacts on Community Design

<u>No-Growth Alternative</u>. Alternative 1 (No-Growth) would have a positive impact on community design through its programs of BMP implementation, SEZ restoration, capital improvements, excess coverage mitigation, improved mass transit, and revegetation requirements. These programs will contribute to better designed, built, and landscaped urban improvements (e.g., roads, drainage systems) and additional open space, which will have positive effects on community design.

Alternative 1 would complement TRPA programs to attain and maintain the threshold for community design. To the extent that Alternative 1 would reduce or remove incentives for redevelopment and community planning (see Land Use), resulting in slower rehabilitation of the commercial core areas, the positive effects of Alternative 1 would accrue more slowly than Alternative 4, which encourages redevelopment and community planning.

<u>No-Action Alternative</u>. Alternative 2 (No-Action), consists of implementation of the 1981 208 plan. Alternative 2 would have a positive impact on community design through its programs of BMP implementation and capital improvements, and would complement TRPA programs to attain and maintain the threshold for community design. Alternative 2 would contribute to better designed, built, and landscaped urban improvements, but not as much as the other alternatives, since Alternative 2 does not create new open space, restore SEZ areas, improve mass transit facilities, or encourage community planning and redevelopment.

Hybrid Plan. Alternative 3 (Hybrid Plan) is similar to Alternative 2, but also includes the explicit program of BMP implementation, the excess coverage mitigation program, the SEZ restoration program, revegetation requirements, and improved mass transit. The impacts of the Hybrid Plan on community design would be similar to those of the No-Growth Alternative.

Proposed 208 Amendments. Alternative 4 (proposed 208 amendments) will have a positive impact on community design through its programs of BMP implementation, SEZ restoration, capital improvements, excess coverage mitigation, improved mass transit, and revegetation requirements, and will complement TRPA programs to attain and maintain the community design threshold. The positive impacts of these regulatory and remedial programs are discussed under the No-Growth Alternative.

Since Alternative 4 encourages rehabilitation of commercial core areas through redevelopment and community planning (see Land Use), it will help replace obsolete uses, reduce strip development, and contribute to the upgrading of the built environment. Thus, benefits in the area of community design will accrue more rapidly under Alternative 4 than the other alternatives.

K. CULTURAL, HISTORICAL, AND ARCHITECTURAL RESOURCES

1. Applicable Standards

With respect to historical resources, the goal of the TRPA is to identify and preserve sites of historical, cultural, and architectural significance within the Region (Goals and Policies, p. IV-26). Chapter 29 of the Code of Ordinances provides for the recognition, protection, and preservation of the Region's significant historical, archaeological, and paleontological resources (Code, Section 29.0) and sets standards for resource protection, discovery of resources, designated historic resources, eligibility as historic resources, projects relating to historic resources, and exceptions.

2. Existing Situation

Designated historic resources are depicted on the TRPA Historic Resource Map (TRPA, 1987c) and in some confidential TRPA records where necessary to protect sites from trespassers. The TRPA map includes 73 named, mapped sites and numerous Washoe cultural sites. The majority of the sites are in or near urbanized areas, since early inhabitants of the Region occupied the same parts of the Region that more modern man finds attractive. There is a need for additional research and mapping of historical, cultural, and architectural sites.

3. Anticipated Impacts on Cultural, Historical, and Architectural Resources

No-Growth Alternative. Since the No-Growth Alternative (Alternative 1) allows no new land coverage and no transfers of land coverage within the Region, it poses the least risk to cultural resources of the four alternatives. Some risk to cultural resources may still be posed by the program of BMP implementation, the SEZ restoration program, the capital improvements program, and the excess coverage mitigation program, to the extent that construction of remedial measures or rehabilitation of disturbed areas may affect mapped or unmapped sites.

To reduce the risk of disturbance of historical and cultural sites, it would be necessary for persons implementing remedial and rehabilitation measures to observe the standards of Chapter 29 of the Code of Ordinances.

No-Action Alternative. The No-Action Alternative, implementation of the 1981 208 plan, poses some risk to cultural and historical resources because of the additional development it allows, and through the programs of capital improvements and BMP implementation, since new development or construction of remedial measures may affect mapped and unmapped sites. To reduce the risk of disturbance, it would be necessary for persons creating additional development, and persons implementing remedial programs, to observe the standards of Chapter 29 of the Code of Ordinances.

Hybrid Plan. Alternative 3 (Hybrid Plan) includes a level of risk to cultural and historical resources because of the additional development it allows, and through the programs of capital improvements, BMP implementation, SEZ restoration, and excess coverage mitigation. Like the other alternatives, it would be necessary for persons creating additional development, and persons implementing remedial and restoration programs, to observe the standards of the TRPA Code. Since Alternative 3 includes less additional development than Alternative 2, the risk to historical and cultural resources should be lower.

Proposed 208 Amendments. Alternative 4 (proposed 208 amendments) will have impacts on cultural and historical resources as described for the Hybrid Plan, Alternative 3.

L. ENERGY

1. Applicable Standards

The Goals and Policies state TRPA's goal of promoting energy conservation programs and development of alternative energy sources to lessen dependence on scarce and high-cost energy supplies. TRPA policies require new development to comply with state and federal energy efficiency standards; call for a coordinated program to encourage recycling; encourage development of alternative energy sources; and recognize traffic flow improvements, measures to reduce VMT, combustion heater standards, home weatherization, and solar heating as energy conservation measures (Goals and Policies, p. IV-26).

2. Existing Situation

Detailed discussions of the the energy situation are included in the Lake Tahoe Environmental Assessment (WFRC, 1979) and the EIS for the Adoption of a Regional Plan for the Lake Tahoe Basin (TRPA, 1983). Those discussions are incorporated by reference.

Six major forms of energy are consumed in the Region: electricity, natural gas, liquified petroleum gas, fuel oil, wood, and transportation fuels. With the exception of some of the wood, all of these energy sources are imported to the Region via transmission lines, pipelines, and trucks. As of 1976, annual energy consumption for buildings accounted for 69 percent of energy consumption (7300 billion BTUs) and transportation accounted for 31 percent (3200 billion BTUs). Gasoline accounts for 96 percent of the transportation fuels.

In recent years, natural gas has replaced electricity, LPG, and fuel oil as a source of heat in many homes, as the natural gas companies have expanded their service areas. As of 1976, natural gas accounted for half of all energy consumed in buildings.

According to the WFRC (1979), peak electricity demand has exceeded reliable capacity at the south shore since 1971; but only once on the north shore between 1971 and 1979. Sierra Pacific Power Co., which provides electricity to the Region, has been upgrading the reliability of its transmission systems in recent years.

3. Anticipated Impacts on Energy

No-Growth Alternative. Alternative 1 (No-Growth) would not significantly affect energy consumption for buildings in the Region, since it does not allow additional development (except through conversion of existing uses) and does not increase the Region's population. Alternative 1 would result in a decrease in transportation fuel consumption, since it is estimated to result in a 12 percent reduction of vehicle-miles-travelled (VMT) over 20 years. (See Transportation.)

No-Action Alternative. Alternative 2 (1981 208 plan) would increase energy consumption for buildings in the Region, since it allows additional development in the Region in the residential, commercial, tourist, recreational, and public service categories. Since TRPA estimates Alternative 2 would result in a 31 percent increase in the Region's population (see Table 21), energy demand for buildings would also increase by up to 31 percent. It would be necessary to improve reliable supplies of electricity, natural gas, and other heating fuels to accommodate this increase.

Alternative 2 would also result in an increase in transportation fuel consumption, since TRPA estimates it would result in a 12 percent increase in VMT over 20 years. (See Transportation.)

Hybrid Plan. Alternative 3 (Hybrid Plan) would also increase energy consumption for buildings in the Region. Since TRPA estimates Alternative 3 would result in a 27 percent increase in the Region's population, energy demand for building would also increase by up to 27 percent, although the controls on combustion heaters in the hybrid plan will bring about a degree of energy conservation. It would be necessary to improve reliable sources of home heat.

Alternative 3 would result in a decrease in transportation fuel consumption, since TRPA estimates it will result in an 8 percent decrease in VMT over 20 years.

Proposed 208 Amendments. Alternative 4 (proposed 208 amendments) will have impacts on energy usage within the Tahoe Region as described under the hybrid plan (Alternative 3). TRPA estimates VMT will decrease 10 percent over 20 years under Alternative 4.

M. FISH

1. Applicable Standards

There are six TRPA thresholds covering fisheries of the Tahoe Region in the following areas: stream habitat, instream flows, and Lake habitat. (See Attachment 1.)

In the area of stream habitat, the thresholds require the upgrading of 51 miles from good to excellent, and 91 miles from marginal to good. The standard represents the full habitat potential. For instream flows, the thresholds require nondegradation of flows pending adoption of instream flow standards. With respect to Lake Tahoe habitat, the thresholds call for the achievement of 5,948 acres of excellent habitat. The thresholds also state that it is the policy of the TRPA to support, in response to justifiable evidence, state and federal efforts to reintroduce the Lahontan cutthroat trout.

For additional discussion of standards, see Shorezone.

2. Existing Situation

The fish of the Tahoe Region have always been important to the Region. Lake Tahoe and its tributaries supported a commercial fishery through the early 1900's. Lake and stream angling is today a popular activity throughout the Region. Fish which inhabit Lake Tahoe include the dace, sculpin, sucker, mountain whitefish, tui chub, redside, rainbow trout, kokanee, and lake trout or mackinaw. All of these species except the mackinaw use the streams for spawning or nursery habitat. The non-native brook trout is the principal game species in the streams, although some rainbow, brown, and cutthroat trout are also found (TRPA, 1982b). For additional detail, refer to the EIS for the Establishment of Environmental Threshold Carrying Capacities, TRPA, 1982, pp. 34 to 40. The native Lahontan cutthroat trout no longer inhabits the Tahoe Region because of competition from other non-native species.

Streams in the Tahoe Region fall into two categories: those that support only resident populations of fish, and those that support resident and migratory populations. TRPA (1982b) ranked streams according to the existing and natural potential as a fishery. The threshold is to maintain 75 miles of excellent habitat and 105 miles of good habitat, which requires upgrading 51 miles from good to excellent and 91 miles for marginal to good.

Siltation, channelization, dredging, removal of rock or gravel, culverts, bridges, diversions, urban runoff, snow disposal, and trash all degrade stream habitat. The Plan Area Statements contain frequent references to degraded habitat, including PASs 024B (Snow Creek), 037 (Lakeview), 047 (Tunnel Creek), 048 (Incline Village Tourist), 055 (East Shore), 057 (Spooner Lake), 066 (Zephyr Cove), 100 (Truckee Marsh), 150 (Meeks Bay), and 161 (Tahoe Pines).

According to TRPA (1982b), Lake Tahoe has 2,776 acres of excellent Lake habitat and 3,172 acres of good Lake habitat. The latter category experiences moderate to heavy boat traffic, contributing to the decrease in its rating from excellent to good. Siltation and alteration of the Lake bottom also contribute to degraded Lake habitat. Because there is a lack of reliable scientific information regarding cause-effect relationships between development and Lake habitat, TRPA has recently initiated a study of Lake habitat, scheduled for completion in 1990.

There are 29 TRPA Plan Areas which adjoin prime fish habitat in Lake Tahoe. TRPA has targeted all but five of these habitat areas for restoration. (See TRPA, 1987a, p. IV-53.)

The California Department of Fish and Game has recently completed a study for TRPA on instream flow requirements (Snider et al., 1987) and TRPA plans to amend the Code of Ordinances to incorporate the recommended instream flow standards. Stream flows for fish habitat may be endangered by diversions for domestic use, irrigation, and snow making.

Chapter 79 of the TRPA Code of Ordinances addresses protection of fish habitat and enhancement of degraded habitat. Under Chapter 79, projects and activities in the shorezone of lakes may be prohibited or otherwise regulated in prime habitat areas, or other areas TRPA finds to be vulnerable or critical to the needs of fish. Certain activities (e.g., construction) may be restricted in areas where spawning is occurring (Code, Subsection 79.2.A).

Modifications to stream channels, and other activities in SEZs that may physically alter the natural characteristics of a stream, are not permitted unless TRPA finds they avoid adverse effects to fish or are otherwise allowed under the Code, and development adjacent to tributaries is required to fully mitigate adverse impacts to the fishery (Code, Subsection 79.2.B).

3. Anticipated Impacts on Fish

No-Growth Alternative. The regulatory and remedial programs of Alternative 1 (No-Growth), as described in Section I, Chapter IV, would have a beneficial effect on several of the causative factors that degrade stream habitat for fish. The program of BMP implementation, the Capital Improvements Program, the SEZ Restoration Program, the excess coverage mitigation program, and the use of discharge standards and permits would reduce siltation problems, improve the quality of urban runoff, and reduce the impacts of snow disposal on stream habitat. The SEZ Restoration Program would also help remedy existing impacts from past channelization, dredging, and quarrying and from bridges and culverts. Alternative 1 allows no new SEZ disturbance, and results in the restoration of about 1300 acres of SEZ (Table 27).

Siltation of Lake habitat would also be reduced by the regulatory and remedial programs, along with restrictions on shorezone encroachment and alteration of vegetation in the shorezone. Controls on dredging and other construction in the shorezone, which limit activities to those which are beneficial to existing shorezone conditions, would also have a positive effect on Lake habitat.

Alternative 1 would complement TRPA programs to attain and maintain the thresholds for fish, and would have positive impacts on both stream and Lake habitat.

No-Action Alternative. Alternative 2 (No-Action) would also have a positive impact on several of the factors which degrade stream habitat for fish in the Tahoe Region. Implementation of BMPs, the Capital Improvements Program, and discharge standards and permits would reduce siltation and reduce the impacts of urban runoff. Despite the additional development allowed under Alternative 2, controls on SEZ encroachment would minimize new channelization, dredging, quarrying, and other disturbances to the streams themselves. However, as shown in Table 27, Alternative 2 would permit about 10 acres of SEZ encroachment for certain public recreation and environmental projects, which could have a negative impact on stream habitat. Alternative 2 contains no SEZ restoration program.

With respect to Lake habitat, Alternative 2 (implementation of the 1981 208 plan) would reduce or eliminate additional damage to existing fish spawning habitat and other prime fish habitat. Alternative 2 prohibits the discharge, or threatened discharge, of solid or liquid wastes attributable to new pier construction in fish spawning habitat or areas immediately offshore of stream inlets. Pier construction is discouraged in other prime fish habitat. BMPs, capital improvements, and discharge permits should also reduce silt damage to Lake habitat.

Alternative 2 would be consistent with the attainment and maintenance of TRPA thresholds pertaining to fish, and would have a positive impact on both stream and Lake habitat. Compared to the other alternatives, the magnitude of the positive impacts is smaller, because Alternative 2 allows additional development but does not include SEZ restoration and allows SEZ encroachment without explicit requirements for offsetting restoration.

Hybrid Plan. Although it allows additional development in the Tahoe Region, the regulatory and remedial programs of Alternative 3 (Hybrid Plan) would have a beneficial effect on several of the causative factors that degrade stream habitat for fish. The program of BMP implementation, the Capital Improvements Program, the SEZ Restoration Program, the excess coverage mitigation program, and the use of discharge standards and permits would reduce siltation problems, reduce the impacts of urban runoff, and reduce the impacts of snow disposal on stream habitat. The SEZ Restoration Program (Volume III) would also help to remedy existing impacts from past channelization, dredging, and quarrying and from bridges and culverts. Although Alternative 3 allows about 30 acres of new SEZ disturbance, that disturbance must be offset at 1.5:1. The offsets and the SEZ Restoration Program, combined, would result in the restoration of about 1345 acres of SEZ (Table 27).

Siltation of Lake habitat would also be reduced by the regulatory and remedial programs, along with restrictions on shorezone encroachment and alteration of vegetation in the shorezone. Like Alternative 2, Alternative 3 prohibits the discharge, or threatened discharge, of solid or liquid wastes attributable to new pier construction in fish spawning habitat or areas immediately offshore of stream inlets.

Alternative 3 would complement TRPA programs to attain and maintain the thresholds for fish, and would have positive impacts on both stream and Lake habitat. The impacts of Alternative 3 on fish would be more positive than the impacts of Alternative 2.

Proposed 208 Amendments. Although Alternative 4 (proposed 208 amendments) allows additional development in the Tahoe Region, the regulatory and remedial programs of Alternative 4 will have a beneficial effect on several of the causative factors that degrade stream habitat for fish, including siltation, urban runoff, and snow disposal. The SEZ Restoration Program will help remedy existing impacts from past channelization, dredging, and quarrying and from bridges and culverts. Although Alternative 4 allows about 35 acres of new SEZ disturbance, that disturbance must be offset at 1.5:1. The offsets and the SEZ Restoration Program, combined, would result in the restoration of about 1352 acres of SEZ (Table 27).

Siltation of Lake habitat would also be reduced by the regulatory and remedial programs, along with restrictions on shorezone encroachment and alteration of vegetation in the shorezone. Controls on dredging and other construction in the shorezone, which limit activities to those which are beneficial to existing shorezone conditions, will have a positive effect on Lake habitat.

Alternative 4 will be consistent with TRPA programs to attain and maintain the thresholds for fish, and will have positive impacts on both stream and Lake habitat. Compared to the other alternatives, Alternative 4 should have impacts similar to Alternative 1, due to the similarities in their remedial and regulatory programs.

N. HOUSING

1. Applicable Standards

There are no TRPA environmental thresholds for housing. The Goals and Policies include a goal of providing, to the extent possible, affordable housing in suitable locations for the residents of the Region, and call for special incentives to promote affordable or government-assisted housing for low-income households (Goals and Policies, p. II-19). California redevelopment law (California Health and Safety Code Section 33000 et seq.) requires redevelopment projects to include a proportion of affordable housing.

2. Existing Situation

According to the Urban Land Institute study panel (1985), housing construction costs in the Tahoe Region are high. When other costs of development (e.g., mitigation fees) are added, a shortage of affordable housing results. Although there are approximately 200 designated affordable housing units in the Region, Census data indicate there are over 7000 low-income residential housing units (TRPA, 1987a). The demand for affordable housing can be expected to increase, as the construction sector of the economy is replaced by minimum-wage earners in service industries (Economic Technical Committee, 1986).

There are approximately 26,500 single-family homes in the Region, and about 12,000 other dwelling units, but there are only about 19,000 residential households. Thus, 50 percent of the dwelling units in the Region have resident households, and 50 percent are used to house visitors.

Maintaining a diversity of housing types is important to the economy of the Region. If sufficient housing diversity can be achieved to allow those employed in the Region to also live there, more potential sales could be captured by local merchants, setting off multiplier effects throughout the Region's economy (ULI, 1985).

The Plan Area Statements make employee housing a permissible use in 43 Plan Areas, and multi-family dwellings a permissible use in 52 Plan Areas (TRPA, 1987a). Chapter 33 of the Code of Ordinances includes an incentive for the construction of new affordable housing, by excepting eligible projects from the requirement to have residential growth allocations (Code, Subsection 33.2.A). The Code also requires the community planning process to consider housing needs (Chapter 14), authorizes transfers of existing housing to designated receiving zones (Chapter 34), and authorizes TRPA to award bonus multi-family units for provision of employee housing or affordable housing and for rehabilitation of multi-residential units (Chapter 35).

3. Anticipated Impacts

No-Growth Alternative. Alternative 1 (No-Growth) would not affect the supply of housing, and would affect the diversity of available housing only to the extent that it is affected by rehabilitation and conversion of other uses. Since the population of the Region would not change significantly, overall demand for housing would not increase. But, if recent trends continue, the demand for affordable housing would increase because of the higher proportion of minimum-wage workers in the work force.

No-Action Alternative. Alternative 2 (No-Action) implements the 1981 208 plan. This alternative would increase the supply of single-family houses and other housing in the Region, by allowing additional residential development. Since Alternative 2 would remove many of the incentives for redevelopment and community planning, the housing-related goals of these programs would be achieved less quickly under Alternative 2 than other other alternatives which encourage redevelopment and community planning.

Alternative 2 would allow about 9000 new single family homes and approximately 1600 multi-family residences (see Land Use), increasing the overall supply of housing but not changing the existing diversity of housing, which strongly favors medium- and high-income households. Alternative 2 would continue the existing imbalance between low-income households and available affordable housing.

Hybrid Plan. Alternative 3 (Hybrid Plan) would also increase the supply of single-family houses and other housing in the Region, by allowing additional residential development. Like Alternative 2, the Hybrid Plan removes many of the incentives for redevelopment and community planning, and would achieve the housing-related goals of these programs less quickly than Alternative 4.

Alternative 3 would allow about 6000 new single family homes and approximately 1600 multi-family residences (see Land Use), adding primarily to the supply of medium- and high-income housing, and continuing the imbalance between supply and demand for low-income housing.

Proposed 208 Amendments. Alternative 4 (proposed 208 amendments) also allows additional residential development and will increase the supply of single-family houses and other housing in the Region. Since Alternative 4 is meant to encourage redevelopment and community planning, and foster rehabilitation of existing properties, Alternative 4 may increase the diversity of available housing and make more low-income housing available for those who work and live in the Tahoe Region. Transfers of coverage to multi-residential development in community plan areas can either improve or diminish project feasibility, depending on the price of the transferred coverage with respect to market prices (Economic Technical Committee, 1986).

O. NATURAL HAZARDS

1. Applicable Standards

There are no TRPA thresholds specifically related to natural hazards. The Goals and Policies include a goal of minimizing risks from natural hazards, including flood, fire, avalanche, and earthquake. They provide that construction, reconstruction, or replacement of structures in identified avalanche or mass instability hazard areas shall be restricted unless precautionary measures can be implemented to ensure protection of public health and safety. And they call for public education programs to be implemented regarding wildfire and fuels management (Goals and Policies, p. II-23, 24).

The Goals and Policies also (p. II-24):

> Prohibit construction, grading, and filling of lands within the 100-year flood plain and in the area of wave runup except as necessary to implement the Goals and Policies . . . [and] require all public utilities, transportation facilities, and other necessary public uses located in the 100-year flood plain and area of wave runup to be constructed or maintained to prevent damage from flooding and to not cause flooding.

Federal regulations generally prohibit development within flood plains (Executive Order Nos. 11988 (1977) and 11296 (1966)).

2. Existing Situation

Because man has developed the Tahoe Region in a rugged, mountain environment, there is human exposure to natural hazards from earthquakes, landslides, avalanches, floods, and fires. The EIS for the Adoption of a Regional Plan for the Lake Tahoe Basin (TRPA, 1983) includes a discussion of natural hazards which is incorporated herein by reference.

Earthquakes. The Tahoe Region is located in a region of active and potentially-active faults, with evidence of movement along faults, and with earthquakes in and around the Region. The major north-south fault zone of the Sierra Nevada is about six miles east of the Tahoe Basin. Active fault movement occurs here and also north of the Basin. The Tahoe Basin and vicinity have experienced over 135 earthquakes since 1855. Earthquakes can result in ground shaking, failure, or rupture, or in landslides and abnormally large waves (seiches) which could inundate a zone 10 feet above the maximum high water line of Lake Tahoe. Seiches are also possible on the smaller lakes in the Region, such as Fallen Leaf Lake. (See TRPA, 1983, p. 21.)

Landslides. Landslides or mudslides involve accelerated erosion of large volumes of soil and rocks. Steep slopes, lack of vegetative cover, and saturated soils increase the potential for landslides and mudslides, as do poorly-engineered physical improvements. Recent mass wasting has occurred in Emerald Bay and Incline Village (TRPA, 1983).

Avalanches. Snow avalanches occur more frequently along the west side of the Tahoe Basin than the east side. Avalanches occur frequently along California 89 at Emerald Bay and on U.S. 50 at Meyers Grade. Travellers on the highway network have a higher exposure to avalanche hazard than occupants of the urbanized areas, although isolated buildings have been damaged or destroyed by avalanches in the past.

Flooding. Flooding results from rapid surface water runoff from rainfall, snowmelt, or both, that exceeds the capacity of the natural and man-made drainage systems. Localized flooding occurs throughout the urbanized areas of the Region, but is most prevalent in low-lying areas of the south shore, with its broad alluvial plain. There have been numerous large floods in the Region, including those in December, 1955; January, 1963; December, 1964; and June, 1969 (COE, 1969 and 1971). Tributary streams that are most-likely to cause flood hazards, by virtue of their large flows, include the Trout Creek and Upper Truckee River systems, Blackwood Creek, and Taylor Creek.

Fire. Due to the fire suppression efforts of the federal, state, and local agencies in the Tahoe Region, there has not been a catastrophic fire in the Tahoe Region in many years, despite the even-aged and over-stocked stand of trees in many areas. A high potential exists, however, for fires in both natural and urbanized areas, due to the normally dry summers and dense vegetative cover. Steep slopes with south or west exposure have the highest hazard.

TRPA has not adopted a Natural Hazards chapter in the Code of Ordinances. However, the Code of Ordinances does mitigate risk of exposure to natural hazards by emphasizing infill of urban areas, requiring master plans for ski area and marina expansion, limiting land coverage in areas of low land capability, authorizing transfers of development from SEZs and steep areas, regulating uses in unstable areas of the backshore, requiring subsurface investigations and slope stability reports, and authorizing management of wildfire hazards (TRPA, 1987a).

TRPA's official Natural Hazard Maps depict the locations of areas of ground instability, seismic ground response, snow avalanche, and seiches. The procedure for establishing SEZ boundaries and setbacks in Chapter 37 of the Code, and incorporated in the proposed 208 amendments, defines "designated flood plain" as the Intermediate Regional Flood or the 100-year flood as established by the U.S. Army Corps of Engineers (COE). The BMP Handbook also refers to the COE maps. The Corps has analyzed and mapped the 100-year floodplain for 27 streams in the Region, as listed in Table 33.

TABLE 33

Streams with Mapped 100-Year Flood Plains

Flood Plain Information Reports

Upper Truckee River (U.S. COE, 1971)
Trout Creek (U.S. COE, 1969)
Bijou Creek (U.S. COE, 1969)
Truckee River (U.S. COE, 1971)

Flood Hazard Information (U.S. COE, 1979)

Angora Creek
Barton Creek
Blackwood Creek
Burke Creek
Burton Creek
Carnelian Creek
Cold Creek
Edgewood Creek
First Creek
Glenbrook Creek
Griff Creek
Heavenly Valley Creek
Homewood Creek
Lake Forest Creek
Lonely Gulch Creek
Madden Creek
McFaul Creek
McKinney Creek
Mill Creek
North Zephyr Creek
South Zephyr Creek
Tahoe Vista Creek
Ward Creek

3. Anticipated Impacts on Natural Hazards

No-Growth Alternative. Alternative 1 (No-Growth) would maintain the risk of exposure to natural hazards (earthquake, landslides, avalanches, flooding, and fires) at approximately the existing levels. Existing development, especially in low-lying areas, steep areas, known avalanche areas, and areas near major tributary streams would continue to have some exposure to hazards from earthquakes, landslides, avalanches, flooding, or fire.

No-Action Alternative. Alternative 2 (No-Action) would continue the risk of exposure to natural hazards for existing development, especially in low-lying areas, steep areas, avalanche areas, and areas near major tributary streams. Alternative 2 would also increase exposure to natural hazards by increasing the population of the Region and allowing additional residential, commercial, tourist, commercial, and public service development.

Alternative 2 includes the 100-year flood plain as one of the four attributes that identifies the limits of an SEZ. Therefore, under Alternative 2, the 100-year flood plain is afforded the same protection as an SEZ. Construction, grading, and vegetation removal are prohibited, except for approved erosion control work; projects necessary for implementation of the air quality nonattainment plan or the transportation element of the Regional Plan; or projects necessary for public recreation or the protection of the public health, safety, or general welfare, provided all feasible alternatives have been exhausted (TRPA, 1981b, Ordinance 81-5). The allowed land coverage in 100-year flood plains is one percent, except for the types of projects listed above, which are exempt from the coverage limits.

As discussed under Stream Environment Zones, the 1981 208 plan (Alternative 2) could allow about 10 acres of encroachment into SEZs under these exceptions. This encroachment may reduce the ability of the SEZ to convey flood flows, and expose physical improvements to flood damage.

Hybrid Plan. Alternative 3 (hybrid plan) would also continue the risk of exposure to natural hazards for existing development, especially in low-lying areas, steep areas, avalanche areas, and areas near major tributary streams. Alternative 3 would increase exposure to natural hazards by increasing the population of the Region and allowing additional residential, commercial, tourist, commercial, and public service development.

Like Alternative 2, Alternative 3 includes the 100-year flood plain as one of the four attributes that identifies the limits of an SEZ. Construction, grading, and vegetation removal in the 100-year flood plain are, therefore, prohibited, except for approved erosion control work; projects necessary for implementation of the air quality nonattainment plan or the transportation element of the Regional Plan; or projects necessary for public recreation or the protection of the public health, safety, or general welfare, provided all feasible alternatives have been exhausted. The base allowed coverage in designated 100-year flood plains is one percent under Alternative 3.

As discussed under Stream Environment Zones, the hybrid plan (Alternative 3) could allow about 30 acres of encroachment into SEZs under the exceptions, with a required 1.5:1 offset. This encroachment may nevertheless reduce the ability of a given SEZ to convey flood flows, and expose physical improvements to flood damage, because the offset make not take place in the same watershed as the encroachment.

The restoration of 1300 acres of SEZs under Alternative 3 would have a beneficial impact on flood hazards, since it will increase the ability of SEZs in the Region to convey flood flows, and remove physical improvements that can be abandoned or relocated. Based on acreage alone, restoration should affect about 50 times more SEZ area than permitted encroachment.

Transfer of development programs under Alternative 3 would reduce exposure to natural hazards to the extent that existing development is transferred from hazard areas, including SEZs.

Proposed 208 Amendments. Like Alternatives 2 and 3, Alternative 4 (the proposed 208 amendments) will also continue the risk of exposure to natural hazards for existing development, especially in low-lying areas, steep areas, avalanche areas, and areas near major tributary streams. Alternative 4 will also increase exposure to natural hazards by increasing the population of the Region and allowing additional residential, commercial, tourist, commercial, and public service development.

Under Alternative 4, the 100-year flood plain is a secondary SEZ indicator and does not, by itself, cause a given parcel to be classified an SEZ. Therefore, although the Goals and Policies prohibit construction, grading, and filling inconsistent with the Goals and Policies, the base allowed coverage on parcels in the 100-year flood plain but not in SEZs is generally greater than under Alternatives 2 and 3. This coverage cannot be applied within the flood plain, except where TRPA finds it to be consistent with the Goals and Policies, but it can be transferred to another parcel or another part of the same parcel outside the flood plain.

As discussed under Stream Environment Zones, the proposed amendments (Alternative 4) could allow about 35 acres of encroachment into SEZs for public outdoor recreation, public health and safety, and access, with a required 1.5:1 offset. This encroachment may nevertheless reduce the ability of a given SEZ to convey flood flows, and expose physical improvements to flood damage, because the offset may take place in a different watershed.

The restoration of 1300 acres of SEZs under Alternative 4 will have a beneficial impact on flood hazards, since it will increase the ability of SEZs in the Region to convey flood flows, and remove physical improvements that can be abandoned or relocated. Based on acreage alone, restoration should affect about 43 times more SEZ area than permitted encroachment.

Transfer of development programs under Alternative 4 would reduce exposure to natural hazards to the extent that existing development and land coverage are transferred from hazard areas, including SEZs.

P. NOISE

1. Applicable Standards

The TRPA thresholds (Attachment 1) establish threshold standards for both single-event noise and community noise levels. The thresholds apply to single-event noise from aircraft, boats, motor vehicles, motorcycles, off-road vehicles, and snowmobiles, and community noise levels in high density residential areas, low density residential areas, hotel/motel areas, commercial areas, urban outdoor recreation areas, rural outdoor recreation areas, wilderness and roadless areas, and critical wildlife habitat.

Chapter 23 of the TRPA Code of Ordinances implements the noise thresholds, except for aircraft, which are to be addressed later. It establishes methods for measuring noise levels, set performance standards, specifies compliance procedures, and provides exceptions to the noise limitations.

2. Existing Situation

Although existing data on single-event and community noise levels are sparse, TRPA and others have monitored individual aircraft, snowmobiles, and helicopters in the context of master planning, compliance programs, and project review. Some commercial and general aviation aircraft currently operating at the Lake Tahoe Airport violate the aircraft thresholds (TRPA, 1987a).

Data on community noise levels are also limited. Community noise sources include aircraft, traffic, snow making, power transformers, pets, parks, playgrounds, outdoor speakers, beaches, boats, and natural causes such as wind and waves. Areas typically affected by community noise levels are urbanized areas and areas near transportation corridors. Land uses such as hospitals and schools are considered sensitive to noise impacts, as are backcountry recreation and most wildlife habitat areas.

3. Anticipated Noise Impacts

No-Growth Alternative. Although controls on off-road vehicle use in Alternative 1 (No-Growth) would reduce community noise impacts from ORVs, they would not affect single-event noise levels from individual vehicles. In general, Alternative 1 would not affect single-event noise levels.

The No-Growth Alternative would limit impacts on community noise levels from sources such as transformers, pets, parks, playgrounds, beaches, and boats to existing levels, and would reduce community noise impacts from traffic, by virtue of the anticipated 12 percent decrease in vehicle-miles-travelled (VMT).

The No-Growth Alternative would complement TRPA programs to attain and maintain the noise thresholds, and would not increase existing noise levels significantly.

No-Action Alternative. Like Alternative 1, Alternative 2 (No-Action) would reduce community noise impacts from ORVs, but would not affect single-event noise levels from individual vehicles. Additional development within the Region would increase the potential number of single noise events from such sources as boats, trucks, and motorcycles. A single boat, car, truck, motorcycle, snowmobile, or aircraft may or may not meet the single-event standards depending on how it is designed, operated, and maintained.

The No-Action Alternative would increase impacts on community noise levels from sources such as aircraft, traffic, snow making, power transformers, pets, parks, playgrounds, outdoor speakers, beaches, and boats. Of the four alternatives, only Alternative 2 would increase Region-wide contributions to community noise from traffic, due to the expected 12 percent increase in vehicle-miles-travelled (VMT).

Hybrid Plan. Alternative 3 (hybrid plan) would have noise impacts similar to Alternative 2 (No-Action). However, Alternative 3 would decrease Region-wide contributions to community noise from traffic, since it is expected to decrease VMT by about 8 percent. Alternative 3 would complement TRPA programs to attain and maintain the noise thresholds.

Proposed 208 Amendments. Alternative 4 (the proposed 208 amendments) will have noise impacts similar to Alternative 3 (hybrid plan). Alternative 4 is expected to decrease Regional VMT by about 10 percent, with a corresponding decrease in community noise impacts from traffic. Alternative 4 will complement TRPA programs to attain and maintain the noise thresholds.

Q. PUBLIC HEALTH, SAFETY, AND WELFARE

1. Applicable Standards

[Note: Sewage Collection and Treatment, Water Supply, Energy, and Recreation are discussed separately in this chapter. Refer to those titles for additional information.]

There are no TRPA thresholds specifically applicable to education, health care services, police, fire protection, and solid waste management. All five of these areas, however, are covered by numerous federal, state, and local standards.

The TRPA Goals and Policies call for staged or phased expansion of public facilities to meet the needs of new development without creating inefficiencies from over- or under-expansion (Goals and Policies, p. VI-1).

The Goals and Policies prohibit the discharge of solid wastes in the Region by depositing them in or on the land, except as provided in TRPA ordinances (Goals and Policies, p. II-45). Existing state policies and laws also prohibit solid waste disposal in the Tahoe Region. The Goals and Policies state that garbage pick-up shall be mandatory throughout the Region, and structured to encourage clean-ups and recycling. Local government should review waste disposal programs to provide incentives for clean-up programs, composting, and recycling (Goals and Policies, p. VI-3).

2. Existing Situation

Education. Four school districts and a community college district serve the Tahoe Region: the Lake Tahoe Unified School District, the Tahoe-Truckee Unified School District, the Washoe-Incline Village School District, the Douglas County School District, and the Lake Tahoe Community College District. There are other private educational facilities in the Region, the largest being Sierra-Nevada College in Incline Village.

In 1983, TRPA reported student-teacher ratios in the public schools ranged from 16:1 to 25:1, indicating no overcrowding at that time (TRPA, 1983). Since that time, the population of the Region has not significantly increased and the economy of the Region has been in decline (Economic Technical Committee, 1986). Nevertheless, overcrowding of schools has begun to be a problem, especially at the elementary level. This is apparently due to the changing family makeup of the workforce in the Region.

The Lake Tahoe Community College District gained TRPA approval of a master plan for development in 1986, and is completing the first phase of construction of a new community college campus on Al Tahoe Boulevard in the City of South Lake Tahoe. Refer to the master plan (LTCC District, 1986) for additional detail.

Health Care. There are two hospitals, Barton Memorial and Lakeside, in the Tahoe Region and another, Tahoe Forest, outside the Region in Truckee, California. Barton Hospital, located in the City of South Lake Tahoe, plans to construct a 2,700 sq. ft. building for post-surgical therapy. Lakeside Hospital, located in Incline Village, is a smaller facility and anticipates no major expansion or modification in the next five years. Tahoe Forest Hospital serves portions of the North Shore of Lake Tahoe and the Truckee Area.

According to the SWRCB (1980), demands for skilled nursing and intermediate care exceed supply in the Tahoe Region, and emergency room care for residents and visitors is considered overcrowded. Mental health services, primary-care detection and prevention clinics, rehabilitation services, educational programs, and drug and alcohol counseling are generally at or over capacity, and many health care needs remain unfulfilled.

Police. In general, staffing levels of the police forces in the Region are geared to the resident population, resulting in understaffed services when the population swells with summer and holiday visitors (SWRCB, 1980). Traffic congestion during peak periods and snow during the winter increase patrol response times (TRPA, 1983). El Dorado County and Douglas County have recently constructed new administrative and jail facilities, and Placer County will initiate construction on a new facility in 1988. No other expansions of police and sheriff facilities are planned at this time.

Fire. Fire protection services are provided in California by the City of South Lake Tahoe, the Lake Valley Fire Protection District, the Meeks Bay Fire Protection district, the Tahoe City Fire Protection District, and the North Tahoe Fire Protection District. In Nevada, the North Lake Tahoe Fire Protection District (Incline-Crystal Bay Fire Department) and the Tahoe-Douglas Fire Protection District provide fire protection services. The USFS and the Nevada Division of Forestry are also responsible for wildland fires.

Existing fire stations are located to provide adequate levels of service and response times, although many of the districts would like to increase the number of fire fighters per shift (TRPA, 1983). A new fire station is planned to serve the Mountain View Estates area in El Dorado County (Lake Valley Fire Protection District) and a consolidation of three buildings into one larger building is planned at the Zephyr Cove Fire Station (Tahoe-Douglas Fire District).

Also, as discussed under Water Supply, STPUD, TCPUD, the Quail Lake Water Company, and the Zephyr Cove Water District plan 11 projects in the next five years to meet fire flow requirements.

Solid Wastes. The Lake Tahoe Basin Water Quality Plan (SWRCB, 1980) and the EIS for the Adoption of a Regional Plan for the Lake Tahoe Basin (TRPA, 1983) include discussions of solid waste disposal, incorporated herein by reference. California and Nevada both prohibit the disposal of solid waste within the Tahoe Region. Waste from the South Shore is exported to the Douglas County landfill near Gardnerville, NV; the Eastern Regional landfill near Truckee, CA, serves the California North Shore; and the Carson City landfill serves the North Shore of Nevada.

There are nine solid waste haulers (two municipal, seven private) and two transfer stations within the Region. All solid waste generated in the Region is transported to one of the three landfills (TRPA, 1983).

The Eastern Regional Landfill near Truckee has recently been granted permission to expand, and its remaining useful life is estimated at about 15 years. The Douglas County landfill is nearing its capacity.

3. Anticipated Impacts on Public Health, Safety, and Welfare

No-Growth Alternative. Alternative 1 (No-Growth) would maintain the existing population in the Tahoe Region and would, in general, not affect the existing situation with respect to the public health, safety, and welfare. Demand for solid waste disposal may be reduced by waste reduction, resource recovery, and recycling programs in the Region, including the recently-enacted California program placing a one-cent redemption value on many beverage containers.

No-Action Alternative. As discussed under Land Use, Alternative 2 (No-Action) would increase the total population of the Region by approximately 35 percent over a 20-year period. The biggest increases would occur in El Dorado County (40 percent) and Placer County (37 percent). (See Table 21.) These population increases would place additional demands on education, health care, police, fire, and solid waste services and facilities. Increased demand for solid waste disposal may be attenuated by waste reduction, resource recovery, and recycling programs.

Since Alternative 2 allows exceptions to the limitations on land coverage for construction of new public health, safety, and welfare facilities, Alternative 2 may result in lower construction costs for such facilities, compared to Alternatives 3 and 4, if those facilities must exceed the Bailey coverage coefficients on individual parcels.

Hybrid Plan. Alternative 3 (hybrid plan) would increase the total population of the Region by approximately 27 percent over a 20-year period. El Dorado County and Placer County would grow by 28 to 30 percent, while Washoe County and Douglas County would grow by 20 to 21 percent. (See Table 21.) These population increases would place additional demands on education, health care, police, fire, and solid waste services and facilities. Increased demand for solid waste disposal may be attenuated by waste reduction, resource recoverage, and recycling programs.

Since Alternative 3 explicitly requires transfers of coverage for construction of new public health, safety, and welfare facilities which exceed the base allowed land coverage, construction costs for such facilities may be higher, compared to Alternative 2.

Proposed 208 Amendments. Alternative 4 (the proposed amendments) would also increase the population of the Region by about 27 percent over a 20-year period. The population in El Dorado County would increase the most (31 percent), while the population in Washoe County would increase the least (18 percent). (See Table 21.) These population increases will place additional demands on education, health care, police, fire, and solid waste services and facilities. The largest increases in demand will occur in El Dorado County. Increased demand for solid waste disposal may be attenuated by waste reduction, resource recovery, and recycling programs.

Like Alternative 3, Alternative 4 explicitly requires transfer of coverage for construction of new public health, safety, and welfare facilities which exceed the base allowed land coverage. Construction costs for such facilities may be higher than they would be under Alternative 2.

R. RECREATION

1. Applicable Standards

The TRPA thresholds include a policy statement calling for the preservation and enhancement of a high quality recreational experience in the Tahoe Region, preservation of high quality undeveloped shorezone and other natural areas, provisions for additional access to the shorezone and low density recreational areas, and reservation of a fair share of the Region's total capacity for outdoor recreation available to the general public. (See Attachment 1.)

The Goals and Policies call for low-density recreational experiences along undeveloped shorelines and other natural areas; regulation of areas selected for nature study and wildlife observation; expansion of trail systems for hiking and horseback riding; relocation of underutilized trails in sensitive areas; and regulation of off-highway vehicle use. The Goals and Policies also require TRPA to make written findings, when reviewing indoor recreational uses, that sufficient capacity remains for outdoor uses (Goals and Policies, pp. V-1 to 5).

The Goals and Policies also call for additional developed outdoor recreation facilities capable of accommodating 6,114 PAOT in overnight facilities, 6,761 PAOT in summer day use facilities, and 12,400 PAOT in winter day-use facilities. The Plan Area Statements allocate recreational PAOTs to the various plan areas.

2. Existing Situation

The EIS for the Adoption of a Regional Plan for the Lake Tahoe Basin (TRPA, 1983) includes a discussion of the existing recreation situation, incorporated herein by reference.

The Tahoe Region is ideal for a variety of outdoor recreational activities, including swimming, boating, water skiing, fishing, sight-seeing, hiking, skiing, camping, and other outdoor activities. Of the 23 million visitor days spent each year in the Region, 27 percent (about 6.2 million days) are associated with outdoor recreational activity (WFRC, 1979). The present outdoor recreational facilities are heavily utilized during the peak winter and summer periods. During peak summer months, there is a shortage of developed and wilderness campsites, day use facilities, and trails. During peak winter days, capacity constraints at developed ski areas are sometimes exceeded (TRPA, 1983).

Seasonal use of campgrounds is estimated at 71 percent of capacity. The USFS standards consider a campground heavily-used at 50 percent of capacity over a 100- to 120-day season. Campground use increased at an annual average rate of 13 percent from 1972 to 1982 (TRPA, 1983). The total capacity of public and private camping facilities is over 10,000 PAOT, assuming 5 persons per campsite.

There are approximately 22 miles of beach open to the public in the Region, representing 31 percent of the shoreline. The beaches experience intense use and are frequently at capacity in the summer. Parking is often a limiting factor to beach use (TRPA, 1983).

Back country and wilderness areas provide recreational opportunities for hiking and camping. The Desolation Wilderness Area has approximately 21,300 acres within the Lake Tahoe Region. Total use of the Desolation Wilderness in 1981 was 104,300 visitor days (TRPA, 1983).

The Tahoe Region contains all or part of five developed ski areas which provide capacity for about 18,000 skiers at one time. Ski areas outside the Region provide a capacity of over 66,000 skiers at one time within reasonable daily travel distance from Lake Tahoe. In the 1981-1982 season, lift ticket sales in the Tahoe Region totalled about 740,000 (TRPA, 1983).

3. Anticipated Impacts on Recreation

No-Growth Alternative. Under the No-Growth Alternative (Alternative 1) it would be difficult or impossible to provide the additional recreational capacity in the Region the TRPA thresholds and Goals and Policies call for. Construction of new facilities to accommodate overnight use and summer and winter day use could not result in additional land coverage or transfer of coverage. Imbalances between supply and demand in these categories would continue to exist. Because resident and visitor population would remain stable under Alternative 1, the demand for recreational facilities by residents and visitors would not change significantly, although demand could be affected by increased levels of day use from outside the Tahoe Region.

The No-Growth Alternative would interfere with TRPA's programs to provide additional access to the shorezone and low density recreational areas and, therefore, is not consistent with the TRPA threshold. To attain and maintain the threshold, Alternative 1 would have to be modified to allow additional access to the shorezone and low density recreational areas.

No-Action Alternative. The 1981 208 plan, Alternative 2 (No-Action), allows exceptions for public recreation to the requirement that future development comply with the Bailey coefficients on a lot-by-lot basis, and to the prohibition on construction, grading, and vegetation removal within SEZs.

The California-side policies of the 1981 208 plan prohibit further encroachment of golf courses into SEZs, and prohibit fertilizer use on new or expanded golf courses except where they are located away from SEZs.

Alternative 2 prohibits the channelization, diversion, or other manipulation of streams for new developed ski areas. No riparian vegetation may be removed, and no physical structures or other improvements are allowed within SEZs. Crossing of SEZs with ski runs shall be accomplished with as little disturbance as possible.

For new ski resorts in California, Alternative 2 prohibits new roads on high erosion hazard lands and in SEZs; limits land coverage to one percent on low capability lands; specifies that stream crossings shall not affect more than five percent of the total SEZ within the ski area, with no cut, fills, or relocations of SEZs; prohibits soil disturbance in SEZs except for stream crossings; and requires revegetation with native plants rhizomatous grasses.

Within California, Alternative 2 prohibits campground development in high erosion hazard lands or SEZs.

According to the SWRCB (1980), the control measures of Alternative 2 should not affect ski area expansion in California, but they may affect operation of facilities when snow cover is poor. The policies regarding golf courses effectively prohibit golf course construction in the portions of the Region in California (SWRCB, 1980, p. 232).

In general, the impacts of Alternative 2 on recreation would be positive, since it allows for development of additional recreational facilities to balance supply and demand during summer and winter peak periods. Alternative 2 would be consistent with TRPA programs to attain and maintain the recreation threshold. Under Alternative 2, the population of the Region is expected to increase about 35 percent, increasing demand for recreational facilities from residents and visitors by a corresponding amount.

Hybrid Plan. Alternative 3 (hybrid plan) continues the regulatory provisions of Alternative 2. Alternative 3 also includes an SEZ restoration program and land use planning and controls to direct recreational development to the most appropriate areas. It allows land coverage for new public outdoor recreation which is in excess of the Bailey coefficients or in SEZs only by offset or transfer, and only up to the limits set forth in Table 13.

Thus, Alternative 3 would effectively prohibit golf course construction in the portion of the Region in California, and might affect operations of developed ski areas when snow cover is poor. It would have a generally positive impact on recreation, since it allows for development of additional facilities to balance supply and demand in peak periods, results in the restoration of 1300 acres of stream environment zones, and directs recreation expansion to the most-appropriate areas of the Region. Alternative 3 would be consistent with TRPA programs to attain and maintain recreation thresholds. The population of the Region would increase by about 27 percent under Alternative 3, with a corresponding effect on recreational demand.

To the extent that Alternative 3 requires coverage transfers for construction of outdoor recreation facilities, the cost of such facilities may be higher than under Alternative 2. This impact would be limited to recreation facilities within community plan areas, since coverage for recreation facilities outside community plans is limited to the Bailey coefficients. Since Alternative 3 does not allow overrides of the Bailey coefficients for public outdoor recreation, it would constrain site selection for outdoor recreation facilities more than Alternative 2.

Proposed 208 Amendments. Alternative 4 (proposed 208 amendments) identifies recreation areas through the Plan Area Statements as non-urban areas with good potential for developed outdoor recreation or concentrated recreation, and assigns a management theme to each area. (See Section I, p. 114.) Outdoor recreation uses are permissible uses as set forth in the Plan Area Statements.

Alternative 4 allows public outdoor recreation facilities in land capability districts 1, 2 and 3 and SEZs only within the coverage limits set forth in Table 15, and only if (1) necessary as part of a public agency's plans for public outdoor recreation, (2) consistent with the Recreation Element of the Regional Plan, (3) the project, by its nature, must be sited there, (4) there is no feasible alternative which avoids or reduces the encroachment, (5) impacts are fully mitigated, and (6) lands in capability districts 1, 2 and 3 are restored in an amount 1.5 times the area disturbed beyond the Bailey coefficients and SEZ lands are restored in an amount 1.5 times the SEZ area disturbed. Land coverage for recreation projects outside community plan areas is limited to the Bailey coefficients, without the availability of additional coverage by transfer. (See Section I, p. 121.)

Under Alternative 4, expansion of existing ski facilities may be permitted based on a master plan for the entire ski area which demonstrates: (1) consistency with the Regional Plan and the Compact, (2) consistency with the availability of accommodations and infrastructure, and (3) that expansion of existing parking facilities for day use does not occur. Alternative 4 does not include the same constraints on intrusions in SEZs for ski facilities as do Alternatives 2 and 3. However, the proposed 208 plan amendments include guidelines on facilities that need not, be their nature, be located in SEZs and land capability districts 1, 2 and 3. See Table 16.

New campground facilities must be located in areas of suitable land capability and in proximity to necessary infrastructure. Existing facilities in sensitive areas shall be encouraged to relocate to higher capability lands, where practical, and day use facilities shall be encouraged in or near established urban areas. (See Section I, p. 149.)

Alternative 4 would have a generally positive impact on recreation, since it allows for development of additional facilities to balance supply and demand in peak periods, results in the restoration of 1300 acres of stream environment zones, and directs recreation expansion to the most-appropriate areas of the Region. Alternative 4 will complement TRPA programs to attain and maintain the recreation threshold. The population of the Region would increase by about 27 percent under Alternative 4, with a corresponding effect on recreational demand.

To the extent that Alternative 4 requires coverage transfers for construction of outdoor recreation facilities, the cost of such facilities may be higher than under Alternative 2. This impact would be limited to recreation facilities within community plan areas, since coverage for recreation facilities outside community plans must conform to the Bailey coefficients. Since Alternative 4 does not allow overrides of the Bailey coefficients for public outdoor recreation, it would constrain site selection for outdoor recreation facilities more than Alternative 2.

Unlike the other alternatives, Alternative 4 does not prohibit the expansion of golf courses in the portions of the Region in California, but it does require TRPA to make the six findings, above, to allow golf course expansion in land capability districts 1, 2, and 3 or in SEZs and, pursuant to the guidelines in Table 16, the TRPA could not make the finding that a golf course, by its nature, must be sited in land capability districts 1, 2 or 3 or in a SEZ.

S. SCENIC RESOURCES

1. Applicable Standards

The TRPA thresholds address scenic resources within 46 roadway units and 33 shoreline units. (See TRPA, 1982d, p. 13-24.) For these units, the TRPA thresholds require the numerical rating assigned each unit to be maintained or improved, including the composite scenic quality ratings and scenic resource thresholds. The thresholds also require travel route ratings to be maintained for all roadway and shoreline units, and improved in roadways units rated 15 or below and shoreline units rated 7 or below. The thresholds also state that it is TRPA policy to improve the visual quality of views from bike paths and outdoor recreation areas open to the general public. (See Attachment 1.)

The Goals and Policies include goals of maintaining and restoring the scenic qualities of the natural-appearing landscape, and improving accessibility of Lake Tahoe for public viewing (Goals and Policies, p. IV-20).

2. Existing Situation

The most-recent surveys of scenic ratings in the Tahoe Region took place in 1982 (TRPA, 1982d) and 1987 (Wagstaff and Brady, 1987). The results of these surveys are incorporated herein by reference. In general, scenic ratings are reduced by such factors as roads, buildings, signs, powerlines, and fences stemming from the urbanization of the Tahoe Region and subsequent demand for services, utilities, and recreation.

The Plan Area Statements designate approximately 50 plan areas for scenic restoration. (See TRPA, 1987a, Table 14.) TRPA is developing a set of scenic management criteria for each of the restoration areas to guide project review and community planning activities in those areas. The Code of Ordinances addresses scenic concerns in Chapter 14 (community plan provisions), Chapter 16 (master plan requirements), Chapter 22 (height standards), Chapter 30 (design standards), Chapters 54 and 55 (development standards for the shorezone and backshore), and Chapter 71 (tree removal standards).

TRPA is currently developing additional ordinances and programs to attain and maintain the scenic resource thresholds.

3. Anticipated Impacts on Scenic Resources

<u>No-Growth Alternative</u>. Alternative 1 (No-Growth) would not increase visual clutter with new roads or buildings that require additional coverage, since it allows no new land coverage or transfers of coverage. Signs, fences, and other structures that do not require additional land coverage would continue to be built.

The programs of BMP implementation, capital improvements, SEZ restoration, and excess coverage mitigation, native and adapted plant requirements, and restrictions on shoreline encroachment and vegetation alteration under Alternative 1 would enhance the quality of scenic resources throughout the Region.

Since, as discussed under Land Use, Alternative 1 reduces the incentives for community planning and redevelopment, the scenic benefits which would accompany those programs would not occur, or would occur very slowly. Thus, although the impacts of Alternative 1 on scenic resources are generally positive, implementation of Alternative 1 would interfere with TRPA programs to attain and maintain the scenic resource thresholds. To attain and maintain the thresholds, Alternative 1 would have to be modified to include incentives for rehabilitation of areas targeted for scenic restoration.

No-Action Alternative. Alternative 2 (No-Action) includes a risk of increasing visual clutter with new roads, buildings, signs, fences, and other structures, since it allows additional development in all categories: residential, commercial, tourist, recreation, and public service. Alternative 2 would allow the largest number of new single-family homes of the four alternatives. This risk would be reduced by implementation of the regulatory programs of Alternative 2, including BMP implementation, SEZ protection, land coverage limitations, and limits on new subdivisions.

Alternative 2 would enhance the quality of scenic resources through the programs of BMP implementation and capital improvements, but not to the same extent as the other alternatives, since Alternative 2 does not include SEZ restoration, excess coverage mitigation, native and adapted plant requirements, and restrictions on shorezone encroachment and vegetation alteration.

Since Alternative 2 also reduces the incentives for community planning and redevelopment, the scenic benefits which would accompany those programs would not occur, or would occur very slowly. Thus, implementation of Alternative 2 would interfere with TRPA programs to attain and maintain the scenic resource thresholds. To attain and maintain the thresholds, Alternative 2 would have to be modified to include incentives for rehabilitation of areas targeted for scenic restoration.

Hybrid Alternative. Alternative 3 (hybrid plan) also includes a risk of increasing visual clutter with new roads, buildings, signs, fences, and other structures, since it allows additional development in all categories: residential, commercial, tourist, recreation, and public service. Alternative 3 would allow fewer new single-family homes than Alternative 2. The risk to scenic quality would be mitigated by implementation of the regulatory programs of Alternative 3, including

BMP implementation, SEZ protection, land coverage limitations, and limits on new subdivisions, and especially the provisions to protect and enhance the scenic quality contained in various chapters of the Code of Ordinances, such as Chapter 22 (height), Chapter 30 (design standards), and Chapters 54 and 55 (shorezone).

Alternative 3 would enhance the quality of scenic resources through the programs of BMP implementation, capital improvements, SEZ restoration, excess coverage mitigation, native and adapted plant requirements, and restrictions on shorezone encroachment and vegetation alteration.

Since Alternative 3 also reduces the incentives for community planning and redevelopment, the scenic benefits which would accompany those programs would not occur, or would occur very slowly. Thus, implementation of Alternative 3 would interfere with TRPA programs to attain and maintain the scenic resource thresholds. To attain and maintain the thresholds, Alternative 3 would have to be modified to include incentives for rehabilitation of areas targeted for scenic restoration.

Proposed 208 Amendments. Alternative 4 (the proposed 208 amendments) will have impacts on scenic resources similar to Alternative 3, the hybrid plan. However, since Alternative 4 includes incentives for community planning and redevelopment, and since it allows coverage transfers between parcels, it will result in additional benefits to scenic resources from revitalization of urban areas and creation of additional view corridors to the mountains and Lake Tahoe.

Implementation of Alternative 4 is consistent with TRPA programs to attain and maintain the scenic resource thresholds, and will contribute to the attainment and maintenance of the threshold standards.

T. SHOREZONE

1. Applicable Standards

There are no TRPA thresholds specifically applicable to the shorezone. The Goals and Policies establish a goal of providing for the appropriate shoreline uses of Lake Tahoe, Cascade Lake, and Fallen Leaf Lake while preserving their natural and aesthetic qualities (Goals and Policies, p. IV-15). Chapters 50 through 56 of the TRPA Code of Ordinances establish detailed shorezone standards regarding project review, permissible uses and accessory structures, existing structures, shorezone tolerance districts and development standards, development standards lakeward of high water, development standards in the backshore, and mitigation requirements.

Local, state, and federal agencies have also established standards for activities in the shorezone, including: the California Division of State Lands, the Nevada Division of State Lands, the U.S. Army Corps of Engineers, the Nevada Department of Wildlife (NDW), the California Department of Fish and Game (CDFG), county governments, and the California State Water Resources Control Board. These standards are discussed in the EIS for the Establishment of Environmental Threshold Carrying Capacities (TRPA, 1982b), pp. 36 and 37.

The policy of the CDFG is to recommend against approval of any private pier and buoy projects proposed in prime fish habitat areas, and to recommend against any proposed development which will have an adverse impact on a marsh. NDW policies call for prime fish and aquatic habitats to be protected from unnecessary and unreasonable interference, especially in prime shore spawning areas. The policies of the other federal and state agencies also protect prime fish habitat, significant fish spawning areas, biologically important stream inlets, and marsh or riparian habitats from the impacts of construction of public and private docking facilities (TRPA, 1982b).

The SWRCB, through the Lahontan Board, regulates activities in the shorezone under the provisions of the 1981 208 plan, which, within California, require construction in Lake Tahoe to be surrounded by vertical sediment barriers and prohibit the discharge, or threatened discharge, of solid or liquid wastes attributable to new pier construction in significant fish spawning habitat or areas immediately offshore of stream inlets. (See p. 206.)

2. Existing Situation

The shorezone of Lake Tahoe is described in The Shorezone System for Lake Tahoe (Orme, 1971) and the EIS for the Adoption of a Regional Plan for the Lake Tahoe Basin (TRPA, 1983). These descriptions are included herein by reference.

The shorezone consists of the backshore, foreshore, and nearshore. The backshore is the area of wave runup or area of instability, plus ten feet. The foreshore is the area of lake level fluctuation between the high and low water level. The nearshore of Lake Tahoe extends lakeward from the low water elevation to a depth of 30 feet, or to a minimum width of 350 feet. In other lakes, the nearshore extends to a dept of 25 feet below the low water elevation. (Code of Ordinances, Sections 2.2 and 55.2.)

The shoreline of Lake Tahoe is 71 miles long, with approximately 70 percent in private ownership. Recreation and open space are the overall dominant uses of the shorezone. There are approximately 72 beach sites of varying size in Lake Tahoe's shorezone, with about half in public ownership. There are 14 existing marinas, with a total of about 950 boat slips, in the Tahoe Region. Nine marinas responded to a TRPA survey of marina operators in 1988, expressing interest in expansions totalling about 850 slips. TRPA is not aware of plans by any public or private entities to construct new marinas. There are approximately 1300 littoral parcels on Lake Tahoe. As of 1977, there were 511 single-use piers, 122 multi-use piers, and 25 boat launching facilities including marinas (Phillips Brandt Reddick McDonald and Grefe, 1978). Thus, there are over 600 littoral parcels without piers or marinas.

Piers, marinas, buoys, breakwaters, floating docks, and jetties are found in the nearshore, along with most prime fish habitat. Prime fish habitat consists of areas of rock, rubble, or cobble substrates which provide suitable conditions to support prey organisms and spawning. TRPA has recently initiated a study of the relationships between shorezone development and fish habitat, which will be completed in 1990.

The shorezone is particularly attractive to many species of wildlife. Habitats of special interest in the shorezone include bald eagle, waterfowl, and osprey habitat. (See Wildlife.)

As discussed in the Problem Assessment (Section I, p. 103), erosion of Lake Tahoe's shoreline is largely a natural process which contributes to the stability of the shoreline. Erosion of backshore bluffs is a major source of beach sand, and where the erosion process is interrupted by man's intervention, beach erosion and deep water beaches result. Tributary streams whose channels meander back and forth create barrier beaches, which protect backshore areas from wave action. Encroachment into delta areas interrupts the natural process of barrier beach formation, and backshore erosion may occur. When Lake levels rise unnaturally, large quantities of sediment may be eroded from backshore areas while the Lake attempts to establish a new equilibrium with the shoreline.

Of the 62 plan areas adjacent to the shorezone, 35 are designated as residential areas. Ten areas are eligible for community plans, and there are 21 in which marinas are permissible uses.

3. Anticipated Impacts on the Shorezone

No-Growth Alternative. Alternative 1 (No-Growth) includes the restrictions on shoreline encroachment from the proposed 208 amendments, described in Section I, p. 154. All vegetation at the interface of the backshore and foreshore shall remain undisturbed; the use of lawns or ornamental vegetation is discouraged; and policies are established to protect the various shorezone tolerance districts. TRPA would regulate the placement of new buoys, piers, and other structures to avoid degradation of fish habitat and interference with littoral drift, and would require mitigation of all impacts. Retention of a natural buffer to minimize impacts of backshore development is preferred over engineering solutions to backshore instability. The BMP Handbook includes special construction techniques and development criteria applicable to the shorezone.

Since Alternative 1 allows no new land coverage or transfers of coverage, additional development in the shorezone would be limited compared to the other alternatives. TRPA regulations would avoid impacts of new structures in the shorezone on fish habitat, in accordance with the findings of the ongoing TRPA study. Implementation of shorezone BMPs and vegetation policies would have a positive impact on the stability and integrity of the shorezone.

No-Action Alternative. Alternative 2 (No-Action) includes the implementation of the shorezone policies of the 1981 208 plan, described under Applicable Standards, above. Those policies require sediment barriers for all construction activities in the nearshore and effectively prohibit new pier construction in significant fish spawning habitat or areas immediately offshore of stream inlets. They would have a positive impact on shorezone water quality and values related to fisheries.

Alternative 2 would nevertheless result in some additional development in the shorezone. Implementation of BMPs, limits on land coverage, restrictions on SEZ encroachment and vegetation alteration, and controls on vessel wastes would minimize the impacts of that development on the shorezone.

Hybrid Plan. Alternative 3 (hybrid plan) adds control measures to the 1981 plan, Alternative 2. Alternative 3 restricts shorezone development in accordance with the shorezone tolerance districts depicted on TRPA overlay maps, and requires the application of BMPs to public and private lands in shorezone areas. In combination with the policies of the 1981 plan, these policies would have a positive impact on shorezone water quality, shorezone fishery values, shorezone stability and integrity, and shorezone erosion, and would have a more positive impact than Alternative 2.

Under Alternative 3, there would also be additional development in the shorezone. Implementation of BMPs, limits on land coverage, restrictions on SEZ encroachment and vegetation alteration, controls on vessel wastes, excess coverage mitigation, land use planning and control, SEZ restoration, restrictions on pier construction, and protection of the various shorezone tolerance districts would minimize the shorezone impacts of that development.

Proposed 208 Amendments. Alternative 4 (proposed 208 amendments) includes the restrictions on shoreline encroachment described in Section I, p. 154. All vegetation at the interface of the backshore and foreshore shall remain undisturbed; the use of lawns or ornamental vegetation is discouraged; and policies are established to protect the various shorezone tolerance districts. TRPA will regulate the placement of new buoys, piers, and other structures to avoid degradation of fish habitat and interference with littoral drift, and will require mitigation of all impacts. Retention of a natural buffer to minimize impacts of backshore development is preferred over engineering solutions to backshore instability. The BMP Handbook is being amended to include special construction techniques and development criteria applicable to the shorezone.

Alternative 4 will result in some additional development in the shorezone. TRPA will avoid impacts of new structures in the shorezone on fish habitat, in accordance with the findings of the ongoing TRPA study. Implementation of shorezone BMPs and vegetation policies will have a positive impact on the stability and integrity of the shorezone, and implementation of the shorezone policies, above, will minimize the impacts of additional development on the shorezone.

U. VEGETATION

1. Applicable Standards

There are 16 TRPA thresholds covering common and uncommon vegetation and sensitive plants. (See Attachment 1.) The thresholds call for an increase in plant and structural diversity, perpetuation of specific vegetation associations, limitations on forest openings, protection of four uncommon plant communities, and the maintenance of population sites for five sensitive plants. State and federal standards for threatened and endangered plant species also apply within the Region.

2. Existing Situation

For a description of the vegetation of the Tahoe Region, see the Setting, p. 24. The existing data are insufficient to reveal whether plan and structural diversity have changed since the thresholds were adopted in 1982. Poor diversity is the result of the even-aged timber stand resulting from logging in the late 1800's, along with current fire suppression practices.

The uncommon plant communities listed in the thresholds (deepwater plants of Lake Tahoe, Grass Lake sphagnum bog, Osgood Swamp, and the Freel Peak Cushion Plant Community) are all on public lands or in the deep waters of Lake Tahoe.

With the exception of the <u>Rorippa subumbellata</u> ("Tahoe Yellow Cress"), all population sites of the sensitive plants listed in the thresholds are on public lands in the following areas: Freel Peak, Desolation Wilderness, Job's Sister, and Mount Rose. The <u>Rorippa</u> is found in the moist backshore and in dry sandy soils on the shore areas of Lake Tahoe, and is susceptible to human disturbance and inundation. Population sites are found at Glenbrook, Logan Shoals, Nevada Beach, Edgewood Golf Course, Tahoe Meadows, the Upper Truckee Marsh, Taylor Creek, Tahoma, Ward Creek, Baldwin Beach, and in the Meeks Bay Vista/Rubicon area.

3. Anticipated Impacts on Vegetation

<u>No-Growth Alternative</u>. Alternative 1 (No-Growth) would allow little or no additional residential, commercial, tourist, recreational, and public service development in the Tahoe Region. Except for the <u>Rorippa</u>, all Plan Areas including habitat for sensitive and uncommon plants are classified for conservation and recreation land uses, and stresses upon the vegetation of the Region would remain at about the existing levels. Restoration of about 1300 acres of stream environment zones will have beneficial impacts on vegetation. Because of its location in the margin of Lake Tahoe, <u>Rorippa</u> habitat would be most susceptible to pressure from existing development. See also the discussion of Stream Environment Zones, p. 229.

No-Action Alternative. Alternative 2 (No-Action) would allow additional residential, commercial, tourist, recreational, and public service development in the Tahoe Region, bringing about increased stresses upon the vegetation of the Region. This alternative does not include the SEZ restoration program, so the benefits of SEZ restoration on vegetation would not occur. Except for the *Rorippa*, all Plan Areas including habitat for sensitive and uncommon plants are classified for conservation and recreation land uses, so that preservation of sensitive and uncommon plants should be consistent with land uses in those areas. Because of its location in the margin of Lake Tahoe, and considering the increased development of the shorezone which will accompany Alternative 2, *Rorippa* habitat will be susceptible to pressure from existing and additional development, and development and activity in the shorezone should avoid adverse impacts on *Rorippa* habitat. See also the discussion of SEZs, p. 230.

With respect to standards calling for increased vegetative diversity, the USFS, state park departments, state forestry departments, and other agencies will carry out harvesting programs, prescribed burning, fuels management, and revegetation, with beneficial impacts upon diversity. These same agencies will also enforce grading standards, tree removal standards, and off-road vehicle and snowmobile controls, and monitor and evaluate common vegetation in the Region, to ensure that the applicable standards are attained and maintained.

Hybrid Plan. Alternative 3 (hybrid plan) will have impacts upon vegetation very similar to the No-Action Alternative. The restoration of 1300 acres of SEZ will have additional beneficial impacts on vegetation. Prohibitions on permanent disturbance or alteration of vegetation, shorezone setbacks, control of ornamental vegetation in the shorezone, shorezone tolerance districts, and prohibitions on disturbance to vegetation at the foreshore/backshore interface will also assist with attaining and maintaining the vegetation thresholds.

Proposed 208 Amendments. Alternative 4, the proposed 208 amendments, will have impacts upon vegetation very similar to the Hybrid Plan.

V. WILDLIFE

1. Applicable Standards

The TRPA thresholds (Attachment 1) include nine standards covering special interest species and habitats of special significance to wildlife. The thresholds call for maintenance of a minimum number of population sites for the special interest species: goshawk, osprey, bald eagle, golden eagle, peregrine falcon, waterfowl, and deer. The thresholds also require nondegradation of deciduous trees, wetlands, and meadows, as discussed under Stream Environment Zones.

Federal legislation (Endangered Species Act of 1973) and policies of the U.S. Forest Service also are intended to protect threatened and endangered species of wildlife. The Forest Service also has a policy to protect snags (dead trees) to provide wildlife habitat. The CDFG has drafted two deer management plans for the Truckee-Loyalton herd at the north end of the Region, and the Carson River herd in the south (TRPA, 1982d).

2. Existing Situation

The Study Report for the Establishment of Environmental Threshold Carrying Capacities (TRPA, 1982d) contains a detailed discussion of wildlife in the Region, incorporated herein by reference.

The basic requirements of wildlife are food, water, cover, and space. Combinations of different terrestrial and aquatic environments are usually necessary to fulfill the needs of a given species (TRPA, 1982d). A wide variety of wildlife species visit or live year-round in the Region. Many species migrate out of the Region before the winter, but in a given year up to 260 different wildlife species (birds, mammals, reptiles, amphibians) may be observed (TRPA, 1982b).

Much of the habitat for the TRPA special interest species is on public lands, but also involves private property near Heavenly Valley, Tahoe Pines, the Cascade Area, the Upper Truckee marsh, Christmas Valley, Echo Lakes, and Fallen Leaf Lake. Habitat modification, alteration, and disturbance; noise; harassment; and dogs all interfere with the maintenance of population sites (TRPA, 1987a).

Habitat for the various special interest species is found in the following locations (TRPA, 1982b, 1987a):

Goshawk: East Shore, Heavenly Valley area, Tahoe Pines area

Osprey: Emerald Bay, East Shore Beaches

Bald Eagle: Emerald Bay, Cascade area, Upper Truckee marsh, Pope marsh

Golden Eagle: high elevations above Carnelian Bay, Kings Beach, Fallen Leaf Lake, and Luther Pass

Waterfowl: Pope marsh, Echo Lakes, Fallen Leaf Lake, Spooner Lake, other areas

Deer: Martis Peak, Mount Rose, Tunnel Creek, Marlette Lake, Spooner Summit, Genoa Peak, Daggett Pass, Heavenly Valley, Cold Creek, Trout Creek, Saxon Creek, Amstrong Pass, Dardanelles, Desolation, Barker Peak, Ward Peak.

Chapter 78 of the TRPA Code of Ordinances protects and enhances existing wildlife habitats, and applies to any activity or project which could affect basic habitat requirements. The provisions of Chapter 78 protect SEZs, movement and migration corridors, critical habitat, snags, and special habitats of special interest species.

3. Anticipated Impacts on Wildlife

No-Growth Alternative. The No-Growth Alternative (Alternative 1) would generally improve the existing situation with respect to wildlife, since it would not result in additional habitat modification, alteration, or disturbance; would result in restoration of 1300 acres of SEZs; and would decrease cumulative noise levels. Alternative 1 would complement TRPA programs to attain and maintain the wildlife thresholds.

No-Action Alternative. The No-Action Alternative (Alternative 2) would generally result in new residential, commercial, tourist, and public service development in locations away from habitat sites of the special interest species. Recreational development has the potential to impact those sites, however. Also, since Alternative 2 allows certain uses to encroach on SEZs without offset or other mitigation, Alternative 2 does not attain and maintain the nondegradation standard for wildlife habitat of special significance. To attain and maintain the wildlife thresholds under Alternative 2, all development must conform to the standards of Chapter 78 of the TRPA Code, and the alternative must be modified to eliminate encroachments into SEZs without offset or mitigation.

Hybrid Plan. Alternative 3 (hybrid plan) adds the requirement to offset SEZ encroachment 1.5:1 and adds the program of SEZ restoration to the policies of Alternative 2. The impacts of the hybrid plan on wildlife would be more positive than Alternative 2. To attain and maintain the wildlife thresholds under Alternative 3, all development must conform to the standards of Chapter 78 of the TRPA Code.

Proposed 208 Amendments. Alternative 4 (proposed amendments) is similar to Alternative 3 in its impacts on wildlife. To attain and maintain the wildlife thresholds under Alternative 4, all development must conform to the standards of Chapter 78 of the TRPA Code.

III. SUMMARY OF IMPACTS

This chapter summarizes the environmental, social, and economic impacts of the proposed 208 amendments and the three alternatives, in accordance with Article VII of the Tahoe Regional Planning Compact and the requirements of the California Environmental Quality Act (CEQA).

A. PROPOSED 208 AMENDMENTS

1. Unavoidable Significant Adverse Environmental Effects

The proposed 208 amendments (Alternative 4) create no adverse environmental effects which cannot be mitigated to a less-than-significant level. Chapter II, Anticipated Environmental, Social, and Economic Impacts of the Proposed Action and Alternatives, identifies the necessary mitigation measures for each potential adverse impact.

2. Relationship Between Short-Term Uses of the Environment and Enhancement of Long-Term Productivity

Under the proposed 208 amendments, residents and visitors of the Tahoe Region will make short-term use of the environment by filling in existing urbanized areas with additional residential, commercial, tourist, recreation, and public service development; providing improved transportation systems to serve existing and future development; creating additional recreation facilities and opportunities in the natural areas of the Region; applying remedial measures to correct existing problems of erosion, runoff, and land disturbance; and--in general--enjoying the unique environmental, recreational, educational, and scenic values of the Tahoe Region.

These short-term uses of the environment will make use of portions of the remaining carrying capacity of the Region in terms of water quality, air quality, vegetation, wildlife, fish, soils, scenic resources, and recreation, and will place additional demands on services and facilities for the public health, safety, and welfare. However, the proposed amendments are designed to attain and maintain the environmental threshold carrying capacities (Attachment 1) and, therefore, they will ensure that the long-term productivity of the Region is not compromised. The remedial programs of the proposed alternative (e.g., SEZ restoration) will enhance the carrying capacity of the Region and, in turn, enhance long-term productivity of the environment.

3. Significant Irreversible and Irretrievable Commitments of Resources Which Would be Involved if the Proposed Action Were Implemented

The proposed action, when implemented, will result in the creation of additional development and new impervious coverage in the Tahoe Region, which represent an essentially irreversible commitment of the terrestrial resources of the Region. The proposed action will reduce the amount of reserve environmental carrying capacity, or "headroom," with respect to water quality, air quality, transportation, soils, sewage treatment, and water supply, thereby limiting the options of future generations who may wish to make additional use of the resources of the Region.

The proposed 208 amendments will also bring about certain transient impacts from construction and remedial activities, such as noise impacts, water quality impacts, and dust. While proper mitigation measures will minimize the transient impacts, they represent an irreversible commitment of resources.

Required investments in water systems, sewage collection and treatment, streets and roads, transit, erosion and runoff controls, SEZ restoration, and other improvements represent an irretrievable commitment of financial resources.

4. Growth-Inducing Impacts

Although the proposed action will maintain the existing boundaries of the urban area within the Tahoe Region, it will result in the in-fill of existing urbanized areas and expanded use of non-urban areas. (See Chapter II, Land Use.) It will allow additional residential, commercial, tourist, recreation, and public service development, and result in approximately a 27 percent increase in the Region's population over a 20-year period.

The proposed amendments will tend to improve the causative factors identified as contributing to the current economic decline of the Tahoe Region. It will reduce regulatory uncertainty, create opportunity for additional investment in the Region, contribute to the upgrading of the built environment and economic recovery, ease peak-period capacity constraints, and have a beneficial effect on the resident economy. (See Chapter II, The Economy.)

This additional growth will utilize portions of the remaining carrying capacity of the Region, as discussed above, and place additional demands on sewage treatment, water supply, solid waste disposal, education, health care, police, and fire services and facilities, as discussed in Chapter II of this Section.

5. Environmental, Social, and Economic Effects Found Not to be Significant

The analysis of probable impacts in Chapter II identifies a number of positive environmental, social, and economic effects of the proposed 208 amendments. The proposed amendments will: promote rehabilitation of the built environment; reduce strip development; result in a net decrease in land coverage in sensitive land capability districts; create new open space; enhance soil productivity, stability, and filtration capacity; restore disturbed stream environment zones; reduce the area of disturbed lands; reduce drainage density; have a positive financial impact on sewage treatment and collection districts; contribute to economic recovery; improve housing diversity and the availability of low-income housing; reduce the risk of flooding; and enhance recreation opportunities.

The analysis in Chapter II identifies potential adverse impacts from the proposed action in the areas of water quality, cultural and historical resources, and natural hazards. However, the proposed action includes mitigation measures which reduce these potential impacts to a less-than-significant level. For details, see Chapter II.

The proposed amendments will attain and maintain the TRPA thresholds for soils, stream environment zones, and water quality, and are consistent with TRPA programs to attain and maintain the remaining thresholds: air quality, community design, fish, noise, recreation, scenic resources, and wildlife.

6. Cumulative Impacts

In analyzing the probable environmental, social, and economic effects of the proposed 208 amendments, TRPA has identified and accounted for the impacts of all reasonably-foreseeable projects and activities which may create related impacts during implementation of the amendments over a 20-year period. The analysis is consistent with, and tiered off, the related environmental documents listed in Section II (p. 188), which the TRPA has certified and made available to the public.

B. ALTERNATIVES TO THE PROPOSED ACTION

Chapter II analyzes the anticipated environmental, social, and economic impacts of the proposed action and three alternatives. For a comparison of the impacts of the four alternative plans, see Table 34.

In general, the No-Growth Alternative would have many positive impacts on the Tahoe Region, but it would discourage redevelopment and community planning, not improve problems of traffic congestion, not meet state and federal air quality standards for carbon monoxide,

TABLE 34

Comparison of Impacts: Proposed Action and Alternatives

Probable Environmental, Social, and Economic Impacts	Alternative 1- No-Growth	2- No-Action	3- Hybrid Plan	4- Proposed Action
A. Land Use				
1. changes the existing land use pattern through redevelopment and community planning?	no	no	no	yes
2. creates new open space through excess coverage mitigation?	yes	no	yes	yes
3. restores SEZs in accordance with TRPA restoration threshold?	yes	no	yes	yes
4. results in what resident and visitor population?	lowest	highest	middle	middle
5. results in what additional development?	none	highest	lower	lower
B. Soils				
1. results in what additional land coverage?	none	highest	lower	lower
2. results in benefits from implementation of CIP, BMPs?	yes	yes	yes	yes
3. allows land coverage in excess of Bailey coefficients without explicit transfer or offsetting restoration?	no	yes	no	no
C. Stream Environment Zones				
1. results in benefits to SEZs from restoration program?	yes	no	yes	yes
2. creates what change in area of naturally functioning SEZ?	positive	negative	positive	positive

Table 34, cont.

Probable Environmental, Social, and Economic Impacts	Alternative 1- No-Growth	Alternative 2- No-Action	Alternative 3- Hybrid Plan	Alternative 4- Proposed Action
H. Community Design: consistent with TRPA threshold?	yes	yes	yes	yes
I. Cultural, Historical, and Architectural Resources: increases pressure on these resources?	no	yes	yes	yes
J. Energy				
1. increases energy use in buildings?	no	yes	yes	yes
2. increases energy use from motor fuels?	no	yes	no	no
K. Fish: consistent with TRPA fish thresholds?	yes	yes	yes	yes
L. Housing: increases diversity of housing?	no	no	no	yes
M. Natural Hazards: increases exposure to natural hazards?	yes	yes	yes	yes
N. Noise: consistent with TRPA noise thresholds?	yes	yes	yes	yes
O. Public Health, Safety, and Welfare: increases demand?	no	yes	yes	yes
P. Recreation: consistent with TRPA recreation thresholds?	no	yes	yes	yes
Q. Scenic Resources: consistent with TRPA scenic resource thresholds?	no	no	no	yes
R. Shorezone: results in increased shorezone development?	yes	yes	yes	yes
S. Wildlife: consistent with TRPA wildlife thresholds?	yes	no	yes	yes

Table 34, cont.

Probable Environmental, Social, and Economic Impacts	Alternative 1- No-Growth	2- No-Action	3- Hybrid Plan	4- Proposed Action
D. Transportation and Air Quality				
1. reduces regional VMT (vehicle miles travelled)?	yes	no	yes	yes
2. meets TRPA standards for intersection level-of-service?	no	no	yes	yes
3. meets state and federal carbon monoxide standards?	no	no	yes	yes
E. Water Quality				
1. what reduction in sediment and nutrient loads to Lake Tahoe?	highest	lowest	middle	middle
2. reduces atmospheric deposition of nitrogen?	yes	yes	yes	yes
3. improves groundwater quality, reduces nutrient loads?	yes	yes	yes	yes
4. will meet ambient quality standards for Lake Tahoe?	yes	no	yes	yes
5. protects tributary water quality?	yes	yes	yes	yes
F. Sewage Collection and Treatment: adequate capacity available at				
1. STPUD (El Dorado)?	yes	no	no	no
2. TTSA (Placer/El Dorado)?	excess[1]	yes[1]	yes[1]	yes[1]
3. IVGID (Washoe)?	excess	yes	yes	yes
4. DCSID (Douglas)?	excess	yes	yes	yes
G. Economy				
1. increases investment in the Tahoe Region?	no	yes	yes	yes
2. changes visitor mix?	no	no	no	yes
3. relieves capacity constraints during peak periods?	no	yes	yes	yes
4. improves the resident economy?	no	yes	yes	yes

Note [1]: TTSA serves areas outside the Tahoe Region. Growth in these areas could utilize available capacity of TTSA facilities. Development within the Tahoe Region will not exceed the capacity of the export line nor fully utilize plant capacity.

further weaken the Region's economy, not improve the diversity of housing, and continue the imbalance between recreation supply and demand.

The No-Action Alternative, implementation of the 1981 plan, would fail to attain and maintain TRPA thresholds for soils, stream environment zones, air quality, and water quality; would hinder efforts to revitalize the built environment and the Region's economy; and would not be consistent with TRPA programs to attain and maintain thresholds for noise, scenic resources, and wildlife.

The Hybrid Plan adds additional environmental control programs to the No-Action Alternative, but it would still fail to attain and maintain air quality thresholds, would hinder revitalization and economic recovery, would not improve housing diversity, and would not be consistent with TRPA programs to meet scenic resource thresholds.

C. ORGANIZATIONS AND PERSONS CONSULTED

TRPA consulted regularly with an inter-agency working group on the preparation of the proposed 208 amendments. The members of the working group represent the following agencies and organizations:

- California State Water Resources Control Board
- California Regional Water Quality Control Board--Lahontan Region
- California Attorney General
- League to Save Lake Tahoe
- Nevada Division of Environmental Protection
- Tahoe Sierra Preservation Council
- United States Environmental Protection Agency--Region IX
- United States Forest Service, Lake Tahoe Basin Management Unit

In addition, TRPA consulted with a number of individual technical experts in the preparation of the analysis of potential environmental social, and economic impacts, including:

- Sid Davis, soil scientist
- Rick Hydrick, South Tahoe Public Utility District
- Wayne Sheldon, soil scientist, USDA, SCS
- Clarence Skau, Ph.D., hydrologist
- Robert Twiss, Ph.D., consultant to the California Attorney General
- Mike Crooks, California Department of Health Services

The seven volumes which make up the proposed 208 amendments were prepared by the TRPA staff. The staff members involved in the preparation of the documents were:

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